17:4 BERKELEY TECHNOLOGY LAW JOURNAL

2002

Pages
1155
to
1387

Production: Produced by members of the *Berkeley Technology Law Journal* on PC computers. All editing and layout is done using Microsoft Word.

Printer: Joe Christensen, Inc., Lincoln, Nebraska.
Printed in the U.S.A.
The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences—Permanence of Paper for Library Materials, ANSI Z39.48—1984.

Berkeley Technology Law Journal
University of California, Berkeley
Boalt Hall School of Law
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Berkeley, California 94720-7200
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BERKELEY TECHNOLOGY LAW JOURNAL

VOLUME 17 NUMBER 4 FALL 2002

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Form. The text and citations in the *Journal* conform generally to the UNITED STATES GOVERNMENT PRINTING OFFICE STYLE MANUAL (28th ed. 1984) and to THE BLUEBOOK: A UNIFORM SYSTEM OF CITATION (Columbia Law Review Ass'n et al. eds., 17th ed. 2000). Please cite this issue of the *Berkeley Technology Law Journal* as 17 BERKELEY TECH. L.J. ___ (2002).

Postmaster: Send address changes to the *Berkeley Technology Law Journal*, University of California, Berkeley, Boalt Hall School of Law, 587 Simon Hall, Berkeley, California 94720-7200.

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IS PATENT LAW TECHNOLOGY-SPECIFIC?

By Dan L. Burk[†] *and Mark A. Lemley*[‡]

> [The software patent cases] stand as a testament to the ability of law to adapt to new and innovative concepts, while remaining true to basic principles.[1]
>
> Fundamental shifts in technology and in the economic landscape are rapidly making the current system of intellectual property rights unworkable and ineffective. Designed more than 100 years ago to meet the simpler needs of an industrial era, it is an undifferentiated, one-size-fits-all system. Although treating all advances in knowledge in the same way may have worked when most patents were granted for new mechanical devices, today's brainpower industries pose challenges that are far more complex.2

Patent law has a general set of legal rules to govern the validity and infringement of patents in a wide variety of technologies. With very few exceptions, the statute does not distinguish between different technologies in setting and applying legal standards.[3] Rather, those standards are designed to adapt flexibly to new technologies, encompassing "anything under the

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We thank Rochelle Dreyfuss, Rebecca Eisenberg, Richard Epstein, Dan Farber, Nancy Gallini, Wendy Gordon, Rose Hagan, Bruce Hayden, David Hyman, Brian Kahin, Clarisa Long, David McGowan, Craig Nard, Arti Rai, Polk Wagner, Tarra Zynda, and participants at the Telecommunications Policy Research Conference, the Washington University Conference on the Human Genome, the University of Toronto conference on Competition and Innovation, and a faculty workshop at the University of Minnesota Law School for comments on an earlier draft of this or a related paper; Kristen Dahling and Colleen Chien for research assistance, and the University of Minnesota Law School, Boalt Hall School of Law, University of California, Berkeley and a generous grant from Washington University for research funding.

1. AT&T v. Excel Communications, 172 F.3d 1352, 1356 (Fed. Cir. 1999).

2. Lester Thurow, *Needed: A New System of Intellectual Property Rights*, HARV. BUS. REV., Sept.-Oct. 1995, at 95, 95.

3. *See, e.g.*, 35 U.S.C. § 103(b) (2000) (creating a special obviousness provision for biotechnology).

sun made by man."[4] In theory, then, we have a unified patent system that provides technology-neutral protection to all kinds of technologies.

Of late, however, we have noticed an increasing divergence between the rules themselves and the application of the rules to different industries. The best examples are biotechnology and computer software. In biotechnology cases, the Federal Circuit has bent over backwards to find biotechnological inventions nonobvious, even if the prior art demonstrates a clear plan for producing the invention. On the other hand, the court has imposed stringent enablement and written description requirements on biotechnology patents that do not show up in other disciplines. In computer software cases, the situation is reversed. The Federal Circuit has essentially excused software inventions from compliance with the enablement and best mode requirements, but has done so in a way that raises serious questions about how stringently it will read the nonobviousness requirements. As a practical matter, it appears that while patent law is technology-neutral in theory, it is technology-specific in application. We provide evidence for this claim in Part I. While our analysis focuses on biotechnology and computer software, which present two extreme examples of this phenomenon, our approach may have application to other industries as well, notably small-molecule chemistry.

Part II explains how the application of the same general legal standards can lead to such different results in diverse industries. Much of the variance in patent standards is attributable to the use of a legal construct, the "person having ordinary skill in the art" (PHOSITA), to determine obviousness and enablement. The more skill those in the art have, the less information an applicant has to disclose in order to meet the enablement requirement—but the harder it is to meet the nonobviousness requirement. The level of skill in the art affects not just patent validity, but also patent scope. Because both claim construction and the doctrine of equivalents turn on the understanding of the PHOSITA in certain circumstances, judgments the court makes about ordinary skill in an industry affect the scope of patents that issue.

One reading of the biotechnology and computer software cases is that the Federal Circuit believes computer programmers are extremely skilled, while biotechnology experts know very little about their art. This implication is closely tied to the Federal Circuit's designation of some technologies as belonging to the "unpredictable arts"; the court treats biotechnol-

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4. Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (citing S. REP. NO. 1979, at 5 (1952); H.R. REP. NO. 1923, at 6 (1952)).

ogy as if the results obtained in that art are somehow outside the control of those of skill in the art, whereas computer science is treated as if those of skill in the art have their outcomes well in hand.

We do not challenge the idea that the standards in each industry should vary with the level of skill in that industry. We think the use of the PHOSITA provides needed flexibility for patent law, permitting it to adapt to new technologies without losing its essential character. We fear, however, that the Federal Circuit has not applied that standard properly in either the biotechnology or computer software fields. The court has a perception of both fields that was set in earlier cases but which does not reflect the modern realities of either industry. The changes in an industry over time present significant structural problems for patent law, both because law is necessarily backward-looking and precedent-bound, and because applying different standards to similar inventions raises concerns about horizontal equity. Nonetheless, we believe the courts must take more care than they currently do to ensure that their assessments of patent validity are rooted in understandings of the technology that were accurate at the time the invention was made.

In Part III, we offer some suggestions for how to free the PHOSITA from its conceptual shackles in order to ensure that where patent law is technology-specific—as it inevitably will be—it is for the right reasons. The question of whether patent law is industry-specific is closely related to arguments over whether patent law *should* vary from industry to industry in any systematic way. This is a difficult policy question, and one we do not address in this Article, though we do so elsewhere.[5] Here, we simply recognize that our nominally unitary patent system in fact conceals a wide variety of different legal rules, and suggest doctrinal changes to optimize certain rules for particular industries. In doing so, we hope to lay the groundwork for a broader exposition as to how patent policy may be tailored to provide optimal incentives for innovation.

I. HETEROGENEITY IN THE PATENT LAW

Intellectual property law generally aims to solve the "public goods" problem that arises in regard to creative activity. Legal rights in the product of creative activity allow creators to control and profit from goods that are costly to produce but which are virtually costless to reproduce or to appropriate once they have been created. A variety of intellectual property

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5. *See, e.g.*, Dan L. Burk & Mark A. Lemley, Policy Levers in Patent Law (2002) (unpublished manuscript, on file with authors).

systems have been promulgated to deal with this problem for different, if occasionally overlapping, areas of subject matter. These various types of legal protection carry different scopes and lengths of protection, hopefully roughly appropriate to their subject areas. Copyright is generally addressed to artistic or aesthetic works, although it now includes software in its ambit; patent law generally addresses industrial or technological inventions; trade secrecy covers a wide range of valuable business assets. Each of these modes of protection covers a wide swath of subject matter; specialized statutes, sometimes called "sui generis" laws, are relatively rare.[6] As a practical matter, Congress cannot enact a new form of intellectual property statute each time a new technology arises.[7] Nevertheless, there are drawbacks to encompassing many types of subject matter within one broad system, as demonstrated by patent law.

A. The History of the Uniform Patent System

A patent statute was one of the first laws Congress passed, in 1790. Since that time, a patent statute has been a constant feature of the U.S. legal landscape.[8] While the nature of the patent system went through some

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6. At various times commentators have called for sui generis protection of specific subject matter. *See, e.g.*, Peter S. Menell, *Tailoring Legal Protection for Computer Software,* 39 STAN. L. REV. 1329, 1364-65 (1987) (computer software); Pamela Samuelson, *Creating a New Kind of Intellectual Property: Applying the Lessons of the Chip Law to Computer Programs*, 70 MINN. L. REV. 471 (1985) (same); Dan L. Burk, *Copyrightability of Recombinant DNA Sequences*, 29 JURIMETRICS J. 469, 530-31 (1989) (biotechnology); Kenneth D. Crews, *Looking Ahead and Shaping the Future: Provoking Change in Copyright Law*, 49 J. COPYRIGHT SOC'Y USA 549, 564 (2001) ("'One-size-fits-all' ultimately fits few."). *Cf.* Nancy Gallini & Suzanne Scotchmer, *Intellectual Property: When Is It the Best Incentive System?*, in INNOVATION POLICY AND THE ECONOMY 2 51, 53 (Adam B. Jaffe et al. eds., 2001) ("[I]ntellectual property regimes should be designed so that the subject matter of each one has relatively homogenous needs for protection."). The Semiconductor Chip Protection Act of 1984 is one of the few examples where Congress heeded such encouragement. It created a unique form of intellectual property in the "mask works" embodying semiconductor chip circuit designs. *See* Semiconductor Chip Protection Act of 1984, 17 U.S.C. §§ 901-914 (2000).

7. *See* Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal,* 97 HARV. L. REV. 1813, 1819-20 (1984); Richard Stern, *The Bundle of Rights Suited to New Technology*, 47 U. PITT. L. REV. 1229, 1261 (1986).

8. *See, e.g.*, BRUCE BUGBEE, THE GENESIS OF AMERICAN PATENT AND COPYRIGHT LAW 126, 143 (1967); Edward C. Walterscheid, *To Promote the Progress of Useful Arts: American Patent Law and Administration, 1787-1836*, pt. 1, 79 J. PAT. & TRADEMARK OFF. SOC'Y 61 (1997); Edward C. Walterscheid, *To Promote the Progress of Useful Arts: American Patent Law and Administration, 1787-1836*, pt. 2, 80 J. PAT. & TRADEMARK OFF. SOC'Y 11 (1998). Even before that time, the U.S. colonies granted patent rights. *See*

rather dramatic changes in the first fifty years of the Republic—beginning with a requirement that two cabinet officials must personally review and sign off on any patent[9] and swinging to the other extreme with an automatic registration system subject to caveats[10]—by 1836 the essential features of modern patent law were in place.[11] Despite periodic revisions, most recently in 1952, the basic structure of the patent system has remained unchanged for 165 years.

Technology, of course, has changed dramatically during that time. The "useful arts" envisioned by the Framers were mechanical inventions useful in a primarily agrarian economy. Since that time, the country has gone through several periods of dramatic innovation in a wide variety of fields. As late as 1950, though, most inventions were still mechanical in nature. It is only in the last half-century—and to a large extent in the last twenty-five years, as Allison and Lemley show[12]—that patent law has lost its primarily mechanical character, branching out into biotechnology, semiconductors, computer hardware and software, electronics, and telecommunications.

What is notable about this history is that the fundamental rules of patent law were set in a world in which inventions were mechanical. Because inventions in the past were far more homogenous than they are today,[13] it made sense to have a unified set of rules for dealing with those inventions. The application of those old rules to new technologies has not been free from controversy. Some have suggested that the unified rules suitable for the old, homogeneous world are no longer appropriate in today's increasingly complex innovative landscape.[14] But without changing the rules themselves, in the last dozen years the Federal Circuit has applied those rules in a way that effectively creates different standards for different in-

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ROBERT P. MERGES ET AL., INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE 127, 128 (2d ed. 2000).

9. This was a feature of the short-lived Patent Act of 1790. *See* Walterscheid, *supra* note 8; Edward C. Walterscheid, *Charting a Novel Course: The Creation of the Patent Act of 1790*, 25 AIPLA Q.J. 445, 519-20 (1997).

10. The 1793 Act replaced the cumbersome cabinet-level review with a registration system. Under this system, patents were granted without examination unless a competitor or other interested party filed a "caveat"—essentially a request to be notified and given a chance to object if someone patented in a particular field. *See* Walterscheid, *supra* note 8, at 73.

11. *See* MERGES ET AL., *supra* note 8, at 128.

12. *See* John R. Allison & Mark A. Lemley, *The Growing Complexity of the United States Patent System*, 82 B.U. L. REV. 77, 87-90 (2002).

13. *Id*. at 79-80.

14. *See infra* notes 120-124 and accompanying text.

dustries.[15] In the sections that follow, we examine the treatment of two such industries in detail: computer software and biotechnology.

B. Software Patent Law

Software is patentable today, though it was not always so.[16] The Federal Circuit moved towards declaring software patentable by fits and starts for years. Finally, with the late-1990s decisions in *State Street Bank*[17] and *AT&T v. Excel*,[18] the court unreservedly admitted software to the pantheon of patentable subject matter. In doing so, the court emphasized that it was deciding only the question of whether software was the sort of invention that could be patentable.[19] It left the remaining patent validity issues—

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15. Hodges observes that computers and biotechnology are treated differently in the written description cases, though he limits his focus primarily to biotechnology. Robert A. Hodges, Note, *Black Box Biotech Inventions: When a "Mere Wish or Plan" Should be Considered an Adequate Description of the Invention*, 17 GA. ST. U. L. REV. 831, 833 (2001). Others have complained that even within industries the standard may not be applied consistently. *See, e.g.*, Glynn S. Lunney Jr., *E-Obviousness*, 7 MICH. TELECOMM. & TECH. L. REV. 363, 365 & n.13 (2001).

16. The curious history of the patentability of software is discussed in detail elsewhere. *See, e.g.*, GREGORY A. STOBBS, SOFTWARE PATENTS (1995); David S. Benyacar, *Mathematical Algorithm Patentability: Understanding the Confusion*, 19 RUTGERS COMPUTER & TECH. L.J. 129 (1993); Donald S. Chisum, *The Patentability of Algorithms*, 47 U. PITT. L. REV. 959 (1986); Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CAL. L. REV. 1 (2001); Irah H. Donner & J. Randall Beckers, *Throwing Out Baby Benson with the Bath Water: Proposing a New Test for Determining Statutory Subject Matter*, 33 JURIMETRICS J. 247 (1993); Lee A. Hollaar, *Justice Douglas Was Right: The Need For Congressional Action On Software Patents*, 24 AIPLA Q.J. 283 (1996); Allen Newell, *The Models Are Broken, The Models Are Broken!*, 47 U. PITT. L. REV. 1023 (1986); Pamela Samuelson, *Benson Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions*, 39 EMORY L.J. 1025, 1033 n.24 (1990); Richard H. Stern, *Tales from the Algorithm War: Benson to Iwahashi, It's Déjà Vu All Over Again*, 18 AIPLA Q.J. 371 (1991); Jur Strobos, *Stalking the Elusive Patentable Software: Are There Still Diehr or Was It Just a Flook?*, 6 HARV. J.L. & TECH. 363 (1993); John Swinson, *Copyright or Patent or Both: An Algorithmic Approach to Computer Software Protection*, 5 HARV. J.L. & TECH. 145 (1991); Jonathan N. Geld, Note, General Does Not Mean Generic—Shedding Light on In re Alappat, 4 TEX. INTELL. PROP. L.J. 71 (1995); Maximilian R. Peterson, Note, *Now You See It, Now You Don't: Was It a Patentable Machine or an Unpatentable "Algorithm"? On Principle and Expediency in Current Patent Law Doctrines Relating to Computer-Implemented Inventions,* 64 GEO. WASH. L. REV. 90 (1995).

17. State Street Bank & Trust v. Signature Fin. Group, 149 F.3d 1368, 1373 (Fed. Cir. 1998).

18. AT&T Corp. v. Excel Communications, 172 F.3d 1352 (Fed. Cir. 1999).

19. *State Street*, 149 F.3d at 1373. The categories of subject matter that are patentable are enumerated in 35 U.S.C. §101 (2000).

notably novelty,[20] nonobviousness,[21] and compliance with the disclosure requirements[22]—to be worked out by the courts on a case-by-case basis.[23]

Section 112 of the Patent Act requires that patentees publish to the world a description of the invention sufficient to enable one of ordinary skill in the art to make and use it, and to include the "best mode" of implementing the invention.[24] Indeed, this disclosure "bargain" between patentees and the public is central to patent policy.[25] Disclosure serves two purposes. First, it permits competitors to make use of the patented invention once the patent expires, ensuring that the invention will ultimately enter the public domain.[26] Second, it enables others to improve on the patented technology during the term of the patent itself, either by "designing around" the patent to produce a noninfringing variant or by developing a better version that, while infringing, is itself entitled to protection.[27]

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20. 35 U.S.C. § 102 (2000).

21. 35 U.S.C. § 103 (2000).

22. 35 U.S.C. § 112 ¶ 1 (2000).

23. *See State Street*, 149 F.3d at 1375. Indeed, on remand in *AT&T* the district court held the patent invalid under § 102. AT&T Corp. v. Excel Communications, 52 U.S.P.Q.2d 1865 (D. Del. 1999).

24. 35 U.S.C. § 112 ¶1 (2000).

25. One classic justification for having a patent system is to encourage inventors to disclose their ideas to the public, who will benefit from this new knowledge once the patent expires. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 489 (1974) (referring to the "federal interest in disclosure" embodied in the patent laws); *see also* EDITH TILTON PENROSE, THE ECONOMICS OF THE INTERNATIONAL PATENT SYSTEM 31-34 (1951).

26. Without the disclosure obligation, patentees could conceivably keep the workings of their inventions secret, relying on that secrecy to extend protection even after the patent has expired. *See* Pitney-Bowes, Inc. v. Mestre, 701 F.2d 1365, 1372 n.12 (11th Cir. 1983) (discussing such policy concerns).

27. For a detailed discussion of how the law allocates rights between initial inventors and improvers, see, e.g., Howard F. Chang, *Patent Scope, Antitrust Policy, and Cumulative Innovation*, 26 RAND J. ECON. 34 (1995); Jerry R. Green & Suzanne Scotchmer, *On the Division of Profit in Sequential Innovation*, 26 RAND J. ECON. 20 (1995); James B. Kobak Jr., *Intellectual Property, Competition Law and Hidden Choices Between Original and Sequential Innovation*, 3 VA. J. L. & TECH. 6 (1998); Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989 (1997); Clarisa Long, *Proprietary Rights and Why Initial Allocations Matter*, 49 EMORY L.J. 823 (2000); Robert P. Merges, *Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents*, 62 TENN. L. REV. 75 (1994); Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839 (1990); Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29 (1991); Suzanne Scotchmer, *Protecting Early Innovators: Should Second-Generation Products be Patentable?*, 27 RAND J. ECON. 322 (1996).

For software patents, however, a series of recent Federal Circuit decisions has all but eliminated the enablement and best mode requirements. In recent years, the Federal Circuit has held that software patentees need not disclose source or object code, flow charts, or detailed descriptions of the patented program. Rather, the court has found high-level functional descriptions sufficient to satisfy both the enablement and best mode doctrines.[28] For example, in *Northern Telecom, Inc. v. Datapoint Corp.*,[29] the patent claimed an improved method of entering, verifying, and storing (or "batching") data with a special data entry terminal. The district court invalidated certain claims of the patent on the grounds that they were inadequately disclosed under § 112.[30] The Federal Circuit reversed.[31] It held that when claims pertain to a computer program that implements a claimed device or method, the enablement requirement varies according to the nature of the claimed invention as well as the role and complexity of the computer program needed to implement it.[32] Under the facts in this case, the court reasoned, the core of the claimed invention was the combination of components or steps, rather than the details of the program the applicant

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On the importance of creative design-arounds for innovation, see *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 36 (1997), which contrasts "the intentional copyist making minor changes to lower the risk of legal action" with "the incremental innovator designing around the claims, yet seeking to capture as much as is permissible of the patented advance". *See also* Slimfold Mfg. Co. v. Kinkead Indus. Inc., 932 F.2d 1453, 1457 (Fed. Cir. 1991) ("Designing around patents is, in fact, one of the ways in which the patent system works to the advantage of the public in promoting progress in the useful arts, its constitutional purpose."); State Indus. v. A.O. Smith Corp., 751 F.2d 1226, 1236 (Fed. Cir. 1985) ("One of the benefits of a patent system is its so-called 'negative incentive' to 'design around' a competitor's products, even when they are patented, thus bringing a steady flow of innovations to the marketplace."); Matthew J. Conigliaro et al., *Foreseeability in Patent Law*, 16 BERKELEY TECH. L.J. 1045 (2001); Craig Allen Nard, *Toward a Pragmatic Textualist Theory of Claim Interpretation*, 14 HARV. J. L. & TECH. 1, 40-43 (2000) ("The practice of designing around extant patents creates viable substitutes and advances, resulting in competition among patented technologies. The public clearly benefits from such activity.").

28. *See* Fonar Corp. v. General Electric Co., 107 F.3d 1543, 1549 (Fed. Cir. 1997); *see also* Lawrence D. Graham & Richard O. Zerbe, Jr., *Economically Efficient Treatment of Computer Software: Reverse Engineering, Protection, and Disclosure*, 22 RUTGERS COMPUTER & TECH. L.J. 61, 96-97 (1996); Anthony J. Mahajan, Note, *Intellectual Property, Contracts, and Reverse Engineering After* ProCD*: A Proposed Compromise for Computer Software*, 67 FORDHAM L. REV. 3297, 3317 (1999).

29. 908 F.2d 931 (Fed. Cir. 1990), *cert. denied*, 498 U.S. 920 (1990).

30. Northern Telecom, Inc. v. Datapoint Corp., No. CA3-82-1039-D (N.D. Tex. Aug. 31, 1988).

31. 908 F.2d at 943 (Fed. Cir. 1990).

32. *Id*. at 941.

actually used.[33] The court noted expert testimony that various programs could be used to implement the invention, and that it would be "relatively straightforward [in light of the specification] for a skilled computer programmer to design a program to carry out the claimed invention."[34] The court continued:

> The computer language is not a conjuration of some black art, it is simply a highly structured language . . The conversion of a complete thought (as expressed in English and mathematics, i.e. the known input, the desired output, the mathematical expressions needed and the methods of using those expressions) into a language a machine understands is necessarily a mere clerical function to a skilled programmer.[35]

And in *Fonar Corp. v. General Electric Co.*,[36] involving the best mode requirement, the Court explained:

> As a general rule, where software constitutes part of a best mode of carrying out an invention, description of such a best mode is satisfied by a disclosure of the functions of the software. This is because, normally, writing code for such software is within the skill of the art, not requiring undue experimentation, once its functions have been disclosed. It is well established that what is within the skill of the art need not be disclosed to satisfy the best mode requirement as long as that mode is described. Stating the functions of the best mode software satisfies that description test. We have so held previously and we so hold today. Thus, flow charts or source code listings are not a requirement for adequately disclosing the functions of software.[37]

Indeed, in a few cases the Federal Circuit has gone so far as to hold that patentees can satisfy the written description and best mode requirements for inventions implemented in software even though they do not use

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33. *Id*.
34. *Id*. at 941-42.
35. *Id*. at 942 (quoting *Ex rel* Sherwood, 613 F.2d 809, 817 n.6 (C.C.P.A. 1980).
36. 107 F.3d 1543 (Fed. Cir. 1997).
37. *Id*. at 1549 (citations omitted).

the terms "computer" or "software" anywhere in the specification![38] To be sure, in these latter cases it would probably be obvious to one skilled in the art that the particular feature in question should be implemented in software, though it would not necessarily be obvious *how* to do so. One recent case suggests limits on this conclusion, holding that an oil drilling company failed to enable its method for calculating the location of a borehole when it kept all information about the computer programs used to perform the calculation secret.[39] Still, it is remarkable that the Federal Circuit is willing to find the enablement requirement satisfied by a patent specification that provides *no* guidance whatsoever on how the software should be written.[40]

It is simply unrealistic to think that one of ordinary skill in the programming field can necessarily reconstruct a computer program given no more than the purpose the program is to perform. Programming is a highly technical and difficult art. Unfortunately, the Federal Circuit's peculiar direction in the software enablement cases has effectively nullified the dis-

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38. *See* Robotic Vision Sys., Inc. v. View Eng'g, Inc., 112 F.3d 1163 (Fed. Cir. 1997) (best mode); *In re* Dossel, 115 F.3d 942 (Fed. Cir. 1997) (written description).

By contrast, in *White Consol. Indus., Inc. v. Vega Servo-Control, Inc.*, 713 F.2d 788 (Fed. Cir. 1983), the Federal Circuit had invalidated a patent for a machine tool control system which was run by a computer program. Part of the invention was a programming language translator designed to convert an input program into machine language, which the system could then execute. The patent specification identified an example of a translator program, the so-called SPLIT program, which was a trade secret of the plaintiff. The court held that the program translator was an integral part of the invention, and that mere identification of it was not sufficient to discharge the applicant's duty under section 112. The court seemed concerned that maintaining the translator program as a trade secret would allow White to extend the patent beyond the 17-year term then specified in the patent code.

While *White* suggests that it is not sufficient merely to identify the program or its functions, more recent Federal Circuit authority is overwhelmingly to the contrary. *See, e.g.*, *In re* Dossel, 115 F.3d at 946 (Fed. Cir. 1997) (deeming the disclosure that "'known algorithms'" can be used to solve standard equations which are known in the art" sufficient to satisfy the written description requirement, although the exact mathematical algorithm. . . was not).

39. *See* Union Pacific Resources v. Chesapeake Energy Corp., 236 F.3d 684, 690-92 (Fed. Cir. 2001). However, the court made it clear that only the general nature of the program, not the program itself, need be disclosed. *Id*. at 691.

40. One recent decision even found that a specification that provided inconsistent and inaccurate guidance as to how the invention worked was not rendered indefinite by a lack of enablement. *See* S3 Inc. v. Nvidia Corp., 259 F.3d 1364 (Fed. Cir. 2001). *But see id*. at 1371 (Gajarsa, J., dissenting).

closure requirement for software patents.[41] And since source code is normally kept secret, software patentees generally disclose little or no detail about their programs to the public.[42] Software patentees during the 1980s and early 1990s tended to write their patents in means-plus-function format[43] in order to satisfy the changing dictates of the Federal Circuit's patentable subject matter rules.[44] Lawyers writing patents in such a format have an incentive to describe their invention in the specification in terms that are as general as possible, since means-plus-function claim elements will be limited to the actual structure disclosed in the specification and

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41. A recent development in Federal Circuit jurisprudence may suggest another source for a robust disclosure obligation, however. The court has recently reinvigorated the written description requirement in § 112 ¶ 1, not only in biotechnology cases, *see, e.g.*, Regents of the Univ. of Calif. v. Eli Lilly & Co., 119 F.3d 1559 (Fed. Cir. 1997), but also in cases about other types of inventions, *see, e.g.*, Gentry Gallery, Inc. v. Berkline Corp., 134 F.3d 1473 (Fed. Cir. 1998) (reclining chairs); Hyatt v. Boone, 146 F.3d 1348 (Fed. Cir. 1998) (computer chip); Purdue Pharma v. Faulding, Inc., 230 F.3d 1320 (Fed. Cir. 2000) (method of treating pain). Under those cases, a patent claim may be invalid in certain circumstances if the specification does not expressly describe what the claim covers, even if the specification gave sufficient information to enable the claim. *See also* Johnson & Johnston Assoc. v. R.E. Service Co., 285 F.3d 1046 (Fed. Cir. 2001) (en banc) (equivalents disclosed in the patent but not claimed are dedicated to the public domain). We argue below that a broad reading of the written description requirement is largely unique to biotechnology cases and is primarily limited to those cases in which a patent claim is amended during prosecution to track a competitor's product. The cases so far suggest that the courts will not apply *Eli Lilly* to software. *See In re* Dossel, 115 F.3d 942, 946 (Fed. Cir. 1997) (rejecting written description argument in a software case, albeit before the Federal Circuit's more recent cases on the issue); Reiffin v. Microsoft Corp., 214 F.3d 1342, 1348 (Fed. Cir. 2000) (Newman, J., concurring) (arguing that *Gentry Gallery* does not create a new, stringent written description rule; the majority did not address the merits); Sun Microsystems v. Kingston Tech., 57 U.S.P.Q.2d 1822 (N.D. Cal. 2000) (holding that lack of written description does not invalidate software patent). If we are wrong, however, and cases like *Eli Lilly* represent a general rule, it could mean that most software patents will be held invalid for failure to describe the invention in any detail.

42. *See, e.g.*, MELVIN C. GARNER ET AL., *Advanced Claim Drafting and Amendment Writing Workshop for Electronics and Computer-Related Subject Matter*, *in* ADVANCED CLAIM AND AMENDMENT WRITING 1996, 227, 275 (PLI 1996) (source code listings in patents "are primarily a relic of the early days of computer program patents when it was unclear what would suffice for sufficiency of disclosure"); Thomas P. Burke, Note, *Software Patent Protection: Debugging the Current System,* 69 NOTRE DAME L. REV. 1115, 1158-60 (1994).

43. *See* 35 U.S.C. § 112 ¶ 6 (2000).

44. *See, e.g.*, *In re* Alappat, 33 F.3d 1526 (Fed. Cir. 1994) (en banc).

equivalents thereof.[45] As a result, there is no easy way to figure out what a software patent owner has built except to reverse engineer the program.[46]

The court's reasoning in the enablement and best mode cases has another implication as well. Because the court views actually writing and

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45. *Id*. at 1541.

46. On the perils of reverse engineering patented software, see Cohen & Lemley, *supra* note 16, at 17-21. For discussions of how to satisfy the disclosure requirement in software patents, see Wesley L. Austin, *Software Patents*, 7 TEX. INTELL. PROP. L.J. 225, 277 (1999); David Bender & Anthony R. Barkume, *Disclosure Requirements for Software-related Patents*, 8 NO. 10 COMPUTER LAW. 1 (1991); Michael Bondi, *Upholding the Disclosure Requirements of 35 U.S.C. § 112 Through The Submission of Flow Charts with Computer Software Patent Applications*, 5 SOFTWARE L.J. 635 (1992); D.C. Toedt III, *Patents for Inventions Utilizing Computer Software: Some Practical Pointers*, 9 NO. 10 COMPUTER LAW. 12 (1992) (suggesting disclosure of 'pseudo-code,' i.e., generalized code not written in a particular programming language, to satisfy § 112, and discussing pros and cons of disclosing actual source code). Thomas Burke provides a policy argument in favor of greater disclosure:

> A software patent without source code is like a law review piece filled with case names but missing citations to case reporters. A person of ordinary skill in legal research might be able to track down the full-text of all the opinions. Marbury v. Madison would be found quicker than a state trial court opinion. But, would anyone think that such a practice was enabling or the best mode? As it is now, the disclosure requirements can be met using such devices as specifications, flowcharts, and pseudo-code.

Professor Randall Davis of MIT summed it up at the National Research Counsel in 1990:

> There is almost no way to visualize software. Sure, we have flow charts, we have data-flow diagrams, we have control flow diagrams, and everybody knows how basically useless those are. Flow charts are documentation you write afterward — because management requires them, not because they are a useful tool.
>
> A patent is most similar to a real property deed specifying the metes and bounds for a parcel of land. Both documents are not easily understood but succeed if they secure the owners' interests in the specified claims. If the goal is to inform the world of an invention, software professionals have avenues more timely and less expensive than pursuing a patent application. In fostering the trade-off between the interests of inventors and the public, the source code is the best way to explain an algorithm.
>
> Under this proposal, a computer system's complete source code would not have to be appendixed to the patent. The applicant would only have to include the source code directly relevant to enabling the claim language. In cases where claims are broadly written (as in a means-plus-function apparatus claim that covers the automation of an entire industry), a nearly complete program listing would be required.

Burke, *supra* note 42, at 1158-60.

debugging a program as a "mere clerical function" "within the skill of the art," it seems to follow that the court is unlikely to consider the work of programming itself to be sufficiently innovative to meet the nonobviousness threshold of section 103. After all, much the same test for adequacy of disclosure—would one of ordinary skill in the art be able to make the patented invention without undue experimentation—is also central to the obviousness inquiry.[47]

While only a limited number of appellate decisions discuss obviousness in the context of software patents, there is some reason to believe that the court is imposing a rather strict standard. The first case involving the obviousness of a software-implemented invention is, perhaps surprisingly, a Supreme Court case from the 1970s. In *Dann v. Johnston*,[48] the Court held a patent on a "machine system for automatic record-keeping of bank checks and deposits" invalid for obviousness.[49] The Court took a rather broad view of obviousness in the computer industry, focusing on whether systems analogous to the patentee's had been implemented in computers before, rather than analyzing the precise differences between the patentee's program and the prior art programs.[50] The clear implication of the opinion is that if a reasonably skilled programmer could produce a program analogous to the patented one, and if there was motivation in the prior art to do so when the program was written, the patented program is obvious and thus not patentable.

The Federal Circuit has found software patents invalid for obviousness in two recent cases, *Lockwood v. American Airlines*[51] and *Amazon.com v. Barnes & Noble*.[52] Neither case opined directly on the ease with which computer programs could be produced, but both viewed obviousness as a rather substantial hurdle to patenting software.[53] In *Lockwood*, the question was

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47. *Compare In re* Vaeck, 947 F.2d 488, 493-94 (Fed. Cir. 1991) (levels of experimentation and skill in the art in obviousness test) *with In re* Wands, 858 F.2d 731, 736-37 (Fed. Cir. 1988) (levels of experimentation and skill in the art in enablement test). *See also* Donald S. Chisum, *Anticipation, Enablement and Obviousness: An Eternal Golden Braid*, 15 AIPLA Q.J. 57, 58 (1987) (discussing the fundamentally interrelated nature of the obviousness and enablement inquiries).

We argue below, however, that the two PHOSITA standards are not necessarily equivalent.

48. 425 U.S. 219 (1976).

49. *Id.* at 228-29.

50. *Id.* at 220.

51. 107 F.3d 1565 (Fed. Cir. 1997).

52. 239 F.3d 1343 (Fed. Cir. 2001).

53. *See Lockwood*, 107 F.3d at 1572; *Amazon.com*, 239 F.3d at 1359-60. In *In re Zurko*, 111 F.3d 887, 889 (Fed. Cir. 1997), the Federal Circuit held that a patented soft-

whether the defendant's own system made the patented claims obvious. The system had been in public use, but American Airlines had kept the workings of the system secret. Nonetheless, because Lockwood's patent was claimed in broad functional terms, the court found that similarly broad functional disclosures in the prior art were sufficient to render the patent obvious. While Lockwood argued that the information provided was not sufficient for one skilled in the art to make and use the system, the court pointed out that it was as detailed as the information Lockwood's own patent provided.[54] Thus, the patent's meager disclosure of technical details indirectly contributed to the court's finding of obviousness. In *Amazon.com*, the court found Amazon's "one-click" shopping feature to be obvious in view of certain references describing the desirability or feasibility of such a system in general terms, and one prior system that delivered data online in response to a mouse click. The court rejected arguments that the one-click feature was technically difficult to implement, relying on the fact that the prior art generally described such a system as both desirable and feasible. The court also gave surprisingly short shrift to Amazon's evidence of secondary considerations of nonobviousness.[55]

The likely result of the Federal Circuit's focus on high-level functionality is that improvements in programming techniques will be found obvious and thus not patentable in view of prior art that solved the same basic problem in a somewhat different way. This was arguably the result in both *Dann* and *Lockwood*,[56] and it seems to follow from the court's view in the section 112 cases that programmers are an extremely skilled bunch needing little or no guidance from the prior art in order to implement a new idea in software. While disclosure is a minimal hurdle for software patents, then, obviousness can be a rather tough one.[57]

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ware invention was nonobvious even though each of the elements of the invention could be found in the prior art, because the prior art did not identify the problem to be solved. While *Zurko* certainly demonstrates that some software patents will be held nonobvious, it is a specific holding of rather limited utility to most software patentees.

54. *See Lockwood*, 107 F.3d at 1570.

55. *Amazon.com*, 239 F.3d at 1366. To be sure, the court may have treated Amazon's patent more harshly because the case arose on appeal from a preliminary injunction. The court suggested that preliminary injunctions should not be granted if there were any serious questions as to the validity of the patent. *Id*. at 1350-51. Whether it would apply such a strict test of obviousness after trial is not clear.

56. *See also* Electronic Planroom v. McGraw-Hill Cos., 135 F. Supp. 2d 805, 826-27 (E.D. Mich. 2001).

57. The minimal disclosure requirement can create other problems for software patentees as well. For example, under the Supreme Court's decision in *Pfaff v. Wells Electronics*, 525 U.S. 55, 67 (1998), a § 102(b) on sale bar is triggered when an invention that is put on sale is "ready for patenting." That in turn means that the patentee has prepared

This argument may strike the reader as somewhat surprising. After all, legions of scholars and commentators complain that the PTO is issuing too many software patents, and in particular that it is issuing patents on subject matter that should be considered obvious.[58] We agree with these commentators that the PTO is issuing bad software patents, in part because it cannot find relevant prior art.[59] But our point is a different one: those patents will not fare well in litigation because the Federal Circuit will consider them obvious in view of any other computer program that implements the same basic concepts, regardless of how different those programs are in detailed implementation, or perhaps even in view of prior art merely suggesting the desirability of such a program. Further, while hidden prior

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an enabling disclosure. *Id*. But since the standard for enabling disclosure is so low in software, it is very easy to trigger an on sale bar. *But cf.* Space Systems/Loral, Inc. v. Lockheed Martin Corp., 271 F.3d 1076, 1080 (Fed. Cir. 2001) (holding in a computer hardware case that substantial description was required).

58. *See, e.g.*, Julie E. Cohen, *Reverse Engineering and the Rise of Electronic Vigilantism: Intellectual Property Implications of "Lock-Out" Technologies*, 68 S. CAL. L. REV. 1091, 1178 (1995); Lunney, *supra* note 15, at 374; Robert P. Merges, *As Many As Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 BERKELEY TECH. L.J. 577, 584-87 (1999).

59. A number of commentators have expressed concern about the difficulty PTO examiners have in finding software prior art. As Julie Cohen explains:

> [I]n the field of computers and computer programs, much that qualifies as prior art lies outside the areas in which the PTO has traditionally looked — previously issued patents and previous scholarly publications. Many new developments in computer programming are not documented in scholarly publications at all. Some are simply incorporated into products and placed on the market; others are discussed only in textbooks or user manuals that are not available to examiners on line. In an area that relies so heavily on published, "official" prior art, a rejection based on "common industry knowledge" that does not appear in the scholarly literature is unlikely. Particularly where the examiner lacks a computer science background, highly relevant prior art may simply be missed. In the case of the multimedia data retrieval patent granted to Compton's New Media, industry criticism prompted the PTO to reexamine the patent and ultimately to reject it because it did not represent a novel and nonobvious advance over existing technology. However, it would be inefficient, and probably impracticable, to reexamine every computer program-related patent, and the PTO is unlikely to do so.

Cohen, *supra* note 58, at 1178 (citations omitted). *See also* Cohen & Lemley, *supra* note 16, at 42-44; Greg Aharonian, *Legal Resources and Tools for Surviving Bad Patents*, *at* http://www.bustpatents.com (last visited Oct. 12, 2002). *But cf.* John R. Allison & Mark A. Lemley, *Who's Patenting What? An Empirical Exploration of Patent Prosecution*, 53 VAND. L. REV. 2099, 2131-32 (2000) (noting that software patents actually cite slightly more nonpatent prior art than other types of patents do).

art is indeed a problem, parties in litigation have far more time and money to spend than do patent examiners, and they are much more likely than the PTO to find the best prior art.[60] The probable result is that, while numerous software patents will issue, a large number of those actually litigated will be found obvious and thus invalid.

The court's assumption that programmers are extremely skilled may have other implications as well. For example, under *Pfaff v. Wells Electronics*,[61] an invention is "on sale" for purposes of the § 102(b) statutory bar when it is "ready for patenting."[62] If a program need not be written in order for a software invention to be described or enabled, programmers may find that they put a not-yet-written computer program on sale—and therefore potentially lost their patent rights—merely by describing it in broad functional terms in a commercial communication.

Patent scope is necessarily interrelated with obviousness and enablement.[63] The breadth of patent protection is in part a function of how different the invention is from the prior art. Further, patent claims are invalid if they are not fully described and enabled by the patent specification, so the permissible breadth of a patent will be determined by how much information the court determines must be disclosed to enable one of ordinary skill in the art to make and use the patented invention. The scope of the doctrine of equivalents is also a function of obviousness and enablement, since a patentee is not permitted to capture ground under the doctrine of equivalents that it would not have been permitted to claim in the first place.[64]

The Federal Circuit's treatment of software validity issues suggests that while the court will find relatively few software patents nonobvious, those that it does approve will be entitled to broad protection. The Federal Circuit's decisions strongly suggest that a patent is nonobvious only if it is the first program to perform a given function. Most patents will not meet this test, of course, but those that do will not be constrained by prior art to claim only their particular implementation of a function. They can claim the function itself. And the fact that they give little or no description of how to achieve this function will be no bar to the broad claims because the

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60. *See, e.g.*, Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495 (2001).

61. 525 U.S. 55 (1998).

62. 35 U.S.C. § 102(b) (2000).

63. *See* Chisum, *supra* note 47.

64. *See* Wilson Sporting Goods v. David Geoffrey & Assoc., 904 F.2d 677 (Fed. Cir. 1990).

Federal Circuit has proven remarkably unwilling to require software patentees to disclose details. As a result, we should expect the first programmer to implement a new idea in software to claim the entire category of software, regardless of how second-comers actually implement the same concept.

The evidence on software patent claim scope so far is mixed, though there is some evidence tending to support this hypothesis. Most notably, in *Interactive Gift Express v. Compuserve*,[65] the patentee had designed a kiosk system for printing copyrighted works on demand. The Federal Circuit held that the claims of the patent should be read broadly, to cover any form of online downloading in response to a remote request.[66] In doing so, it reversed the district court's construction of five separate claim elements. As construed by the Federal Circuit, the patent is breathtaking in its scope, and most electronic commerce sites that permit downloading of digital information are likely within its ambit.

The court's treatment of software patent scope under the doctrine of equivalents has been less uniform. Many of these decisions have rejected the application of the doctrine of equivalents to read claim language written for one product generation at such a high level of abstraction that it covers accused products from a different generation. Thus, in *Alpex Computer Corp. v. Nintendo Co.*,[67] the Federal Circuit held that a patent claim to a video game output display system was not infringed by a next-generation system that worked in a different way. Alpex's claimed system included a display RAM that stored information corresponding to each pixel of a television screen in a discrete location. Nintendo's accused device, by contrast, used shift registers to store one "slice" of the video display at any given time. The Federal Circuit rejected a jury finding that the two systems were equivalent.[68] In *Digital Biometrics, Inc. v. Identix, Inc.*,[69] the court likewise construed narrowly a patent claim to "image ar-

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65. 256 F.3d 1323 (Fed. Cir. 2001).

66. *Id*.

67. 102 F.3d 1214 (Fed. Cir. 1996).

68. *Id.* at 1222. To similar effect as *Alpex* is *Wiener v. NEC Electronics, Inc.*, 102 F.3d 534 (Fed. Cir. 1996). In that case, the Federal Circuit upheld the district court's finding of noninfringement under the doctrine of equivalents, because there were substantial differences between the patent's requirement that a computer program "call on" columns of data one byte at a time and the defendant's product, in which the columns alleged to be equivalent were not in the data matrix, and therefore were not called upon to read data. The court rejected the "conclusory" declaration of plaintiff's expert that the two processes were identical.

69. 149 F.3d 1335 (Fed. Cir. 1998).

rays" which stored a two-dimensional slice of video data, and which were merged into a "composite array" for storing a fingerprint image. The court held that the defendant's systems, which constructed the composite array directly rather than by using two-dimensional slices, did not create "image arrays" within the meaning of the claims. More recently, in *Wang Laboratories, Inc. v. America Online*,[70] the court affirmed a district court decision granting summary judgment of noninfringement under the doctrine of equivalents. The patent claims in that case covered "frames," defined in the specification as pages encoded in character-based protocols. The court rejected Wang's attempt to extend the patent to cover bit-mapped pages, crediting evidence that there were "huge, huge differences" between the two approaches.[71]

Other cases have applied the doctrine of equivalents more broadly. In some of those cases, the Federal Circuit has found equivalence between two different types of software programs written in different product generations. More troubling, some cases suggest that software implementations of certain ideas are equivalent to older mechanical implementations. An example is *Overhead Door Corp. v. Chamberlain Group, Inc.*,[72] where the patented system claimed a (mechanical) switch connected to a microprocessor that could store the codes of multiple garage doors. The Federal Circuit held that the claim was not literally infringed by an electronic switch implemented in software. However, the court reversed a grant of summary judgment to the defendants under the doctrine of equivalents, concluding that a reasonable jury could find that the difference between mechanical and software implementations was a mere "design choice."

WMS Gaming, Inc. v. International Game Technology[73] is also instructive. In that case, the court held that a claim written in means-plus-function language that relied for its corresponding structure on a computer

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70. 197 F.3d 1377 (Fed. Cir. 1999).

71. *Id*. at 1386. *See also* Network LLC v. Centraal Corp., 58 U.S.P.Q.2d 1076 (Fed. Cir. 2001) (claim requiring caching of data by local servers that pulled information from a central registry not infringed under the doctrine of equivalents by a system in which all local computers hold full copies of the central registry).

In a related context (interpreting equivalent structure in a means-plus-function claim), the court held that Nintendo's video game systems did not infringe GE's television switch patents because the patents, written in means-plus-function format, did not disclose a function for the switches identical to Nintendo's function. *See* General Electric Co. v. Nintendo Co., 179 F.3d 1350, 1363 (Fed. Cir. 1999). On how the doctrine of equivalents differs from equivalence under a means-plus-function analysis, see *Chiuminatta Concrete Concepts, Inc. v. Cardinal Indus.*, 145 F.3d 1303 (Fed. Cir. 1998).

72. 194 F.3d 1261 (Fed. Cir. 1999).

73. 184 F.3d 1339 (Fed. Cir. 1999).

programmed with a particular algorithm was limited in literal scope to the particular algorithm chosen and equivalents thereof. However, the court found the defendant's algorithm infringing under the doctrine of equivalents, presumably because it was largely indifferent to which algorithm implemented the function of the program. This latter approach has the potential to expand the scope of patents in the software industry dramatically.[74]

Software patents, then, are likely to face serious obviousness hurdles. The few patents that overcome those hurdles need disclose virtually nothing about the detailed workings of their invention, and will likely be broadly interpreted to cover a variety of algorithms and program structures for implementing the basic software invention. We would expect the outcome of such a patent policy to be an industry dominated by a relatively small number of broad patents. But this is not the inescapable result arising from application of current patent doctrines, as we see when we turn to consider the Federal Circuit's contemporary treatment of a different sector, biotechnology.

C. Biotechnology Patent Cases[75]

In contrast to the Federal Circuit decisions regarding software, recent decisions involving genetic material have imposed a stringent disclosure standard for patenting macromolecules.[76] The Court has placed particular

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74. For an argument that a variety of structural tendencies are likely to drive the courts to read software patent claims broadly under the doctrine of equivalents, see Cohen & Lemley, *supra* note 16, at 39-50.

75. For background on the science of biotechnology, see generally ROBERT P. MERGES, ET AL., INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE: 2002 CASE AND STATUTORY SUPPLEMENT 501-16 (2001); Dan L. Burk, *A Biotechnology Primer*, 55 U. PITT. L. REV. 611 (1994).

76. We acknowledge Lawrence Sung's contrary view, that the Federal Circuit's biotechnology cases are simply decided on their individual facts and do not reflect any patterns. *See* Sung, *infra* note 188, at 107. *See also* John W. Schlicher, *Biotechnology and the Patent System: Patent Law and Procedures for Biotechnology, Health Care and Other Industries*, 4 U.BALT. INTELL. PROP. L.J. 121, 127 (1996) ("I do not understand the Court of Appeals for the Federal Circuit to have created a subset of patent law doctrines for biotechnology."). But other commentators appear to recognize that something unusual is happening in the case of biotechnology. *See, e.g.*, Hodges, *supra* note 15, at 832; Janice M. Mueller, *The Evolving Application of the Written Description Requirement to Biotechnological Inventions*, 13 BERKELEY TECH. L.J. 615 (1998); Harris A. Pitlick, *The Mutation on the Description Requirement Gene*, 78 J. PAT. & TRADEMARK OFF. SOC'Y 209 (1998); Margaret Sampson, *The Evolution of the Enablement and Written Description Requirements Under 35 U.S.C. § 112 in the Area of Biotechnology*, 15 BERKELEY TECH. L.J. 1233 (2000). It seems readily apparent to us, as to the majority of other com-

emphasis on the "written description" requirement of section 112, which requires the patentee to specifically describe the claimed invention as part of the disclosure. The justification for such a detailed description is to demonstrate to others of ordinary skill that the inventor in fact has the invention in her possession; the assumption being that a sufficiently detailed description would not be possible if the inventor were speculating or guessing about its features.[77] This requirement is separate from (and potentially more stringent than) the enablement requirement. Although the two are closely connected, satisfying one requirement does not necessarily satisfy the other. The classic example offered by one court is the situation in which the description of a particular chemical compound enables one of ordinary skill to make other, related, compounds, yet those other compounds are not described in the patent disclosure. The first compound is both enabled and described; the others are only enabled.[78]

This venerable chemical patenting hypothetical has been brought to life by the Federal Circuit's biotechnology opinions. For example, in *Fiers v. Revel*,[79] the court considered the decision of the Patent Office in a three-way interference over patent applications claiming the human DNA sequence that produces the protein fibroblast beta-interferon (β-IF).[80] One of the applicants, Revel, relied for priority upon his Israeli patent application, which disclosed methods for isolating a fragment of the DNA sequence coding for β-IF and for isolating messenger RNA coding for β-IF. The court considered whether the disclosure in Revel's Israeli application satisfied the U.S. written description requirement and could therefore support a U.S. application. The Federal Circuit upheld a determination by the Board of Patent Appeals and Interferences that Revel's disclosure was not an adequate description, largely because it failed to disclose the actual sequence of the DNA molecule at issue. According to the court's reasoning, disclosing a method for obtaining the molecule was not the same as disclosing the molecule itself:

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mentators, that the biotechnology cases consistently depart from the standards applied in other industries.

77. Of course, in the case of constructive reduction to practice, or filing a "paper patent" without having actually made the invention, the inventor is in some sense speculating or guessing about the features of an invention not yet built. But even in that instance, the underlying assumption in patent law is that the inventor "has" the invention mentally, and so can give a sufficiently detailed description of that inventive conception—physically creating the invention is straightforward.

78. *In re* DiLeone, 436 F.2d 1404, 1405 n.1 (C.C.P.A. 1971).

79. Fiers v. Revel, 984 F.2d 1164 (Fed. Cir. 1993).

80. In biotechnology terms, we say that the DNA sequence in question "codes for" the protein.

> An adequate written description of a DNA requires more than a mere statement that it is part of the invention and reference to a potential method for isolating it; what is required is a description of the DNA itself. . A bare reference to a DNA with a statement that it can be obtained by reverse transcription is not a description; it does not indicate that Revel was in possession of the DNA.[81]

Since the Revel application did not disclose the sequence for the molecule claimed, the court characterized it as disclosing merely "a wish, or arguably a plan, for obtaining the DNA."[82] Under *Fiers*, an inventor does not conceive of a DNA invention until she actually creates it.[83]

A similar conclusion was reached in a subsequent case, *Regents of the University of California v. Eli Lilly*.[84] The patent at issue covered a microorganism carrying the DNA sequence coding for human insulin. The patentee supported this claim by disclosing a method for obtaining the human cDNA[85], as well as the amino acid sequences for the insulin protein and the corresponding insulin DNA sequence in rats. Relying on the *Fiers* opinion, the court concluded that the written description requirement again was not met: "Describing a method of preparing a cDNA or even describing the protein that the cDNA encodes, as the example does, does not necessarily describe the DNA itself."[86]

In reaching these results, the Federal Circuit has been adamant that the degree of specificity required for an adequate description of nucleic acids

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81. *Fiers*, 984 F.2d at 1170-71.

82. *Id.*

83. *See also* Adang v. Fischhoff, 286 F.3d 1346 (Fed. Cir. 2002) (disclosure of genetically altered tobacco plant did not enable claim to genetically altered tomato plant); Hitzeman v. Rutter, 243 F.3d 1345 (Fed. Cir. 2001) (conception of biotechnology invention simultaneous with reduction to practice). To be sure, the court stopped short of creating an absolute rule, noting that "[t]here may be situations where an organism's performance of certain intracellular processes might be reasonably predictable, and evidence of such predictability might be sufficient to support a finding of conception prior to reduction to practice." *Id*. at 1357. But even here the court's language focuses on organic processes, not DNA sequences.

84. 119 F.3d 1559 (Fed. Cir. 1997).

85. cDNA, or complementary DNA, is produced by reverse transcribing the messenger RNA transcript of genomic DNA. DAVID FREIFELDER & GEORGE M. MALACINSKI, ESSENTIALS OF MOLECULAR BIOLOGY 278 (2d ed. 1993). This process reverses the usual flow of genetic information from DNA to RNA, but the cDNA transcript is not necessarily identical to the genomic DNA template, as the mRNA sequence may have been edited after translation. *Id.*

86. *Fiers*, 984 F.2d at 1170-71.

requires description of "structure, formula, chemical name, or physical properties."[87] In *Eli Lilly*, because "[n]o sequence information indicating which nucleotides constitute human cDNA appears in the patent . . the specification does not provide a written description of the invention."[88] The court in such cases seems particularly incensed by applicants who designate a macromolecule by generic or functional terms, such as "vertebrate insulin cDNA":

> A definition by function . . is only an indication of what the gene does, rather than what it is. It is only a definition of a useful result rather than a definition of what achieves that result. Many such genes may achieve that result. The description requirement of the patent statute requires a description of an invention, not an indication of a result that one might achieve if one made that invention. Accordingly, naming a type of material generally known to exist, in the absence of knowledge as to what that material consists of, is not a description of that material.[89]

Such failure to describe more than one or two nucleotides is a particular problem where the patent claims are drawn to a broad class of nucleotides. For example, Revel's claim covered all DNA molecules that code for β-IF, but "[c]laiming all DNAs that achieve a result without defining what means will do so is not in compliance with the description requirement; it is an attempt to preempt the future before it has arrived."[90]

The Federal Circuit's construction of the written description requirement as requiring precise sequence data gains particular significance whenever claims are drawn to an entire genus, or family, of molecules. The patent discussed in the *Eli Lilly* written description analysis claimed a broad family of DNA molecules coding for insulin in different mammalian species, but it disclosed only one species of DNA, that coding for rat insulin. The court held this to be insufficient to describe the broad class of cDNAs coding for mammalian or vertebrate insulin.[91] Although declining to specify exactly what would be needed to support a broad claim, the court cited previous chemical cases dealing with related groups of small molecules. Based on these cases, the court declared that macromolecules should be treated in the same fashion: the patentee need not show every member of a claimed genus, but is required to show a "representative"

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87. *Id.* at 1171.
88. *Eli Lilly*, 119 F.3d at 1567.
89. *Id.* at 1568 (citations omitted).
90. *Fiers*, 984 F.2d at 1171.
91. *Eli Lilly*, 119 F.3d at 1567.

number of cDNAs illustrating or defining the common structural features of a "substantial" portion of the genus.[92]

A similarly broad claim was rejected in the *Amgen* case as failing the standard for enablement rather than written description.[93] There, the patentee claimed nucleic acid sequences coding for the protein erythropoetin or for other proteins with the same biological function. The trial judge concluded that because Amgen was unable to specify which analogs might have the biological properties claimed, the claims were not enabled.[94] The Federal Circuit panel, however, held that the district court had reached the right conclusion for the wrong reason. While the district court focused on the thousands of EPO analogs that could be created by substituting amino acid residues in the polypeptide chain, the appellate court focused on the patentee's failure to disclose the DNA molecules that would code for those analogs.[95] Since the claims were directed to DNA sequences, the issue was not the enablement of the EPO analogs, but rather the enablement of the myriad DNA sequences, which the court held could not be made and used on the basis of a few examples.[96]

In an important recent decision, the Federal Circuit backed off somewhat from its categorical insistence on structure in biotechnology disclosure cases. In *Enzo Biochem v. Gen-Probe*,[97] the court adopted the PTO's Guidelines on Written Description.[98] Those Guidelines provide that biotechnology inventions normally must be described by structure, but may also be described by "functional characteristics when coupled with a known or disclosed correlation between function and structure."[99] The court specifically identified antibody claims as ones that might be described by function—i.e., by describing the antigen to which they bind.[100] Its holding was more limited, however. It held that the deposit of three actual DNA sequences created a factual question as to whether the deposited

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92. *Id*. at 1569. *Cf.* Amgen, Inc. v. Hoechst Marion Roussel, Inc., 126 F. Supp. 2d 69 (D. Mass. 2001) (finding patent for urinary erythropoietin preparations invalid under written description requirement because different preparations vary in glycosylation).

93. Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1212 (Fed. Cir. 1991).

94. *Id.* at 1205.

95. *Id.* at 1212-14.

96. *Id.*

97. 296 F.3d 1316 (Fed. Cir. 2002).

98. *Id*. at 1324-25.

99. U.S. Patent & Trademark Office, Guidelines for the Examination of Patent Applications Under the Written Description Requirement, 66 Fed. Reg. 1099, 1106 (Jan. 5, 2001).

100. *Enzo*, 296 F.3d at 1324.

sequences could satisfy the written description requirement for claims covering those sequences and a broader genus. Because the deposited sequences inherently included the structure of the gene, the court in *Enzo* had no opportunity to endorse claims based entirely on proof of function rather than structure. The court did not repudiate, and indeed relied upon, the *Eli Lilly* baseline rule that disclosure of structure was required.

The same concerns that characterize the Federal Circuit's jurisprudence of biotechnology disclosure—the inadequacy of methodological disclosure, the requirement to specify sequence or structure, and uncertainty of selection within large classes of homologous molecules—have shaped the Federal Circuit's biotechnology obviousness cases. However, in the case of obviousness, the issue has been the presence of such factors in the prior art, rather than in the inventor's disclosure. Thus, the Federal Circuit held in *In re Bell* that a claim to DNA coding for human insulin-like growth factor (hIGF) was not obvious even though the prior art disclosed the amino acid sequence for the hIGF proteins and a method for using that information to obtain the corresponding DNA molecule.[101] Under similar facts in *In re Deuel*, the court found claims directed to DNA coding for heparin binding growth factors (HBGFs) were not obvious in light of prior art disclosure of a partial amino acid sequence and a method for using that information to obtain the corresponding DNA molecule.[102]

Each decision rested largely upon the court's perception that the actual sequence of the claimed DNA molecules was uncertain or unpredictable from the prior art. In both cases the court dismissed as irrelevant the biological relationship between the molecules disclosed in the prior art and those claimed by the patent. The amino acid sequences of the proteins disclosed in the prior art are ultimately determined by the sequence of RNA nucleotides coding for the protein, which is in turn determinative of the cDNA claimed in the patent.[103] The correspondence of nucleotide sequences to amino acid sequences is well known as key to the "central dogma" of molecular biology: the transfer of genetic information from DNA to RNA to protein chains. However, particular amino acids can cor-

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101. *See In re* Bell, 991 F.2d 781, 784 (Fed. Cir. 1993).

102. *See In re* Deuel, 51 F.3d 1552 (Fed. Cir. 1995).

103. Neither *Bell* nor *Deuel* dealt with genomic DNA (gDNA) sequences, which are transcribed by cellular proteins to produce a messenger RNA molecule. *See* FREIFELDER & MALACINSKI, *supra* note 85 (describing the transcription process). Both cases considered nonnaturally occurring cDNA sequences, which are reverse transcribed from messenger RNAs. The correspondence between gDNA and RNA may be very different than that of cDNA to RNA, especially in eukaryotic organisms where the processing of RNA transcripts may be extensive. *Id.*

respond to more than one nucleotide sequence, introducing uncertainty into the inverse relationship: that of amino acid sequence to nucleotide sequence. Because of this redundancy or "degeneracy" in the genetic code, the court noted in *Bell* that a vast number of possible sequences—about 10^{36}—might code for the protein sequences disclosed in the prior art. The plaintiff claimed only one of these, in essence having searched among a large number of possibilities to select the particular cDNA sequence coding for hIGF.

Numerous commentators have pointed out that such a search is relatively routine using tried and true techniques of molecular biology.[104] But prior art disclosure of a method, even an admittedly obvious method, was held insufficient to cure such uncertainty of structure. In rejecting the DNA claims in *Bell* and *Deuel*, the court rejected "the PTO's focus on known methods for potentially isolating the claimed DNA molecules" as "misplaced because the claims at issue define compounds, not methods."[105] Prior to *Bell*, the opinion in *Amgen* had stressed the uncertainty of the methods for gene location available at the time of invention: while "it might have been feasible, perhaps obvious to try, to successfully probe a human gDNA library with a monkey cDNA probe, it does not indicate that the gene could have been identified and isolated with a reasonable likelihood of success. . .there was no reasonable expectation of success in obtaining the EPO gene by the method that Lin eventually used."[106] The court arguably just got the science wrong; by the time of the research at issue in *Bell*, such methods for searching a large universe of molecules were perhaps painstaking and time-consuming, but had an established likelihood of success.

Yet the court defined the issue in *Bell* and *Deuel* not as a matter of the uncertainty of obtaining a particular sequence, but of the uncertainty of predicting or visualizing from the prior art what sequence would be found. Even in the *Amgen* opinion, the court hinted that the key to macromolecular obviousness lay in the prediction of an exact sequence, as "[n]either the DNA nucleotide sequence . . nor its exact degree of homology with the

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104. *See, e.g.*, Anita Varma & David Abraham, *DNA is Different: Legal Obviousness and the Balance Between Biotech Inventors and the Market*, 9 HARV. J.L. & TECH. 53 (1996); PHILIPPE G. DUCOR, PATENTING THE RECOMBINANT PRODUCTS OF BIOTECHNOLOGY (1998); Arti K. Rai, *Intellectual Property Rights in Biotechnology: Addressing New Technology*, 34 WAKE FOREST L. REV. 827 (1999); Arti K. Rai, *Addressing the Patent Gold Rush: The Role of Deference to PTO Patent Denials*, 2 WASH. U.J.L. & POL'Y 199 (2000).

105. *In re* Deuel, 51 F.3d at 1558; *see also In re* Bell, 991 F.2d at 785.

106. Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d at 1208-09.

[prior art] monkey EPO gene was known at the time."[107] And in *Deuel*, the court explicitly held that "until the claimed molecules were actually isolated and purified, it would have been highly unlikely for one of ordinary skill in the art to contemplate what was ultimately obtained. *What cannot be contemplated or conceived cannot be obvious*."[108] Thus a likelihood—or even a certainty—of finding a DNA molecule with particular properties was deemed essentially irrelevant to whether structural claims to that molecule are obvious.[109]

The corollary to this holding is that a molecule will be obvious if the sequence is discernible in the prior art, even if its function is not. Prior art description of the "general idea of the claimed molecules, their function, and their general chemical nature"[110] is insufficient to render a molecule obvious. Some commentators have suggested that this formulation of obviousness stands some danger of collapsing into the standard for anticipation;[111] under section 102 of the Patent Act, an invention lacks patentable novelty if its elements are fully described in a prior art reference, and the Federal Circuit's obviousness requirement could be read to require such a prior art anticipation as the effective standard for obviousness.[112] But unlike the requirements for anticipation, the Federal Circuit's biotechnology obviousness standard appears to require that the sequence of the DNA be predictable from the prior art, and not necessarily explicitly described. For example, the court in *Deuel* suggests that for "a protein of sufficiently small size and simplicity … lacking redundancy, each possible DNA would be obvious over the protein."[113] Although the Federal Circuit has not explicitly held so, one would also suspect that disclosure in the prior art of a substantial number of homologous sequences would render a new

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107. *Id.*

108. 51 F.3d at 1558 (emphasis added).

109. *Cf.* Rhone-Poulenc Agro v. DeKalb Genetics Corp., 272 F.3d 1335, 1357-58 (Fed. Cir. 2001) (holding that addition of second transit peptide to string of amino acids with transit peptide and fragment of a second transit peptide was not obvious because the amino acids were structurally different).

110. *In re Deuel*, 51 F.3d at 1558.

111. *See* Rebecca Eisenberg & Robert P. Merges, *Opinion Letter as to the Patentability of Certain Inventions Associated with the Identification of Partial cDNA Sequences*, 23 AIPLA Q.J. 1, 32 (1995).

112. Indeed, the Federal Circuit has several times suggested that the two patent standards are closely linked, characterizing obviousness as a sort of continuum with anticipation as the 'epitome' or 'ultimate' endpoint of obviousness. *See, e.g.*, *In re* Baxter Travenol Labs, 952 F.2d 388 (Fed. Cir. 1991); Jones v. Hardy, 727 F.2d 1524 (Fed. Cir. 1984); Connell v. Sears, Roebuck & Co., 722 F.2d 1542 (Fed. Cir. 1983).

113. 51 F.3d at 1559.

homologue predictable, and so render it obvious—just as the court has held that disclosure of a substantial number of homologues is enough to satisfy the written description requirement for a genus of homologues.

The Federal Circuit's biotechnology obviousness cases are all of a piece with the court's earlier holdings, such as the rejection on disclosure grounds of Revel's claim to all DNA sequences coding for β-IF.[114] Due to degeneracy in the genetic code, Revel could not adequately describe the claimed invention as DNA coding for β-IF; an astronomically large number of possible sequences might do so. And if a functional or narrative description in a patent is insufficient to properly describe a DNA molecule coding for β-IF, the presence of a functional or narrative description of β-IF protein in the prior art seems insufficient to render the molecule obvious. According to the court, one cannot describe what one has not conceived, and what cannot be contemplated or conceived cannot be obvious. Just as disclosure in a patent of a method for obtaining a particular cDNA is inadequate to properly describe the invention, so disclosure in the prior art of a method for obtaining a particular cDNA cannot render the claimed invention obvious.

The conceptual linkage of obviousness and enablement to the depiction of macromolecular sequences in, respectively, the prior art or the patent disclosure, dictates a particular and predictable result for the availability and scope of such biotechnology patents. The expected outcome is that DNA patents will be numerous but extremely narrow. Under the Federal Circuit's precedent, a researcher will be able to claim only sequences disclosed under the stringent written description rules—the actual sequence in hand, so to speak. And as Judge Learned Hand observed long ago, a claim that covers only the thing invented is a weak claim indeed.[115] At the same time, the inventor is shielded from obviousness by the lack of such explicit and detailed disclosure in the prior art. This lack of effective prior art seems to dictate that anyone who has isolated and characterized a novel DNA molecule is certain to receive a patent on it. But the inventor is certain to receive a patent only on that molecule, as the Federal Circuit appears to regard other related molecules as inadequately described until their is sequence is disclosed.

The set of axioms underlying this set of results forms a logical framework that may be extended to certain other biotechnology inventions. For

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114. *See* discussion *supra* notes 79-86.

115. *See* Philip A. Hunt Co. v. Mallinckrodt Chem. Works, 177 F.2d 583, 585-86 (2d Cir. 1949) (noting that it may be impossible to write claims of appropriate scope without using functional language to describe variants).

example, one would conclude from the Federal Circuit's analysis in these cases that a cDNA should be obvious in light of its corresponding mRNA[116], since the former is reverse transcribed from the latter, and there is no redundancy or degeneracy in the correspondence between the nucleotides in the two molecules.[117] However, an mRNA or corresponding cDNA need not render obvious the genomic DNA (gDNA) from which it is derived, since in many organisms, the gDNA will include intervening sequences, or introns, that are not predictable from the mRNA sequence.

Perhaps more important than the extension of the Federal Circuit's logic to other classes of molecules is the extension of its logic to other patent doctrines. For example, as we have indicated with regard to software, patent scope is a function of the obviousness and written description requirements. Under the court's decisions, the literal scope of biotechnology patents will be quite narrow: patent claims are confined to the DNA sequences actually generated and disclosed, rather than those enabled by the patentee. While that scope may be broadened by the doctrine of equivalents,[118] the recent trend to limit the scope of the doctrine of equivalents[119] may mean that the biotechnology industry will be characterized by large numbers of narrow patents.

D. The Divergent Standards

Patent practitioners often focus on a single technology area, and so may tend to take the court's rules in that area for granted. Even a casual juxtaposition of the biotechnology and software cases, however, shows

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116. mRNA, or messenger RNA, is the complementary molecule produced from transcription of genomic DNA. *See* FREIFELDER & MALACINSKI, *supra* note 85, at 159.

117. LUBERT STRYER, BIOCHEMISTRY 132 (3d ed. 1988); JAMES D. WATSON, ET AL., MOLECULAR BIOLOGY OF THE GENE 610-11 (4th ed. 1987).

118. The very parsimonious reading that the Federal Circuit gives to obviousness in biotechnology cases seems to leave wide latitude for findings of equivalence in nucleotide infringement cases. *See* Wilson Sporting Goods Co. v. David Geoffery & Assoc., 904 F.2d 677 (Fed. Cir. 1990) (testing equivalence by inquiring whether a hypothetical claim encompassing the accused product would have been obvious at the time of invention).

119. The courts have recently strengthened other limits on the doctrine of equivalents, notably prosecution history estoppel and the doctrine of dedication to the public domain. *See, e.g.*, Festo Corp. v. Shoketsu, 535 U.S. 722 (2002) (prosecution history estoppel applies broadly); Johnson & Johnston Assoc. v. R.E. Serv. Co., 238 F.3d 1347 (Fed. Cir. 2001) (en banc) (equivalents disclosed in the patent but not claimed are dedicated to the public domain). *See also* Matthew J. Conigliaro et al., *Foreseeability in Patent Law*, 16 BERKELEY TECH. L.J. 1045 (2001) (discussing both doctrines). Those limitations may prevent any patent from being read too broadly under the doctrine of equivalents.

dramatic differences in applying what are nominally the same legal rules.[120] District courts have recognized the difference, applying the Federal Circuit rules in different ways depending on the technology at issue.[121] The easiest way to see this difference may be to imagine the court's language from one discipline applied to another. In *Fonar*, for instance, the court said:

> As a general rule, where software constitutes part of a best mode of carrying out an invention, description of such a best mode is satisfied by a disclosure of the functions of the software. This is because, normally, writing code for such software is within the skill of the art, not requiring undue experimentation, once its functions have been disclosed.[122]

Replace software with DNA, though, and the following would result:

> As a general rule, where [DNA] constitutes part of a best mode of carrying out an invention, description of such

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120. Commentators have observed that the Federal Circuit's biotechnology written description cases apply a standard quite different from the written description precedent in other areas. *See, e.g.*, Mueller, *supra* note 76; Sampson, *supra* note 76; Limin Zheng, Note, *Purdue Pharma L.P. v. Faulding Inc.,* 17 BERKELEY TECH. L.J. 95, 95 (2002). While there are a number of recent written description cases outside the biotechnology context, all of them involve patentees who changed their claims during prosecution to cover a competitor's product. *See, e.g.*, Turbocore Div. of Demag Delaval Turbomachinery Corp. v. Gen. Elec. Co., 264 F.3d 1111 (Fed. Cir. 2001); Hyatt v. Boone, 146 F.3d 1348 (Fed. Cir. 1998); Gentry Gallery, Inc. v. Berkline Corp., 134 F.3d 1473 (Fed. Cir. 1998). *See also* Janice M. Mueller, *Patent Misuse Through the Capture of Industry Standards*, 17 BERKELEY TECH. L.J. 623, 639-40 (2002) (distinguishing the biotechnology cases from written description decisions in other areas, especially *Union Oil Co. of Cal. v. Atl. Richfield Co*., 208 F.3d 989 (Fed. Cir. 2000)). *Cf.* Matthew L. Goska, *Of Omitted Elements and Overreaching Inventions: The Principle of Gentry Gallery Should Not Be Discarded*, 29 AIPLA Q.J. 471, 484 (2001) (arguing that the written description requirement makes sense, but that it should not be applied to original claims as it has been in the biotechnology cases).

Other commentators have pointed out that the nonobviousness standard in biotechnology is lower than in other industries. *See, e.g.*, Sara Dastgheib-Vinarov, *A Higher Nonobviousness Standard for Gene Patents: Protecting Biomedical Research from the Big Chill*, 4 MARQ. INTELL. PROP. L. REV. 143, 154 (2000); John Murray, Note, *Owning Genes: Disputes Involving DNA Sequence Patents*, 75 CHI.-KENT L. REV. 231, 247 (1999).

121. *See, e.g.*, Gummow v. Snap-On Tools, 58 U.S.P.Q.2d 1414 (N.D. Ill. 2001) (holding that mechanical patents require less disclosure than biotechnology patents due to the uncertainty in biotechnology).

122. Fonar Corp. v. Gen. Elec. Co., 107 F.3d 1543, 1549 (Fed. Cir. 1997).

> [DNA] is satisfied by a disclosure of the functions of the [DNA]. This is because, normally, [identifying such DNA] is within the skill of the art, not requiring undue experimentation, once its functions have been disclosed.

This is *exactly* antithetical to the actual rule in biotechnology cases, as stated by *Eli Lilly*:

> A definition by function . . . is only an indication of what a gene does, rather than what it is. It is only a definition of a useful result rather than a definition of what achieves that result. Many such genes may achieve that result. The description requirement of the patent statute requires a description of an invention, not an indication of a result that one might achieve if one made that invention. Accordingly, naming a type of material generally known to exist, in the absence of knowledge as to what that material consists of, is not a description of that material.[123]

Conversely, of course, application of the biotechnology rule to software would radically change the law. The legal rules are the same, but the application of those rules to different industries produces results that bear no resemblance to each other.[124]

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123. Regents of the Univ. of Calif. v. Eli Lilly & Co., 119 F.3d 1559, 1568 (Fed. Cir. 1997).

124. Nor are obviousness, disclosure, and patent scope the only doctrines which show such an industry-specific variation. The requirement that an invention have general utility has been all but eliminated in most fields of technology. *See* Juicy Whip, Inc. v. Orange Bang, Inc., 185 F.3d 1364 (Fed. Cir. 1999) (saying that a patented device is useful if there is a demand for it). However, the requirement is alive and well in the life sciences. The Supreme Court imposed a stringent requirement on pharmaceutical inventions in *Brenner v. Manson*, 383 U.S. 519 (1966). The Federal Circuit has relaxed that requirement, *see In re* Brana, 51 F.3d 1560, 1567 (Fed. Cir. 1995), but the court still requires more proof of experimentation in order to satisfy the utility requirement in biotechnology and pharmaceuticals than elsewhere. *See* U.S. Patent & Trademark Office, Utility Examination Guidelines, 60 Fed. Reg. 36263 (July 14, 1995) (describing the law as setting different standards for the life sciences); Timothy J. Balts, *Substantial Utility, Technology Transfer, and Research Utility: It's Time For a Change,* 52 SYRACUSE L. REV. 105 (2002) (describing and criticizing the higher utility standard applied to life sciences); Philippe Ducor, *New Drug Discovery Technologies and Patents*, 22 RUTGERS COMPUTER & TECH. L.J. 369, 431-33 (1996); *cf.* Rebecca S. Eisenberg & Robert P. Merges, *Opinion Letter As To the Patentability of Certain Inventions Associated With the Identification of Partial cDNA Sequences*, 23 AIPLA Q.J. 1 (1995) (arguing that the utility doctrine may bar the

Polk Wagner has argued that these differences need not concern us greatly, because they are merely case-specific differences rather than systematic variations by industry.[125] We simply disagree with that reading of the cases. The court's systematic conclusions in different cases, its reliance on industry-specific precedent from case to case, its focus on uncertainty in the biotechnological arts, and its emphasis in biotechnology cases on proof of structure—a discussion totally absent from the software cases—all point in the direction of industry-specific rather than fact-specific differences in legal rules.

II. MODULATING TECHNOLOGY-SPECIFICITY

Besides divergent results, our survey of the biotechnology and the software patent cases also highlights an important reciprocal relationship between obviousness and disclosure. In biotechnology, where highly detailed disclosure is required to satisfy the enablement and written description standards, similarly detailed disclosure in the prior art is required to render the invention obvious. In software, where little specific detail is needed to satisfy the requirements of disclosure, similarly little detail is needed in the prior art to render the invention obvious. In each case, the Federal Circuit takes the patentability requirements of nonobviousness and disclosure as firmly tied to a common standard. The use and misuse of that common standard, then, is central to the development of technologically tailored patent rules.

A. The Role of the PHOSITA

The common standard connecting the requirements of obviousness and disclosure is the requirement in each statutory section that obviousness and the sufficiency of disclosure must be considered from the perspective of the "person having ordinary skill in the art," sometimes known by the acronym of PHOSITA.[126] Much of the case law concerning the PHOSITA arises out of the consideration of the obviousness standard found in § 103

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patenting of "expressed sequence tags" that can be used to identify human gene sequences).

125. R. Polk Wagner, *(Mostly) Against Exceptionalism*, working paper (2002). *See also* Sung, *infra* note 188 (making the same argument for the biotechnology cases).

126. John O. Tresansky, *PHOSITA—The Ubiquitous and Enigmatic Person in Patent Law*, 73 J. PAT. & TRADEMARK OFF. SOC'Y 37 (1991); *see also* ROBERT L. HARMON, PATENTS AND THE FEDERAL CIRCUIT § 4.3 (5th ed. 2001); Joseph P. Meara, Note, *Just Who is the Person Having Ordinary Skill in the Art? Patent Law's Mysterious Personage*, 77 WASH. L. REV. 267 (2002). The first known use of the term PHOSITA appears to be in Cyril A. Soans, *Some Absurd Presumptions in Patent Cases*, 10 IDEA 433, 438 (1966).

of the patent statute.[127] Although originally developed as a common law doctrine, the nonobviousness criterion was codified in the 1952 Patent Act as a requirement that the claimed invention taken as a whole not be obvious to one of ordinary skill in the art at the time the invention was made.[128]

The PHOSITA is equally central to calibrating the legal standard for patent disclosure. As the quid pro quo for her period of exclusive rights over an invention, the inventor must fully disclose the invention to the public. The first paragraph of section 112 requires that this disclosure enable "any person skilled in the art" to make and use the claimed invention.[129] The parallel language suggests that the inventor's compliance with the requirement of enablement should be measured with reference to a standard similar or identical to that in section 103; indeed, the language appears to tie the enablement requirement to nonobviousness via this shared metric.[130]

This same language sets the metric for several related disclosure doctrines as well. First, the definition of enablement affects the patentability requirement of specific utility, as the invention must operate as described in the specification if the inventor is to enable one of ordinary skill to use it.[131] Additionally, compliance with the independent requirements of adequate written description and best mode disclosure is measured with reference to the understanding of a "person skilled in the art."[132] And finally, the definiteness of patent claims, which must be written so as to warn members of the public just what is and is not covered by the patent, has traditionally been assessed with regard to the knowledge of one having ordinary skill in the art. If the terms of the claims would not be comprehensible to such a person, then they failed the requirements of section 112.[133]

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127. 35 U.S.C. § 103 (2000).

128. *Id.*

129. 35 U.S.C. § 112 ¶ 1 (2000).

130. The language of the two statutes is not identical, however, and one might draw a distinction between one of ordinary skill and "any person skilled," on the theory that the latter standard includes those with less than ordinary skill. More on this *infra* Part II.C.

131. *See, e.g.*, Newman v. Quigg, 877 F.2d 1575, 1581-82 (Fed. Cir. 1989).

132. *See, e.g.*, *In re* Wands, 858 F.2d 731 (Fed. Cir. 1988).

133. The Federal Circuit's recent decision in *Exxon Res. & Eng. Co. v. United States,* 265 F.3d 1371, 1376 (Fed. Cir. 2001), however, holds that indefiniteness is a pure question of law. How the court will resolve the understanding of the PHOSITA as a legal matter is not entirely clear, though it undertakes a similar burden in construing patent claims. *See* Cybor Corp. v. FAS Techs., Inc., 138 F.3d 1448, 1454-55 (Fed. Cir. 1998) (en banc).

The PHOSITA is nothing if not versatile, and may also show up as a convenient metric in other unexpected areas, including judicially created patent doctrines. Claim construction requires reference to how the PHOSITA would understand terms in the patent claims.[134] The PHOSITA reappears in some formulations of the standard for infringement by equivalents. In its germinal opinion on the doctrine of equivalents, *Graver Tank*, the Supreme Court indicated that the equivalence between elements of an allegedly infringing device and those of a claimed invention might be tested by determining whether the elements were known in the art to be substitutes for one another.[135] The Federal Circuit strengthened this use of the PHOSITA by making the "reasonable interchangeability" of elements—judged from the perspective of one of ordinary skill in the art—a fundamental test for equivalence.[136] A great deal of patent doctrine therefore rests upon the measurement of some legal parameter against the skill and knowledge of the PHOSITA.

This is not to say the PHOSITA has any actual skill or knowledge. Like her cousin, the reasonably prudent person in tort law,[137] the PHOSITA is something of a juridical doppelganger,[138] embodying a legal standard for patentability rather than the actual capability of any individual or group of individuals.[139] Courts have on occasion equated the knowledge of a given individual, such as a patent examiner, with that of the PHOSITA.[140] But courts walk a fine line between taking the skill of an examiner or other artisan as probative evidence of the level of skill in the art and equating the skill of such persons with the characteristics of the hypothetical PHOSITA.[141] Further, unlike any actual person of skill in the art,

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134. *See* Craig Allen Nard, *A Theory of Claim Interpretation*, 14 HARV. J. L. & TECH. 1, 6 (2000).

135. *See* Graver Tank Mfg. Co. v. Linde Air Prods. Co., 339 U.S. 605, 609 (1950).

136. *See* Hilton Davis Corp. v. Warner-Jenkinson, 62 F.3d 1512, 1519 (Fed. Cir. 1995) (en banc), *aff'd in part & rev'd in part on other grounds*, 520 U.S. 17 (1997).

137. *See, e.g.*, Panduit Corp. v. Dennison Mfg. Co. 810 F.2d 1561, 1566 (Fed. Cir. 1987) (comparing the PHOSITA to the "reasonable man" in tort law).

138. *Id.* (characterizing the PHOSITA as a "ghost").

139. *See, e.g.*, Stewart-Warner Corp. v. City of Pontiac, 767 F.2d 1563, 1570 (Fed. Cir. 1985); Michael H. Davis, *Patent Politics*, *at* <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=282056> (visited Nov. 15, 2002) (observing that the PHOSITA standard is "undeniably fictional"); David E. Wigley, *Evolution of the Concept of Nonobviousness of the Novel Invention: From a Flash of Genius to the Trilogy*, 42 ARIZ. L. REV. 581, 598-99 (2000).

140. *See* Tresansky, *supra* note 126, at 58 (collecting cases).

141. *See, e.g.*, *In re* Mahurkar Double Lumen Hemodialysis Catheter Patent Litigation, 831 F. Supp. 1354, 1361-62 (N.D. Ill. 1993) (Easterbrook, J., sitting by designation)

the PHOSITA is endowed with knowledge of all of the relevant prior art references.[142]

This places the standard for patentability on a legally objective, rather than subjective, footing. The PHOSITA standard measures the inventor's achievements against a judicially determined external metric, rather than against an expectation based on whatever level of skill the inventor might actually possess. The standard also has the practical effect of avoiding the requirement that judges and other arbiters of patentability be experts in a given field. The PHOSITA standard is thus an ultimate conclusion of law based upon evidence,[143] not dictated by the capabilities or knowledge of the Patent Office examiner, a reviewing judge, or even that of the inventor:

> Realistically, courts never have judged patentability by what the real inventor/applicant/patentee could or would do. Real inventors, as a class, vary in their capacities from ignorant geniuses to Nobel laureates; the courts have always applied a standard based on an imaginary worker of their own devising whom they have equated with the inventor.[144]

The standard is thus objective in the sense that it does not inquire into a particular inventor or artisan's level of skill. But this does not mean that it is static or fixed. Courts consider a number of constituent factors that may be adjusted to modulate the requirements for patentability under different circumstances. The first of these is the definition of the particular "art" in which the PHOSITA is deemed to have ordinary skill. The PHOSITA is generally portrayed as having comprehensive knowledge of the references in the particular art.[145] But the parameters of the art are subject to fluctuation, and thus so is the size and depth of the library of references with which the PHOSITA is presumed to be familiar. For example, in the

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(taking the finding of the examiner, as a PHOSITA, to be probative of written description compliance).

142. *See In re* Winslow, 365 F.2d 1017 (C.C.P.A. 1966).

143. *See* Panduit Corp. v. Dennison Mfg. Co., 810 F.2d 1561 (Fed. Cir. 1987).

144. Kimberly-Clark Corp. v. Johnson & Johnson, 745 F.2d 1437, 1454 (Fed. Cir. 1984). *See also In re* Nilssen, 851 F.2d 1401 (Fed. Cir. 1988) (noting that the Board of Patent Appeals and Interferences was not required to have ordinary skill in the art to apply the standard); Hodosh v. Block Drug Co., 786 F.2d 1136 (Fed. Cir. 1986) (stating that actual inventors cannot be required to have the omniscience of the figurative person of ordinary skill).

145. Although, as we point out below, this imputed knowledge varies a bit depending upon whether obviousness or disclosure is at issue. *See infra* notes 150-55.

case of a DNA patent, would the relevant art be biochemistry, or molecular biology, or cell biology, or biology in general? Courts have attempted to avoid drawing such boundaries by defining the PHOSITA's knowledge as that reasonably pertinent to the problem the inventor was trying to solve. But this requires that the court engage in the equally mercurial exercise of defining the problem that the inventor had under consideration.[146]

A second PHOSITA variable that may be adjusted to different circumstances is the level of skill that would be considered "ordinary." Unlike the inventor, who almost by definition is presumed to be one of extraordinary skill,[147] the PHOSITA standard contemplates some median or common level of skill. In assessing that common level, courts may take into account a long list of factors, including the approaches found in the prior art, the sophistication of the technology involved, the rapidity of innovation in that field, and the level of education typical of those in the field.[148] The courts have also endowed the PHOSITA with mediocre personality traits; she is conceived of as an entity that adopts conventional approaches to problem solving, and is not inclined to innovate, either via exceptional insight or painstaking labor.[149]

Some care must be exercised in characterizing the PHOSITA, as it is tempting to do so on the basis of an unfounded presumption, which is that the PHOSITA remains constant from section to section of the patent statute. On the contrary, some commentators have recognized the possibility that the imaginary artisan found in these different statutory sections, though bearing the same denomination, might well display different and even inconsistent characteristics as between the different sections.[150] The PHOSITA for purposes of obviousness may not necessarily be the PHOSITA for purposes of enablement, written description, definiteness, or equivalence. Because she is a legal construct designated to embody certain legal standards, the PHOSITA could well change depending on the purpose she is serving at the time. Understanding this difference is critical, because the Federal Circuit's linkage of obviousness and enablement depends on the easy equation of the PHOSITAs.

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146. *See e.g.*, George J. Meyer Mfg. Co. v. San Marino Elec. Corp., 422 F.2d 1285, 1288 (9th Cir. 1970) (deeming the PHOSITA in optical bottle inspection art to be aware of prior art in optical missile tracking field).

147. Standard Oil Co. v. Am. Cyanamid Co., 774 F.2d 448, 454 (Fed. Cir. 1985).

148. *See, e.g.*, Bausch & Lomb Inc. v. Barnes-Hind, Inc., 796 F.2d 443 (Fed. Cir. 1986) (listing pertinent factors); *see also* Helifix Ltd. v. Blok-Lok Ltd., 208 F.3d 1339 (Fed. Cir. 2000) (stating that district court erred by failing to consider these factors).

149. *Am. Cyanamid Co.*, 774 F.2d at 454.

150. *See* Tresansky, *supra* note 126, at 52-53.

Some disparity of this sort does in fact appear in the judicial characterization of the PHOSITA in the contexts of obviousness and of enablement. The section 103 PHOSITA appears to be something of a problem solver, who the courts set to work hypothetically tackling the problem solved by the inventor.[151] To be sure, the obviousness PHOSITA is not an especially inspired problem solver, as she is imagined to remain stuck in the rut of conventional thinking.[152] But the obviousness PHOSITA is still someone who is trying to solve new problems. By contrast, the PHOSITA of the first paragraph of section 112 shows no such innovative tendency, but is simply a user of the technology. If the enablement PHOSITA shows any problem solving ability, it is in tapping the prior art to fill in gaps left by the inventor's disclosure—a rather different skill than that of the obviousness PHOSITA.[153]

The two PHOSITAs also differ in the date at which knowledge is imputed to them. The knowledge of the obviousness PHOSITA is assessed as of the time of invention, while the enablement PHOSITA is aware of information available at the time a patent is filed. Due to the passage of time, the latter universe of references is likely to be larger. The temporal disparity is even stronger when the doctrine of equivalents PHOSITA is employed; this latter entity knows of all developments up to the date of infringement.[154] But conversely, hidden or nonpublic references which may serve as prior art under section 103 are not necessarily imputed to the knowledge of the PHOSITAs who make or use the invention under section 112, as such references are not readily available to the public.[155]

B. Misapplication of the PHOSITA Standard

The PHOSITA approach in general represents the proper standard for patent law. Basing the proof required on the level of skill in the art makes logical sense.[156] At the simplest level, this approach is intended to benefit the public; people who work in a given technology must understand the

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151. *See* Orthopedic Equip. Co. v. United States, 702 F.2d 1005 (Fed. Cir. 1983); *In re* Grout, 377 F.2d 1019 (C.C.P.A. 1967).

152. *Am. Cyanamid Co.*, 774 F.2d at 448.

153. *See* Tresansky, *supra* note 126, at 54.

154. *See* Warner-Jenkinson Co., Inc. v. Hilton Davis Chem. Co., 520 U.S. 17, 37 (1997) (holding that equivalence is tested at the time of infringement). Indeed, were it otherwise, the doctrine of equivalents could not feasibly be applied to later-developed technologies.

155. *See* Quaker City Gear Works, Inc. v. Skil Corp., 747 F.2d 1446 (Fed. Cir. 1984); *In re* Howarth, 654 F.2d 103 (C.C.P.A. 1981).

156. *But see* Davis, *supra* note 139, at 32 (use of PHOSITA is "disingenuous and almost foolish").

patent as it relates to the prior art, so it makes sense to take into account what that person knows in order to decide whether a patent is obvious or has been enabled. From a policy standpoint, the practicality of working in different technologies requires a flexible approach to determining disclosure or obviousness, and the PHOSITA approach gives a court that flexibility. In this sense, patent law is inherently technology-specific, in essence offering different and fact-sensitive standards of disclosure and obviousness for different technologies.

But even recognizing that the PHOSITA standard dictates that different technologies will be accommodated in different ways, the developments that we have described in software and biotechnology seem to us extraordinary and difficult to explain solely by reference to the level of skill in these arts. Consider, for example, the extremely stringent disclosure standard developed in the biotechnology cases. If the PHOSITA analysis explains that requirement, it suggests that the Federal Circuit believes that biotechnology researchers need a very high degree of assurance before they are capable of replicating an invention. Computer programmers, on the other hand, apparently require very little assurance—simply an indication of function will do. Similarly, with regard to obviousness, the court appears to believe that computer programmers can fully envision working code from only a suggestion of function, whereas biotechnologists apparently need genetic sequences explicitly spelled out in the prior art to render a molecule obvious. As detailed below, we are not persuaded that the levels of skill in these arts are in fact so different, either for innovators or for users.

In this section, we seek to understand why the Federal Circuit's application of the PHOSITA standard has produced such incongruous results in the industries we studied. In order to identify the source of the anomalies in biotechnology and software, we look first to the Federal Circuit's application of this standard, rather than to the standard itself. One possibility, which has occurred to previous commentators as well as to us, is that the Federal Circuit application of the PHOSITA standard in these technologies is wrong as a matter of science.[157] One reading of these cases is that the Federal Circuit seems to have substituted caricature for a nuanced understanding of the technology. The court has repeatedly suggested that programming itself is a "mere clerical function" that presumably does not warrant the grant of a patent. The court seems to consider only the ideas or functions of a computer program worthy of patent protection. In short, the

157. *See, e.g.*, Varma & Abraham, *supra* note 104; Rai, *Addressing New Technology*, *supra* note 104; Rai, *Patent Gold Rush*, *supra* note 104.

court thinks of programmers as people of astonishing skill, capable of implementing any idea in a computer program as a matter of course. Sometimes this assumption benefits patentees, notably in enablement and best mode determinations.[158] Other times, such as in obviousness cases, the assumption that programmers are extremely skilled works against the patentee.[159] But as a matter of computer science, there is ample evidence that the court's assumptions are contrary to actual practice. Those who actually work in the industry know that coming up with an idea for a computer program is rather less than half the battle.[160] Programs can take years to write even under the best circumstances. Some will simply not work. Others will require innovative programming techniques. Even once they are written, most programs have bugs that must be worked out in order for the program to be stable.[161] In many cases, the process of writing the program changes the idea itself in a sort of iterative feedback loop.[162] Not only is it wrong to say that writing a program is a "mere clerical function" to a skilled programmer, but in fact many of the truly innovative improvements in computer software occur at the level of programming, not in the idea to have a computer perform a specific function.[163]

In the biotechnology cases, the situation is reversed; the court focuses repeatedly on the "uncertainty" inherent in the field, scoffing at claims drawn to molecular function rather than structure and demanding precise

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158. *See supra* notes 28-36 and accompanying text (noting the low standards applied to software patents under § 112).

159. *See supra* notes 43-46 and accompanying text.

160. *See, e.g.*, Computer Assoc. v. Altai, Inc., 982 F.3d 693 (2d Cir. 1992). *See also* 4 Nimmer on Copyright §13.03[F]; Peter S. Menell, *An Analysis of the Scope of Copyright Protection for Application Programs*, 41 STAN. L. REV. 1045 (1989); Pamela Samuelson et al., *A Manifesto Concerning the Legal Protection of Computer Programs*, 94 COLUM. L. REV. 2308 (1994); Thomas M. Gage, Note, Whelan Assoc. v. Jaslow Dental Laboratories*: Copyright Protection for Computer Software Structure—What's the Purpose?*, 1987 WISC. L. REV. 859. *Cf.* Mark A. Lemley & David W. O'Brien, *Encouraging Software Reuse*, 49 STAN. L. REV. 255, 261-66 (1997) (detailing the cost savings available from reusing computer code rather than reinventing it from scratch).

161. *See* Lemley & O'Brien, *supra* note 160, at 261-64 and sources cited therein.

162. *See, e.g.*, Menell, *supra* note 6.

163. *See* Lemley & O'Brien, *supra* note 160, at 302 (encouraging protection for such ideas in preference to the more common patents on old ideas implemented in digital format). Indeed, Richard Stern and Julie Cohen have both proposed that software patents be limited to innovative programs rather than simply the concept of implementing a particular function using a computer. *See also* Cohen, *supra* note 58, at 1169; Richard H. Stern, *Tales From the Algorithm War:* Benson *to* Iwahashi*, It's Déjà vu All Over Again*, 18 AIPLA Q.J. 371, 395 (1991).

disclosure of any embodiment.[164] The court seems to believe that biotechnology is as much a black art as a science, where the result of experimentation is largely out of the skilled artisan's hands. While the assumption that an art is uncertain may befit a new and undeveloped field, the court has maintained its assumption that biotechnology is an uncertain art long after the industry began to mature. The Federal Circuit has sidestepped the difficulty of determining the level of skill in the art in each case by grounding biotechnology patent standards in a doctrine of structural foreseeability. This solution is attractive to the court, as the requirement of foreseeable structure becomes an axiom from which other patent standards can be neatly derived. However, just as we are cautioned by the old maxim that when one has a hammer everything looks like a nail, it would seem that the Federal Circuit, having once crafted a solution based on structural foreseeability, begins to see every biotechnology patenting problem as a problem of structure. In *Bell* and *Deuel* the court's belief in uncertainty benefits the patentee, since it means that knowledge of a protein and a method for deriving the cDNA sequence did not render the cDNA sequence obvious without the disclosure of structure.[165] By contrast, the same assumption about uncertainty hurts patentees in cases like *Enzo, Lilly* and *Amgen*, because it precludes them from claiming any DNA sequence they have not actually described in structural terms in the patent specification.[166] All of these holdings are based on the assumption that one ordinarily skilled in biotechnology cannot move conceptually from a protein to a DNA sequence, or from the DNA sequence of one organism to the corresponding DNA sequence of another organism.

Arguably this understanding of the science of biotechnology is simply wrong. Robert Hodges has argued that "[T]he key event is the cloning of the first gene in a family of corresponding genes. Once a researcher accomplishes this very difficult task, the researcher can typically obtain

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164. *See supra* notes 115-118 and accompanying text (discussing the role of uncertainty in the Federal Circuit's biotechnology jurisprudence).

165. *See In re* Deuel, 51 F.3d 1552, 1559 (Fed. Cir. 1995); *In re* Bell, 991 F.2d 781 (Fed. Cir. 1993).. *Cf.* Fiers v. Revel, 984 F.2d 1164 (Fed. Cir. 1993) (using the same standard in an interference proceeding to benefit one applicant at the expense of another). *But cf. In re* Mayne, 104 F.3d 1339 (Fed. Cir. 1997) (DNA sequence in prior art rendered obvious a claim to an altered version of that sequence that changed only one amino acid).

166. *See* Enzo Biochem v. Calgene, Inc., 188 F.3d 1362, 1371 (Fed. Cir. 1999); Regents of the Univ. of California v. Eli Lilly & Co., 119 F.3d 1559 (Fed. Cir. 1997); *In re* Goodman, 11 F.3d 1046, 1052 (Fed. Cir. 1993); Amgen, Inc. v. Chugai Pharmaceutical Co., 927 F.2d 1200 (Fed. Cir. 1991).

other members of the gene family with much less effort."[167] Indeed, today the process is largely automated. Such research is properly compared to searching a "black box" in which are contained molecules of known characteristics, if unknown structure; the search is conducted on the basis of what is known—the function—rather than on the basis of what is unknown—the precise structure. The function of the molecule that will be found is predictable, as is the likelihood of finding such a molecule, even if the precise structure of the molecule cannot be predicted.[168]

This explanation of the Federal Circuit's jurisprudence in these areas is not altogether satisfactory, as (in biotechnology, at least) it fails to explain the court's indifference to the technology subsequent to *Amgen.*[169] The obviousness decision in *Amgen* clearly rested upon the uncertain likelihood of success in the particular probing methodology used to find the EPO gene. Had the court adhered to this analysis in later cases, carrying forward into subsequent opinions a static impression of biotechnological techniques, the poor fit between patent doctrine and patent policy could be easily explained; indeed some commentators have offered this easy explanation.[170] But in those later cases, the court seems quite indifferent to the certainty or uncertainty of methodological success, fashioning instead a standard based on structural precision and foreseeability that ignores the state of technology, past or present. It seems not so much that the court misunderstood the changes in technology since *Amgen* as that the court simply ignored them.

This observation might be accommodated by an alternative explanation: that the court, rather than stumbling in its application of law to changing technology, is as a matter of law deliberately creating a unique enclave of patent doctrine for biotechnology, making patent law indeed

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167. Robert A. Hodges, *Black Box Biotech Inventions: When a Mere "Wish or Plan" Should be Considered an Adequate Description of the Invention*, 17 GA. ST. U. L. REV. 831, 832 (2001). *See also* John M. Lucas, *The Doctrine of Simultaneous Conception and Reduction to Practice in Biotechnology: A Double Standard for the Double Helix*, 26 AIPLA Q.J. 381, 418 (1998) ("Making the inventions of *Amgen, Fiers* and *Lilly* today would be routine.").

168. *See, e.g.*, Alison E. Cantor, *Using the Written Description and Enablement Requirements to Limit Biotechnology Patents*, 14 HARV. J. L. & TECH. 267, 310-11 (2000) (stating that "[t]here is already indication that initial biotechnology techniques are increasingly considered to be more predictable and are more likely to fall into the category of routine experimentation" and citing monoclonal antibodies as an example).

169. *See supra* notes 106-109 and accompanying text.

170. *See supra* notes 111-113 and accompanying text.

technology-specific.[171] The same explanation might be applied to the software cases: it is not a unique set of facts applied to the PHOSITA construct that is generating a technology-specific body of patent law, but rather a deliberate manipulation of doctrine itself.[172] Yet this alternative explanation seems to us even less satisfactory than the first. It essentially moves the problem up one level of abstraction to argue that the Federal Circuit is not mistaken as a matter of fact about the state of technology in biotechnology and software, but rather mistaken as a matter of policy about the needs of those industries. If the court is taking the trouble of fashioning individual patentability standards for different areas of subject matter, one would expect that the standards fashioned would be suited to the needs of the different areas addressed.

Yet the literature analyzing these industries suggests that the likely results of the Federal Circuit's software and biotechnology cases are ill-considered as a policy matter. Several commentators have examined the undesirable consequences of creating an anticommons of fragmented property rights in the biotechnology industry.[173] A multitude of narrow patents

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171. Polk Wagner suggests a third possible explanation: that one judge, Judge Lourie, wrote almost all of the biotechnology cases, and that those decisions reflect not the court's consistency but one author's consistency. *See* Wagner, *supra* note 125, at 4, 5 n. 15. We think this is a distinction without a difference. The Federal Circuit has chosen to assign to Judge Lourie responsibility for writing virtually all of its biotechnology cases. Many other judges have joined his opinions. If one judge writes all of the opinions in a particular area, over time it is reasonable to assume that he speaks for the court. If Wagner is right, one possible difference is that it may be easier for the Federal Circuit to change its behavior merely by changing who writes opinions.

172. *Cf.* Craig Allen Nard, *Toward a Cautious Approach to Obeisance: The Role of Scholarship in Federal Circuit Patent Law Jurisprudence*, 39 HOUSTON L. REV. 667 (2002) (arguing that the Federal Circuit has been less than candid about its technology-specific decisions). Judge Gajarsa has expressly acknowledged this problem: "We also need to determine whether or not we should have a different standard of patentability for biotech cases and also for software. Should there be a different patentability standard that is established by decision of our court or by statute? This is an issue which needs to be considered and thoughtfully analyzed." Hon. Arthur J. Gajarsa, *Quo Vadis?*, 6 MARQ. INTELL. PROP. REV. 1, 6-7 (2002).

173. *See* Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCI., at 698, 698 (1998) (patenting genetic research can lead to an "anticommons" in which multiple, conflicting property rights impede efficient use of the patents); *see also* Rebecca S. Eisenberg, *A Technology Policy Perspective on the NIH Gene Patenting Controversy*, 55 U. PITT. L. REV. 633 (1994); Arti K. Rai, *Fostering Cumulative Innovation in the Biopharmaceutical Industry: The Role of Patents and Antitrust*, 16 BERKELEY TECH. L.J. 813 (2001); Arti K. Rai, *The Information Revolution Reaches Pharmaceuticals: Balancing Innovation Incentives, Cost, and Access in the Post-Genomics Era*, 2001 U. ILL. L. REV. 173.

seems likely to strangle downstream product development in a morass of required licenses, yet the combination of stringent disclosure and permissive obviousness standards is likely to produce just such a patent configuration. In contrast, other commentators have worried over the deleterious effects of overbroad patents on the incremental development of short-lived software products.[174] Again, the Federal Circuit's combination of permissive disclosure and stringent obviousness for software inventions seems likely to produce exactly the results commentators have feared. In each case, application of the PHOSITA standard has lead to an industry-specific outcome that seems exactly the wrong one for the particular industry.[175]

C. Obstacles to Applying the PHOSITA Standard Properly

If, as we suggest, the concept of the PHOSITA makes sense, why has the Federal Circuit got it wrong in these industries? There are several reasons. First, we think that there are several structural barriers that make it difficult for courts to accurately assess the level of skill in a complex technological art. As a practical matter, it is worth emphasizing that judges are at a rather serious disadvantage in trying to put themselves in the shoes of an ordinarily skilled scientist. Judges generally don't have any scientific background and, at the district court level at least, most law clerks don't either. Further, district court judges have extremely full dockets with many different types of cases. The average judge may hear no more than one patent case every few years.[176] Few of those will be software or biotech-

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174. *See, e.g.*, Pamela Samuelson et al., *A Manifesto Concerning the Legal Protection of Computer Programs*, 94 COLUM. L. REV. 2308, 2345-46 (1994); Cohen & Lemley, *supra* note 16.

175. This short summary of the problem cannot of course fully address the issue; we discuss it in more detail in our subsequent work. *See* Burk & Lemley, *supra* note 5.

176. There are roughly 1700 patent cases filed per year. The exact data for the years 1995-1999 can be found in the Derwent Litalert database at <http://www.derwent.com/intellectualproperty/litalert.html>. The data that follow were compiled as of June 1, 2000, and involve cases labeled "patent."

Year	*Number of Cases Filed*
1999	1,652
1998	1,730
1997	1,731
1996	1,514
1995	1,258

Id.

Most of these cases settle, however. Kimberly Moore's comprehensive study of all patent cases that went to trial found only 1,411 cases in the 17 years from 1983 to 1999, an average of less than 100 cases per year. Kimberly A. Moore, *Judges, Juries, and*

nology cases.[177] A very busy judge must therefore learn not only patent law but also some difficult science in a very short period of time. Expert witnesses can help, but the Federal Circuit has imposed some limits on the extent to which district courts can rely on such evidence.[178] In particular, courts must avoid the temptation to assume that the expert witness *is* a person ordinarily skilled in the art.[179] Even the Federal Circuit, which does not suffer nearly so much from these limitations,[180] is not in a position to fully understand all of the science it encounters.[181] Given these limitations, courts understandably won't get it right all the time.[182]

Patent Cases—An Empirical Peek Inside the Black Box, 99 MICH. L. REV. 365, 380 (2000). Since there are over 600 district court judges in the United States, it is obvious that most judges get only a few filed patent cases a year, and well less than one patent trial a year. In fact, many judges get even fewer cases than this number would suggest (though others get more), since the concentration of innovation in certain regions and the permissibility of forum shopping in patent cases cause patent cases to be bunched in a few districts. *See* Kimberly A. Moore, *Forum Shopping in Patent Cases: Does Geographic Choice Affect Innovation?*, 79 N.C. L. REV. 889 (2001) (analyzing where patent suits are filed).

177. *See* John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 217 tbl.5 (1998) (demonstrating that between 1989 and 1996, only 3% of patent cases litigated to judgment involved biotechnology and only 1% involved software).

178. *See* Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1584 (Fed. Cir. 1996) (stating that courts may rely on expert testimony in construing patent claims only in rare circumstances); *but see* Pitney-Bowes v. Hewlett-Packard Corp., 182 F.3d 1298, 1308 (Fed. Cir. 1999) (holding that judges may hear expert testimony on the meaning of patent claims, but may not normally *rely* on such testimony). This distinction between admitting testimony to help the judge understand the claims and reliance on such testimony may make conceptual sense, but courts reading this line of cases may be reluctant to hear such evidence at all. Plus, it will not help much in deciding pretrial motions.

179. *See, e.g.*, Dayco Prods. v. Total Containment, Inc., 258 F.3d 1317, 1324 (Fed. Cir. 2001) ("Our objective is to interpret the claims from the perspective of one of ordinary skill in the art, not from the viewpoint of counsel or expert witnesses."); Endress & Hauser v. Hawk Measurement Sys., 122 F.3d 1040, 1042 (Fed. Cir. 1997) (implying that experts need not themselves be of ordinary skill in the art: "The 'person of ordinary skill' in the art is a theoretical construct" used in determining obviousness under § 103, "and is not descriptive of some particular individual.").

180. While relatively few Federal Circuit judges have technology backgrounds, John R. Allison & Mark A. Lemley, *How Federal Circuit Judges Vote in Patent Validity Cases*, 27 FLA. ST. U. L. REV. 745, 751 n.23 (2000), many of their clerks do. Further, the Federal Circuit has more time to consider each case, has the full record before it, and gets many more patent cases, including software and biotechnology cases, than any district court judge would.

181. Arti Rai argues that the Federal Circuit should defer to the PTO, because the PTO better understands biotechnology. Rai, *Patent Gold Rush*, *supra* note 104. We agree with her that the Federal Circuit makes mistakes in this area. We are not persuaded that the PTO can do any better, however, particularly given the minimal time examiners can

Second, the timing of the PHOSITA analysis complicates the court's task. While the court will determine the level of skill in the art during a pretrial hearing or at trial, the appropriate level of skill in the art is not what people know at the time of trial, but what people knew at the time of the invention (in the case of obviousness) or the filing of a patent application (in the case of enablement).[183] On average, it takes more than twelve years from the time a patent application is filed until final judgment on the merits; it takes even longer from the date of invention, of course.[184] So courts trying to determine the level of skill in the art must learn not just science, but the history of that science. Courts and expert witnesses must shut out of their minds intervening developments in the field. This is notoriously hard to do. Empirical evidence has demonstrated that people in general, and judges in particular, are subject to a "hindsight" bias: they are likely to reason backwards from what did happen to make assumptions about what was likely to happen *ex ante*.[185] The Federal Circuit has repeatedly recognized the problem of hindsight bias in its obviousness juris-

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spend on any one invention. *See* Mark A. Lemley, *Rational Ignorance at the Patent Office*, 75 NW. U. L. REV. 1495, 1500 (2001) (noting that examiners spend only eighteen hours per application on average).

182. *Cf.* Stephen L. Carter, *Custom, Adjudication, and Petrushevsky's Watch: Some Notes From the Intellectual Property Front*, 78 VA. L. REV. 129, 132 (1992) (worrying that judges may not be particularly good at "judicial anthropology").

183. *See* Arkie Lures, Inc. v. Gene Larew Tackle, Inc., 119 F.3d 953, 956 (Fed. Cir. 1997) (holding that PHOSITA analysis must "focus on conditions as they existed when the invention was made" in obviousness cases).

184. Allison & Lemley, *Empirical Evidence*, *supra* note 177, at 236 tbl.11 (12.3 years on average). This has been a particular problem in biotechnology cases, particularly because they spend longer in prosecution and because biotechnology patents are often most valuable at the end of their lives. *See, e.g.*, Enzo Biochem v. Calgene, Inc., 188 F.3d 1362, 1371 (Fed. Cir. 1999) (16 year-old invention); Genentech, Inc. v. Novo Nordisk, 108 F.3d 1361, 1367 (Fed. Cir. 1997) (18 year-old invention); Jeffrey S. Dillen, *DNA Patentability—Anything But Obvious*, 1997 WISC. L. REV. 1023, 1038 (noting this time lag).

185. There is an interesting empirical literature in the behavioral law and economics movement on hindsight bias. The existence of such a bias is well documented. In the behavioral science literature, see, *e.g.*, Baruch Fischhoff, *Hindsight ≠ Foresight: The Effect of Outcome Knowledge on Judgment Under Uncertainty*, 1 J. EXPERIMENTAL PSYCHOL.: HUM. PERCEPTION & PERFORMANCE 288 (1975); Amos Tversky & Daniel Kahneman, *Availability: A Heuristic for Judging Frequency and Probability*, 5 COGNITIVE PSYCH. 207 (1973). In the legal literature, see, *e.g.*, BEHAVIORAL LAW AND ECONOMICS (Cass Sunstein ed. 2000); Russell Korobkin & Thomas S. Ulen, *Law and Behavioral Science: Removing the Rationality Assumption from Law and Economics*, 88 CALIF. L. REV. 1051, 1095 (2000); Eric Talley, *Disclosure Norms*, 149 U. PA. L. REV. 1955, 2000 (2001). There is even empirical evidence that federal judges are subject to hindsight bias. *See* Chris Guthrie et al., *Inside the Judicial Mind*, 86 CORNELL L. REV. 777, 799-805 (2001).

prudence,[186] and has built rules designed to cope with it there,[187] but hindsight bias risks infecting the PHOSITA analysis in enablement and claim scope as well. Hindsight bias will normally lead factfinders to overestimate the level of skill in the art, since subsequent advances will suggest that the invention could not have been that difficult to do. This effect is likely to be the most pronounced in technologies that are familiar or readily understood by the trier of fact—that is, in the "predictable" arts. Occasionally, however, hindsight bias may have the opposite effect, notably where certain things known or believed at one time to be feasible turn out later to be more difficult than anticipated.[188]

Finally, the backward-looking nature of the legal system itself creates a problem that is in some sense the opposite of the hindsight bias. Legal rules are based on *stare decisis*. The law accumulates nuance over time by respecting and building on the body of existing precedent. Only rarely will courts expressly reject their prior decisions. This system has worked well over time in producing thoughtful legal rules.[189] Judges trained in this process will naturally tend to apply it to factual issues they see repeatedly. Indeed, doing so seems economical as well, since revisiting those factual determinations appears redundant. Thus, once the Federal Circuit has ruled on the level of skill in a particular art, the temptation is strong for both that court and district courts to apply that determination in subsequent cases. This tendency is evident in both software and biotechnology cases. In the software cases, the court in *Northern Telecom* held that the patentee need not disclose the actual code implementing a program in or-

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186. *See, e.g.*, Al-Site Corp. v. VSI Int'l, Inc., 174 F.3d 1308, 1324 (Fed. Cir. 1999); Monarch Knitting Mach. Corp. v. Fukuhara Indus. & Trading Co., 139 F.3d 877 (Fed. Cir. 1998).

187. *See, e.g.*, *In re* Dembiczak, 175 F.3d 994, 999 (Fed. Cir. 1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references."). Indeed, the Federal Circuit may have overcompensated, making it very difficult to combine references in order to prove obviousness. *See* Lemley & O'Brien, *supra* note 160, at 301 (making this argument). For an extremely strict statement of the legal standard on combining references, see *Winner Int'l Royalty Corp. v. Wang*, 202 F.3d 1340 (Fed. Cir. 2000).

188. For a detailed discussion of hindsight in biotechnology cases, see Lawrence M. Sung, *On Treating Past as Prologue*, 2001 U. ILL. J. L. TECH. & POL'Y 75.

189. For arguments suggesting the common law evolves towards efficiency over time, see RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 23-27 (1st ed. 1979); George L. Priest, *The Common Law Process and the Selection of Efficient Rules*, 6 J. LEGAL STUD. 65 (1977); Paul H. Rubin, *Why is the Common Law Efficient?*, 6 J. LEGAL STUD. 51 (1977). Whether or not this controversial claim is correct, *stare decisis* is clearly entrenched in the legal mindset.

der to satisfy the enablement or best mode requirements.[190] The court in that case acknowledged that determinations of the level of skill in the computer industry should be made on a case-by-case basis[191]; but subsequent Federal Circuit decisions have not inquired separately into the level of skill in the art, or explored the complexity of the program before them in much detail. Instead, they have tended to rely on prior cases holding that code need not be disclosed.

In biotechnology the linkage is even stronger. *In re Bell* concluded that knowledge of an amino acid sequence produced by a gene, coupled with a plan for identifying the DNA sequence of the gene, did not render the DNA sequence itself obvious.[192] *In re Deuel* relied on *Bell*'s conclusion, despite the fact that biotechnology had advanced somewhat between the two inventions.[193] In *Regents of the University of California v. Eli Lilly & Co.*,[194] the court expressly relied on its conclusions about the level of skill in the art in *Bell* and *Deuel* to determine its conclusions regarding written description.[195] *Fiers* is even more explicit in this regard, creating a firm

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190. N. Telecom, Inc. v. Datapoint Corp., 908 F.2d 931, 941 (Fed. Cir. 1990).

191. *Id*. at 941.

192. *In re* Bell, 991 F.2d 781, 785 (Fed. Cir. 1993).

193. *In re* Deuel, 51 F.3d 1552, 1559 (Fed. Cir. 1995). In *Bell*, the prior art disclosed the amino acid sequence for the proteins of interest, and a method for cloning genes. By contrast, the art in *Deuel* disclosed only a partial sequence. Nonetheless, the passage of several years between the priority dates of the applications (Deuel's application was first filed January 8, 1990, and Bell's application was filed June 16, 1987) was ignored by the court, which did not focus on or even mention when the inventions occurred.

194. 119 F.3d 1559 (Fed. Cir. 1997).

195. According to the court:

> Example 6 provides the amino acid sequence of the human insulin A and B chains, but that disclosure also fails to describe the cDNA. Recently, we held that a description which renders obvious a claimed invention is not sufficient to satisfy the written description requirement of that invention. *Lockwood*, 107 F.3d at 1572. We had previously held that a claim to a specific DNA is not made obvious by mere knowledge of a desired protein sequence and methods for generating the DNA that encodes that protein. *See, e.g.*, *In re* Deuel, 51 F.3d 1552, 1558, 34 USPQ2d 1210, 1215 (1995) ("A prior art disclosure of the amino acid sequence of a protein does not necessarily render particular DNA molecules encoding the protein obvious because the redundancy of the genetic code permits one to hypothesize an enormous number of DNA sequences coding for the protein."); *In re* Bell, 991 F.2d 781, 785, 26 USPQ2d 1529, 1532 (Fed.Cir. 1993). Thus, a fortiori, a description that does not render a claimed invention obvious does not sufficiently describe that invention for purposes of § 112 ¶ 1. Because the '525 specification provides only a general method of producing human insulin

rule that conception of a DNA sequence requires a listing of that sequence "irrespective of the complexity or simplicity of the method of isolation."[196]

While apparently logical, the reliance on industry-specific precedent in determining the level of skill in the art is problematic. First, while both obviousness and enablement rely on the PHOSITA construct, the PHOSITA is not necessarily the same for obviousness and enablement even in a single case. Obviousness is tested at the time the invention was made, while enablement is tested at the time the application was filed. Clearly the application cannot be filed until after the date of invention, and in some cases several years elapse between the two.[197] Knowledge in the art can change during this period, sometimes dramatically. Second, and more important, the level of skill in the art will normally change between the dates of different inventions. It is hazardous, therefore, to rely on one court's statement of the level of skill in the art as determinative or even evidentiary of the level of skill in the same art at a different time. The level of skill in the art is a factual question that must be determined anew on the particulars of each case.[198]

A related problem is the equally time-honored tradition of reasoning by analogy. If courts and lawyers can't find precedent directly on point, they will turn to the closest available analog. In the case of biotechnology, the court appears to have taken its understanding of DNA directly from its small-molecule chemistry cases of a generation before. But if reliance on precedent is bad in the case of the PHOSITA, reliance on analogy is worse. Expanding the search for the PHOSITA beyond a narrow definition of the field in question will almost certainly get it wrong, as indeed the court has done in the biotechnology cases. Given the fact-specific nature of the inquiry, the Federal Circuit may need to resist its tendency—well

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> cDNA and a description of the human insulin A and B chain amino acid sequences that cDNA encodes, it does not provide a written description of human insulin cDNA.

Id. at 1567.

196. Fiers v. Revel, 984 F.2d 1164, 1169 (Fed. Cir. 1993).

197. The law permits a one-year grace period between any public act and the filing of a patent application. *See* 35 U.S.C. § 102(b) (2000). But many inventors wait even longer between invention and the filing of an application. This is permissible, so long as they do not put the invention on sale or in public use in the interim, and do not abandon it. 35 U.S.C. § 102(c) (2000).

198. For a detailed discussion, see Dillen, *supra* note 184, at 1039-44. The U.S. Court of Customs and Patent Appeals in *In re Driscoll*, 562 F.2d 1245, 1250 (C.C.P.A. 1977), and the Federal Circuit in *Enzo Biochem. v. Calgene, Inc*., 188 F.3d 1362, 1374 n.10 (Fed. Cir. 1999), both recognized this. However, it has proven a hard rule to adhere to.

documented in other areas—to substitute its factual conclusions for those of the district court.[199] A clear signal by the Federal Circuit that identifying the PHOSITA is a fact-specific question that must be decided anew in each case (perhaps by reference to expert testimony) might go a long way towards solving the problem of substituting precedent and analogy for detailed analysis.[200] Courts should also spend more time and effort fleshing out the PHOSITA, who in many opinions seems to be mentioned only perfunctorily.[201]

III. FIXING THE PHOSITA DOCTRINE

If we are right that patent law is technology-specific because of the reliance on the PHOSITA, and that the Federal Circuit's application of that standard has proven problematic in biotechnology and software cases, what is to be done? We have suggested that industry-specific tailoring is desirable, but the reciprocal relationship between obviousness and disclosure, mediated by a common PHOSITA standard, leads to perverse results. Consequently, in this section, we propose that courts "decouple" the PHOSITA standards for obviousness and enablement, thus allowing the two requirements for patentability to be independently adapted to the incentive requirements of various technologies.

The seeds of such an approach may already be latent in established legal doctrines of obviousness and enablement. Recall that the characteristics of the obviousness PHOSITA and those of the enablement PHOSITA

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199. *See, e.g.*, William C. Rooklidge & Matthew F. Weil, *Judicial Hyperactivity: The Federal Circuit's Discomfort With Its Appellate Role*, 15 BERKELEY TECH. L.J. 725 (2000) (noting this problem); Arti K. Rai, *Facts, Law and Policy: An Allocation-of-Powers Approach to Patent System Reform*, __ COLUM. L. REV. __ (forthcoming 2003) (arguing that the Federal Circuit's preoccupation with making factual determinations has prevented it from taking a leadership role in guiding legal rules). Empirical data suggests that the Federal Circuit is particularly unlikely to defer to district court rulings construing patent claims. *See* Christian Chu, *Empirical Analysis of the Federal Circuit's Claim Construction Trends*, 16 BERKELEY TECH. L.J. 1045 (2001); Kimberly A. Moore, *Are District Court Judges Equipped to Resolve Patent Cases?*, 15 HARV. J. L. & TECH. 1 (2001). Rai also argues that the Federal Circuit has not shown sufficient deference to factfinders in obviousness and disclosure cases. *See* Rai, *Facts*, *supra* note 199.

200. In this respect we agree with Wagner, who argues that improper determinations of the PHOSITA in one case should not bind courts in a later case. Wagner, *supra* note 125, at 6. But since the Federal Circuit has relied on such prior determinations, we see the current state of affairs as more problematic than he does.

201. *See* Meara, *supra* note 126 (arguing that the existing factors for determining skill in the art do not work very well, and suggesting ways to refine the PHOSITA inquiry).

are not entirely coterminous; they are measured at different times. Because the level of knowledge for the enablement PHOSITA is measured at the time a patent is filed, rather than as of the date of invention, a larger pool of prior art will frequently be imputed to the knowledge of the enablement PHOSITA. The accumulation of prior art between invention and filing could in theory allow an invention to enjoy both a low threshold of obviousness and a low threshold of disclosure.

One possible approach—though one we ultimately reject—would be to emphasize this differential knowledge in order to eliminate the tight reciprocity of obviousness and enablement. The temporal disparity in the two PHOSITAs might get the courts some way towards that goal. Since the body of prior art grows during the period between invention and the filing of a patent, the corpus of knowledge imputed to the enablement PHOSITA will be somewhat larger than that imputed to the obviousness PHOSITA. Thus, the level of disclosure required to enable one of ordinary skill at the time of filing could well be lower than that required to enable one of ordinary skill at the time the invention was made, because the enablement PHOSITA is expected to know more. Conversely, an invention may well be nonobvious at the time it is made, although it would not be at the time a patent is filed.[202]

This same effect may hold true for the PHOSITA of the written description requirement, albeit to a lesser extent. The written description requirement substantially overlaps with the degree of disclosure required for enablement, but is likely to require something more. Because the unique purpose of the written description requirement is to demonstrate what the inventor had in his possession at the time the patent was filed, courts have been understandably reluctant to assume that details missing from the disclosure could be supplied by the prior art knowledge imputed to the PHOSITA. Thus, the inventor is less able to rely upon the level of knowledge in the prior art to accommodate a more relaxed disclosure requirement for written description. Nonetheless, some courts have suggested that there is

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202. This will depend to some extent upon when the invention is considered to be "made" for nonobviousness purposes. If the inventor must rely upon her filing date as the date the invention is made, then the knowledge imputed to the enablement and obviousness PHOSITAs may be coterminous. However, if the date of invention can be related back to an early time of conception, the disparity between the two bodies of prior art may be substantial.

some flexibility in the written description requirement,[203] although that has not been the trend in the Federal Circuit biotechnology cases.[204]

The effect of emphasizing the time difference is that patents are both easier to obtain (since the prior art PHOSITA used in the obviousness inquiry knows less) and broader in scope (since the PHOSITA used in the later disclosure inquiry knows more). Such a result is desirable as a policy matter only if there is reason to believe that there is not currently enough patent protection. Our policy analysis suggests, however, that the real problem in both biotechnology and software lies in the number and scope of patents that are issued, not in inadequate protection. For example, application of a low obviousness threshold and a relaxed disclosure requirement would lead to many valid patents with broad scope. In biotechnology, this will only exacerbate the problem of "patent thickets" identified by Carl Shapiro.[205] Nor will reliance upon the differential in prior art between obviousness and enablement yield the optimal result in the case of computer software. As we have described, the profile of that industry militates in favor of narrower and more sharply defined patents: in other words, toward a higher threshold of disclosure and not as high an obviousness standard. But, in this case, the differential in prior art between the time of invention and the time of filing pushes in exactly the wrong direction, away from a stringent enablement standard. No matter how high the threshold for obviousness may be set, the passage of time between invention and filing will place more knowledge at the disposal of the PHOSITA at the latter event, favoring less disclosure rather than more. This means that even a decoupled PHOSITA standard will not achieve ideal results in both biotechnology—where the disclosure standards may need to be relaxed somewhat—and software—where they need to be tightened.

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203. *See, e.g.*, *In re* Smythe, 480 F.2d 1376, 1384 (C.C.P.A. 1973) (holding that the written description requirement for an embodiment is fulfilled by "description of properties and functions" of an invention if the disclosure would "suggest to a person skilled in the art" the particular embodiment).

204. *But see* Union Oil Co. v. Atlantic Richfield Co., 208 F.3d 989 (Fed. Cir. 2000) (upholding a jury determination that functional descriptions of gasoline compositions satisfied the written description requirement). To the extent that *Union Oil* may signal a shift in the Federal Circuit's approach to written description requirements, it is worth noting that Judge Lourie, the author of most of the biotechnology cases, dissented and vigorously criticized the majority for deciding a written description question on an enablement standard. *Id*. at 1002-05 (Lourie, J., dissenting).

205. Carl Shapiro, *Navigating the Patent Thicket: Cross Licensing, Patent Pools, and Standard Setting*, in INNOVATION POLICY AND THE ECONOMY (Adam Jaffe et al., eds., Nat'l Bureau of Econ., 2001).

Consequently, it is inadequate to rely upon the knowledge differential already found in the PHOSITA standard in order to correct the mismatch of policy outcomes and doctrinal analysis. A more promising approach is to decouple the section 103 and section 112 PHOSITA standards altogether, recognizing that the PHOSITA contemplated for purposes of obviousness is simply not the PHOSITA contemplated for purposes of disclosure. Although tight reciprocity of the two standards, mediated by a common PHOSITA construct, makes for an appealing and intellectually elegant doctrinal framework, theoretical esthetics might be required to give way to technological pragmatics. Again, there are precursors latent in the case law that could be developed into such a doctrinal shift; recall that the section 103 PHOSITA has been portrayed by some courts as a bit of an innovator, while the section 112 PHOSITA has not.[206] Certainly the two constructs are conceived as being engaged in very different inquiries; the first seeking some motivation to compile prior art knowledge into an invention, and the second drawing upon prior art knowledge to supplement an invention disclosure. Thus, arguably it makes sense that the ordinary *inventor* of section 103 be a very different person—with a different knowledge set—from the ordinary *user* of section 112. Divorcing the two inquiries could allow each standard the freedom to independently accommodate the incentive needed by a given industry. In particular, this may be a more felicitous approach for software. If the obvious PHOSITA is expected to know more than the enablement PHOSITA, patents will tend to be narrower than they are today. Fewer patents will be nonobvious, and patentees will have to disclose more. On the other hand, it may prove more problematic in biotechnology cases, where optimal policy would permit broader patents than the law currently does.

CONCLUSION

Patent law is becoming technology-specific. The legal rules applied to biotechnology cases bear less and less resemblance to those applied in software cases. While there may be good policy reasons to treat the two industries differently, the current legal rules are not expressly informed by the economics of the industries, but by an ad hoc combination of judicial anthropology and *stare decisis*. Not surprisingly, they do not reflect optimal patent policy in either biotechnology or software. Nor do the court opinions reflect a particularly good understanding of the science in either computer software or biotechnology. We have offered some explanations

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206. *See supra* notes 150-155 and accompanying text.

for this phenomenon, along with a specific suggestion—decoupling the obviousness and enablement standards. Decoupling will help courts avoid feeling constrained to make industry-specific legal decisions that are inappropriate as a policy matter—setting an obviousness standard that the court believes required by prior disclosure decisions, for example, or vice versa. It will permit the courts to concentrate on the actual skill of the PHOSITA in a given art at a given time for a given purpose.

Clarifying the role of the PHOSITA will help courts avoid making bad decisions because they did not understand the technology in question, or because they felt bound by a prior court's discussion of the level of skill in the art. It will not address the larger policy problems that result from the industry-specific nature of innovation; those policy problems must be addressed elsewhere.[207] Nevertheless, if we are to optimize patent policy, getting the PHOSITA right is at least a step in the right direction.

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207. *See* Burk & Lemley, *supra* note 5.

WESTERN FRONTIER OR FEUDAL SOCIETY?: METAPHORS AND PERCEPTIONS OF CYBERSPACE

By Alfred C. Yen†

ABSTRACT

This Article examines how metaphors influence perceptions of cyberspace. Among other things, the Article studies the comparison of cyberspace to the American western frontier and the metaphor's construction of cyberspace as a "place" whose natural characteristics guarantee freedom and opportunity. This supports an often-made claim that cyberspace is different from real space, and that government should generally refrain from regulating the Internet.

The Article surveys the basis of the Western Frontier metaphor in academic history and popular culture, and concludes that the metaphor misleads people to overestimate cyberspace's "natural" ability to guarantee freedom and opportunity. The Article accomplishes this, in part, by offering feudal society as a metaphor for cyberspace and showing how prominent features of cyberspace correspond to key components of feudal society. The Article does not claim that cyberspace is thoroughly feudal, but it does argue that the feudal society metaphor valuably dislodges the Western Frontier metaphor and reminds us that law has an important role to play in shaping the future of the Internet.

I. INTRODUCTION

This Article offers feudal society as a metaphor for the emerging social organization of the Internet. It does so to illustrate how metaphors

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shape thinking about the Internet and to challenge the sometimes misleading comparison of the Internet to the Western Frontier.[1]

The application of metaphor to the Internet is entirely sensible. It is an unavoidable and useful human habit to compare unfamiliar objects to familiar ones. People use apt metaphors because they stimulate the imagination, drawing attention to patterns and possibilities that would otherwise have escaped attention. If perceptions stimulated by metaphor become suf-

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1. Examples from academic legal writing include STUART BIEGEL, BEYOND OUR CONTROL? CONFRONTING THE LIMITS OF OUR LEGAL SYSTEM IN THE AGE OF CYBERSPACE 4, 13-18 (2001) (discussing use of "Wild West" metaphor); Mary Elizabeth Fitzgibbons, *Foreword to the Fall 1999 Issue*, 4-Fall J. TECH. L. & POL'Y 0, at *2 (1999) ("Cyberspace has often been compared with the 'Wild West' of America's frontier days. This is an apt metaphor."), *available at* http://journal.law.ufl.edu/~techlaw/4-3/Foreword.html; Llewellyn Joseph Gibbons, *No Regulation, Government Regulation, or Self-Regulation: Social Enforcement or Social Contracting for Governance in Cyberspace*, 6 CORNELL J.L. & PUB. POL'Y 475, 475 (1997) ("'Cyberians' are present at the creation of the jurisdiction of cyberspace and at the closing of the electronic frontier."); Raymond Ku, *Foreword: A Brave New Cyberworld?*, 22 T. JEFFERSON L. REV. 125, 125-26 (2000) (discussing connections among cyberspace, the electronic frontier, and the Western frontier); Shamoil Shipchandler, Note, *The Wild Wild Web: Nonregulation as the Answer to the Regulatory Question*, 33 CORNELL INT'L L.J. 435, 436 (2000) ("Today's Wild West is the Internet."); David Yan, *Virtual Reality: Can We Ride Trademark Law to Surf Cyberspace?*, 10 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 773, 777 (2000) ("Originally, however, cyberspace was like the Wild West.").

Examples from general commentators include Andrew P. Morriss, *The Wild West Meets Cyberspace*, THE FREEMAN, vol. 48, No. 7 (July 1998); Paul Ashdown, *From Wild West To Wild Web: Public Intellectuals & the Cyberspace Frontier*, EXECUTIVE SPEECHES, vol. 15, No. 2, 699 (2000); John Perry Barlow, *Jack In, Young Pioneer!*, Keynote Essay for the 1994 Computerworld College Edition, ¶¶ 6-7, *available at* http://www.eff.org/Infra/virtual_frontier_barlow_eff.article (Aug. 11, 1994) [hereinafter Barlow, *Jack In*] (urging young people to connect to the Internet as one might have urged a young person to go West); Mitchell Kapor & John Perry Barlow, *Across the Electronic Frontier*, Electronic Frontier Foundation, ¶ 4, *available at* http://www.eff.org/Publications/John_Perry_Barlow/HTML/eff.html (July 10, 1990) ("Cyberspace is a frontier region"); John V. Lombardi, *Killer Applications, the Net, and the Wild, Wild, West*, Address at the Florida Government Technology Conference, ¶ 6, *available at* http://jvlone.com/cyber2.html (Oct. 10, 1995).

Examples from the press include *Internet Surfing Can Cut Into 'People Time'*, UPI, Feb. 16, 2000, ¶¶ 11-14 (comparing Internet to unsettled Western frontier), *available at* LEXIS, Nexis library, UPI file; Stephen Pounds, *MCI Chairman Sees Internet as 'The Wild West'*, PALM BEACH POST, Apr. 30, 1995, at 3E; Lawrence J. Siskind, *Settling the Wild Cyber Frontier: Domain Names Should be Treated as Property*, TEX. LAW., Nov. 22, 1999, at 43 ("Across the vast expanse of cyberspace, wildcatters are at work, staking claims over thousands of domain names, hoping to strike it rich with one or more."); Mark Trumbull, *Taming the 'Wild West' of the Global Internet*, CHRISTIAN SCI. MONITOR, Nov. 14, 1995, at 12; Dawn Wilensky, *The Internet, the Next Retailing Frontier*, DISCOUNT STORE NEWS, Dec. 4, 1995, at 6.

ficiently ingrained, people may adopt them as reality and make them the basis for future beliefs and actions. At the same time, however, it is important to separate the application of metaphor from the complete apprehension of reality. Metaphors work because they provide perspective, but the adoption of one perspective necessarily omits insights offered by other perspectives. Accordingly, insight gets lost when one metaphor assumes enough prominence to crowd other ones out, especially if the prominent metaphor has misleading qualities. It therefore makes sense to develop and use a balanced set of metaphors when studying any object.[2]

Not surprisingly, metaphors shape the perception of Internet reality. Of the many metaphors that have been applied to the Internet,[3] the most

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2. *See* MILNER S. BALL, LYING DOWN TOGETHER: LAW, METAPHOR, AND THEOLOGY 22 (1985) (describing the importance of metaphor in shaping reality, the power of "preemptive metaphors," and the need for "access to alternate metaphors"); Clay Calvert, Comment, *Regulating Cyberspace: Metaphor, Rhetoric, Reality, and the Framing of Legal Options*, 20 HASTINGS COMM. & ENT. L.J. 541, 542-43, 547-49 (1998) (describing the use of the information superhighway metaphor for the Internet and its limitations); A. Michael Froomkin, *The Metaphor is the Key: Cryptography, the Clipper Chip, and the Constitution*, 143 U. PA. L. REV. 709, 718 (1995) ("As more and more settlers arrive in cyberspace, the nature of this new landscape will depend critically on the legal metaphors that the colonists choose to bring with them."); Dan Hunter, *Cyberspace as Place, and the Tragedy of the Digital Anticommons*, 91 CAL. L. REV. (forthcoming March 2003) (discussing the "cyberspace as place" metaphor and, in general, the widespread use of metaphors); Bruce P. Keller, *The Game's the Same: Why Gambling in Cyberspace Violates Federal Law*, 108 YALE L.J. 1569, 1571 (1999) (criticizing those who take the metaphor of cyberspace as an actual, separate place too literally); F. Gregory Lastowka, Note, *Search Engines, HTML, and Trademarks: What's the Meta For?*, 86 VA. L. REV. 835, 854-58 (2000) (noting influence and importance of metaphors); Michael J. Madison, *Rights of Access and the Shape of the Internet*, 44 B.C. L. REV. (forthcoming May 2003) (advocating the development of metaphors connected to experience); Maureen A. O'Rourke, *Property Rights and Competition on the Internet: In Search of an Appropriate Analogy*, 16 BERKELEY TECH. L.J. 561 (2001) (analyzing effect of analogies and metaphors on property rights and competition policy for the Internet); Jonathan J. Rusch, *Cyberspace and the "Devil's Hatband"*, 24 SEATTLE U. L. REV. 577, 578-81 (2000) (noting the persistence of the Western Frontier metaphor and advocating the intelligent selection of metaphors based on the Western frontier); Timothy Wu, *Application Centered Internet Analysis*, 85 VA. L. REV. 1163 (1999) (criticizing tendency of various commentators who allow a single analogy to dominate their analyses of the Internet).

3. *See* EDIAS Software Int'l, LLC v. BASIS Int'l, Ltd., 947 F. Supp. 413, 419 (D. Ariz. 1996) (noting metaphors that compare the Internet to highways, shopping malls, and telephone systems); Jon. M. Garon, *Media & Monopoly in the Information Age: Slowing the Convergence at the Marketplace of Ideas*, 7 CARDOZO ARTS & ENT. L.J. 491, 589 (1999) (referring to a "portal metaphor" for the Internet); I. Trotter Hardy, *Copyright Owners' Rights and Users' Privileges on the Internet: Computer RAM "Copies": A Hit or a Myth? Historical Perspectives on Caching as a Microcosm of Current Copyright Concerns*, 22 DAYTON L. REV. 423, 436-37 (1997) (comparing the Internet to a cardio-

prominent and influential has been the imagination of the Internet as a separate, new physical place known as "cyberspace" and its comparison to America's Western Frontier. This "Western Frontier" metaphor is both powerful and persistent,[4] particularly in the United States.[5] Americans imagine the Western Frontier as an unexplored place of abundant land, freedom, and opportunity. The West's remoteness ensured the absence of legal and social constraints associated with the civilized East. Those unhappy with Eastern constraints found freedom by moving west, where abundant land and resources ensured their prosperity.

One can see the Internet in a similar way. Cyberspace "pioneers" experience the Internet as a special place devoid of the rules and constraints of "real space." This makes cyberspace a place where people find freedom from real space rules. Additionally, many who have ventured into cyber-

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vascular system and a highway system); Andy Johnson-Laird, *The Anatomy of the Internet Meets the Body of the Law*, 22 DAYTON L. REV. 465, 469 (1997) (adding the metaphor of "global copying machine" to the "list of Internet metaphors"); Stephen McGeady, *The Digital Reformation: Total Freedom, Risk, and Responsibility*, 10 HARV. J.L. & TECH. 137, 139-41 (1996) (referring to comparisons between the Internet and the Gutenberg printing press, and further using the Protestant reformation as a metaphor for the Internet); Tom W. Bell, Book Review, 28 J. MAR. L. & COM. 185, 186 (1997) (reviewing HENRY H. PERRITT, JR., LAW AND THE INFORMATION SUPERHIGHWAY (1996) (criticizing the information superhighway metaphor for the Internet as "outmoded" and comparing the Internet to the ocean).

4. *See* Rusch, *supra* note 4, at 577-79 (discussing the pervasive comparison of cyberspace to the Wild West); Lyrissa Barnett Lidsky, *Silencing John Doe: Defamation & Discourse in Cyberspace*, 49 DUKE L.J. 855, 885 (2000) ("The Internet has often been compared to the Wild West, a frontier society free from the stifling conventions of civilization, and some have even argued that defamation law is an unnecessary anachronism in this new society."); Andrew P. Morriss, *Miners, Vigilantes, & Cattlemen: Overcoming Free Rider Problems in the Private Provision of Law*, 33 LAND & WATER L. REV. 581, 687 ("The 'Wild West' is a frequently applied metaphor for the Internet."); Steven Hetcher, *Climbing the Walls of Your Electronic Cage*, 98 MICH. L. REV. 1916, 1916 (2000) (noting frequent comparison of cyberspace to an unexplored frontier with reference to the American West).

5. This Article recognizes that the perspectives under discussion have a distinctly American orientation. This is hardly surprising, as the Internet originally developed under the auspices of the United States government. *See infra* notes 10-12 and accompanying text. Moreover, the Western Frontier metaphor operates by referring to a part of history dear to many Americans. Accordingly, the metaphor's effect is strongest on Americans, the very people who have had the largest influence over the Internet's development and operation. *Cf.* BIEGEL, *supra* note 1, at 125 ("[T]he culture of the Internet is predominantly American at this point in time."). Indeed, Justin Hughes, a professor at Cardozo Law School, suggested to the author that perceptions of the Internet would be very different if other countries had been primarily responsible for its development. Exploration of these possibilities would undoubtedly be interesting, but is beyond the scope of this Article.

space have discovered that significant economic opportunities exist there. The Internet has become the electronic frontier from which freedom and prosperity will emerge.

Like all metaphors, the Western Frontier metaphor provides a particular perspective on the object described. The metaphor constructs the Internet as a version of the Western Frontier, a historical phenomenon that glorifies individuality and the benefits of minimal government. Put slightly differently, the Western Frontier metaphor suggests that the Internet will permit everyone to live a modern, improved version of America's westward expansion. Like the American West, the unregulated Internet has inherent characteristics that support unlimited economic opportunity, equality, individual freedom, and even political liberty.[6] Private arrangements reached in cyberspace therefore have a particularly strong claim to legitimacy because the Internet makes people free and equal individuals who cannot exploit each other unfairly. These observations support the argument that society should accept the Internet and its developing social practices "as is," with minimal interference from government.[7]

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6. *See* David G. Post, *The "Unsettled Paradox": The Internet, the State, and the Consent of the Governed*, 5 IND. J. GLOBAL LEGAL STUD. 521, 539 (1998) (arguing that the unregulated Internet naturally guarantees consent of the governed); David R. Johnson & David G. Post, *The New 'Civic Virtue' of the Internet*, ¶ 7, *in* THE EMERGING INTERNET: THE 1998 REPORT OF THE INSTITUTE FOR INFORMATION STUDIES (The Aspen Institute ed., 1998), *available at* http://www.cli.org/paper4.htm; *Internet Surfing Can Cut Into 'People Time'*, *supra* note 1, ¶¶ 11-14 (reporting idea that Internet's "endless frontier" expands social horizons).

7. *See infra* Part III.C. Perhaps the most colorful statement of this view comes from John Perry Barlow's "Declaration of the Independence of Cyberspace," which reads:

> Governments of the Industrial World, you weary giants of flesh and steel, I come from Cyberspace, the new home of the Mind. On behalf of the future, I ask you of the past to leave me alone. You are not welcome among us. You have no sovereignty where we gather.
>
> We have no elected government, nor are we likely to have one, so I address you with no greater authority than that with which liberty itself always speaks. I declare the global social space we are building to be naturally independent of the tyrannies you seek to impose on us. You have no moral right to rule us nor do you possess any methods of enforcement we have true reason to fear.

¶¶ 1-2, available at http://www.eff.org/~barlow/Declaration-Final.html (Feb. 8, 1996). *See also* Paulina Borsook, CYBERSELFISH: A CRITICAL ROMP THROUGH THE TERRIBLY LIBERTARIAN CULTURE OF HIGH TECH 1-27 (2000) (describing the relationship between high tech culture and libertarian politics).

Professor Andrew P. Morriss offers a more developed version of this argument in his essay *The Wild West Meets Cyberspace*, *supra* note 1. Professor Morriss directly compares cyberspace to the Western frontier, noting that both are characterized by the

The use of the Western Frontier metaphor to support minimal Internet regulation is not, in and of itself, problematic. Minimal regulation could be a wise strategy for the Internet, and a metaphor that clarifies the relevant arguments helps. However, the Western Frontier metaphor's prominence crowds out other equally important perspectives. If society thinks of the Internet as a new Western Frontier, it will often refrain from using law to rectify problems in cyberspace because legal regulation does not fit comfortably into the Western Frontier metaphor's romanticized tale of progress. This troubling use of the Western Frontier metaphor conveniently overlooks historical episodes of injustice and exploitation in the West[8] that appropriate legal regulation might have prevented. We must therefore think of ways to challenge the Western Frontier metaphor's prominence so that alternate perspectives can emerge.

This Article elaborates on the foregoing observations and then offers feudal society as an alternate Internet metaphor. The metaphor may seem a bit odd because the Internet seems far removed from a society that flourished in Europe over 500 years ago. Nevertheless, this Article will show that prominent features of cyberspace map easily onto feudal society.[9] This does not mean that cyberspace is thoroughly feudal, or that feudal society is the best or only metaphor to apply to the Internet. A feudal soci-

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general absence of state regulation. He goes on to tout the benefits of these laissez-faire conditions:

> The nineteenth-century west was a place of almost limitless opportunity where, through market transactions and voluntary action, tens of thousands of strangers developed institutions that allowed them to take advantage of that opportunity in communities of peace and good order. Today we are only beginning the Information Rush. Like a forty-niner trying to imagine modern-day San Francisco while looking at the mud flats and tents of his day, we cannot foresee what forms the spontaneous order now evolving in cyberspace will take. What we can do is reject the use of the metaphor of "Wild West" as a justification for state intervention. Whether the demand is for enforcement authorities to restrict cryptography or antitrust regulators to crush competition, intervention will stifle freedom. If we are lucky, the Internet will turn out to be just like the American Wild West.

Id. ¶ 22.

8. *See, e.g.*, DAVID HAWARD BAIN, EMPIRE EXPRESS: BUILDING THE FIRST TRANSCONTINENTAL RAILROAD 205-09 (1999) (describing the role that exploitative and racist employment practices played in building the transcontinental railroad); ROBERT M. UTLEY, HIGH NOON IN LINCOLN: VIOLENCE ON THE WESTERN FRONTIER (1987) (describing numerous acts of theft, fraud, exploitation, rape and murder perpetrated by individuals in Lincoln County, New Mexico during a late 19th century period of ineffective government).

9. *See infra* Part IV.

ety perspective simply facilitates appreciation of the Internet in a way that the Western Frontier metaphor does not. The Feudal Society metaphor weakens the ideology of minimal Internet regulation by reminding us that government regulation played a significant role in dismantling undesirable aspects of feudal society. The claim is not that the Feudal Society metaphor is superior to the Western Frontier metaphor, or that a particular ideology of Internet regulation is necessarily correct. Instead, using both metaphors allows a richer appreciation of the Internet, its influence on society, and the possible role of law in regulating that influence.

The Article proceeds in five parts. Part II describes the Internet, its operation, and the perception of the Internet as a separate physical space. Part III analyzes the Western Frontier metaphor and its relationship to arguments in favor of minimal Internet regulation. It briefly explores flaws in the metaphor's account of Western Frontier history and concludes that the metaphor's influence should be countered by the development of new metaphors that highlight the things hidden by the Western Frontier image. Part IV presents feudal society as an alternate, equally plausible metaphor for the Internet. Part V considers some of the implications of applying the Feudal Society metaphor to the Internet, including the use of law to blunt emerging feudal practices in cyberspace. Part VI concludes by urging more careful thought about legal regulation of the Internet and by offering some general ideas about the application of metaphors to the Internet.

II. THE INTERNET AND CYBERSPACE

Any discussion of the Internet as a "place" must first deal with the phenomenon of cyberspace. Cyberspace is the virtual space created by operation of the Internet, a network of computers that share information with each other.[10] The Internet has its origins in a number of experimental networks created and operated with funding from the United States government. The earliest of these was a 1960s Department of Defense project called the "ARPANET."[11] The ARPANET was eventually joined in the 1980s by the NSFNET, which was designed and operated by the National Science Foundation.[12]

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10. *See* BARRY M. LEINER ET AL., A BRIEF HISTORY OF THE INTERNET, version 3.31, *available at* http://www.isoc.org/internet/history/brief.shtml (last revised Aug. 4, 2000). For more detail, see Jay P. Kesan & Rajiv C. Shah, *Fool Us Once Shame on You—Fool Us Twice Shame on Us: What We Can Learn from the Privatizations of the Internet Backbone Network and the Domain Name System*, 79 WASH. U. L.Q. 89 (2001).

11. *See* Kesan & Shah, *supra* note 10, at 101-03.

12. *See id.* at 103.

Over time, these networks grew and developed into the modern Internet as private parties gained access to the network and the operation of the network passed to private, for-profit entities.[13] Now, millions of people can connect to the Internet.[14] This does not mean, however, that everyone connects to the Internet the same way. A relatively small number of large entities, like major corporations and the government, build and maintain the high-speed lines that form the Internet's backbone.[15] They provide Internet access to themselves. By contrast, most entities and individuals gain access to the Internet from someone else, creating a hierarchy of computers. Operators of the Internet's backbone are at the top of the hierarchy. They then support a second level of computers by connecting them to the Internet. Those at the second level can then support a third, and so on. This hierarchy continues until no further delegation of Internet access occurs.

Most private individuals connect to the Internet at the bottom of this hierarchy through Internet Service Providers, or "ISPs." The ISP generally provides a connection to the Internet, along with e-mail and other basic technology, in return for a fee. Information travels to and from the individual's computer through the ISP's computer, which in turn forwards that information up the hierarchy and on to the Internet. In short, the ISP acts as the individual's "gateway" to the Internet.[16]

The existence of cyberspace owes a good deal to the sheer number of individuals, businesses, and other entities now connected to the Internet. However, equal credit must go to the increased processing power of modern personal computers, faster transmission of data over the Internet, and specialized software that make it practical to send text, sound and image files over the Internet. Consider the possibilities now available to the typical Internet user. First, the multi-media capabilities of Internet browsers allow users to "surf" the Internet to view a virtually unlimited number of files that display text, images and sound. Hyperlinking means that a simple click of a button takes our user from files stored in one computer to those stored on another. Second, e-mail and real-time communication

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13. *See id.* at 111-19.

14. A major impediment to genuine worldwide availability of Internet access is the lack of adequate wiring in the third world, particularly sub-Saharan Africa. *See* Hiawatha Bray, *Africa Goes Online*, BOSTON GLOBE, July 22, 2001 at A1 (describing the lack of Internet access in Africa and measures being taken to remedy the problem), *available at* 2001 WL 3943399.

15. *See* PRESTON GRALLA, HOW THE INTERNET WORKS 5-7 (4th ed. 1998).

16. *See id.* at 49-53.

software allow Internet users to "chat" or otherwise communicate with each other interactively.[17]

Together, these technologies create the illusion that logging on to the Internet takes the user to the separate place of cyberspace. No one exists in cyberspace without an Internet account. However, once a person establishes an Internet account, she can visit cyberspace anytime she likes. Logging on gives her an apparently separate virtual life. In cyberspace, there are lots of "places" to "go." Cyberspace contains many inhabitants, some of whom will be "seen" only in cyberspace.[18] She can make friends, fall in love, and buy goods and services for her "real space life" while living her virtual cyberspace life. She can even adopt a new identity.[19] However, all of this exists only as long as she is logged on to Internet. The act of turning off her computer removes her from cyberspace as surely as a flight from New York to Paris removes a traveler from the United States.

Of course, cyberspace is not a real place. Spatial terms such as "cyberspace," "web site," and "visiting" locations in cyberspace are all part of the metaphor commonly applied to the experience of sitting at a desk, logging on to the Internet, and viewing files sent by other Internet users. At first inspection, the maintenance of this fiction seems absurd. However, anyone who has spent significant time "surfing the 'net" understands the power of the cyberspace concept, and the numerous Internet identities different from the people who maintain them demonstrate that people believe in cyberspace as a separate place and live it every day. Even if the cold-

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17. For examples and descriptions of chat software see America Online, Inc., *AOL Instant Messenger*, *available at* http://www.aim.com/index.adp (last visited Nov. 15, 2002); ICQ, Inc., *What is ICQ?*, *available at* http://www.icq.com/products/whatisicq.html (last visited Nov. 15, 2002); and Microsoft, Inc., *.NET Messenger Service*, *available at* http://messenger.msn.com (last visited Nov. 15, 2002). For an example of video chat software, see Eyeball Networks Inc., *Products*, *available at* http://www.eyeball.com/products/index.html (last visited Nov. 15, 2002).

18. *See* HOWARD RHEINGOLD, THE VIRTUAL COMMUNITY: HOMESTEADING ON THE ELECTRONIC FRONTIER 17-37, 176-88 (1993) (describing communications among people who had never met in "real space"), *available at* http://www.rheingold.com/vc/book.

19. *See* Brenda Danet, *Text as Mask: Gender, Play, and Performance on the Internet*, *in* CYBERSOCIETY 2.0: REVISITING COMPUTER-MEDIATED COMMUNICATION AND COMMUNITY 129-158 (Steven G. Jones ed., 1998) (describing experimentation with gender identity on the Internet). This point was perhaps made most vividly in a cartoon that appeared in the New Yorker magazine in which one dog seated at a computer says to another, "On the Internet, nobody knows you're a dog." Peter Steiner, NEW YORKER, July 5, 1993, *available at* www.cartoonbank.com.

blooded realist rejects the whole thing as mass delusion,[20] the fact remains that society talks about cyberspace as if it were real, and it is undeniably true that something of social significance is happening "out there." Accordingly, it is important to study the consequences of thinking about the Internet through metaphors that construct it as a special, separate place.[21]

III. COMPARING CYBERSPACE TO THE WESTERN FRONTIER

A. The Frontier Thesis and American Popular Culture

The Western Frontier metaphor is influential because it rests upon a serious intellectual thesis that popular culture has adopted, idealized and disseminated. This combination of serious history and popular culture has created an enduring image of the Western Frontier whose shortcomings are difficult to diagnose and engage.

Frederick Jackson Turner first advanced the "frontier thesis" in 1893, thereby attributing the development of American society and American virtues to the Western Frontier.[22] Turner wrote:

> American social development has been continually beginning over again on the frontier. This perennial rebirth, this fluidity of American life, this expansion westward with its new opportunities, its continuous touch with the simplicity of primitive society, furnish the forces dominating the American character. The true point of view in the history of this nation is not the Atlantic coast, it is the Great West.[23]

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20. Interestingly, William Gibson, the science fiction author generally given credit for coining the term "cyberspace," described it as "a consensual hallucination." WILLIAM GIBSON, NEUROMANCER 51 (1st ed. Ace Books 1984).

21. *See* Madison, *supra* note 2 (identifying a rough consensus on the Internet as a place metaphor); Hunter, *supra* note 2 (identifying widespread adoption of the cyberspace as place metaphor and describing the importance of physical metaphors to human cognitive systems); Mark A. Lemley, *Place and Cyberspace*, 91 CAL. L. REV. (forthcoming March 2003) (identifying and analyzing use of the cyberspace as place metaphor). *Cf.* Jonathan G. S. Koppell, *No "There" There*, ATLANTIC MONTHLY, Aug. 2000, at 16 (noting the influence and likely persistence of the term "cyberspace" and urging careful understanding of its consequences).

22. Frederick Jackson Turner, *The Significance of the Frontier in American History*, *in* REPORT OF THE AMERICAN HISTORICAL ASSOCIATION FOR 1893 199-227 (1894), *reprinted in* FREDERICK JACKSON TURNER, THE FRONTIER IN AMERICAN HISTORY 1-38 (1st ed. Henry Holt & Co. 1920) [hereinafter TURNER, FRONTIER IN AMERICAN HISTORY].

23. TURNER, FRONTIER IN AMERICAN HISTORY, *supra* note 22, at 2-3.

According to Turner, the West's free availability of unsettled land created the economic opportunities and social values that made America great. Individuals without wealth could always move to the West to take advantage of its abundant wildlife and fertile soil.[24] If a settler had sufficient initiative and persistence, prosperity would surely follow.[25] Similarly, people who felt oppressed could liberate themselves in the West because its unsettled land was remote from the oppressive state and its legal regulations.[26] There, in conditions close to the state of nature, people could discover on their own the uniquely American values that support human flourishing.[27] Those values would, of course, include self-reliance, individualism, equality, and a commitment to democracy. People of like mind could then find each other and create new settlements, towns, cities and states superior to the oppressive ones in the East.[28]

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24. *Id.* at 18 (claiming that availability of natural resources attracted settlers to the West).

25. Frederick Jackson Turner, *The Problem of the West*, ATLANTIC MONTHLY, Nov. 1896 [hereinafter TURNER, *Problems of the West*], *reprinted in* TURNER, FRONTIER IN AMERICAN HISTORY 212 ("The West was another name for opportunity. Here were mines to be seized, fertile valleys to be pre-empted, all the natural resources open to the shrewdest and the boldest.").

26. Frederick Jackson Turner, *Contributions of the West to the American Democracy*, ATLANTIC MONTHLY, Jan. 1903 [hereinafter TURNER, *Contributions of the West*], *reprinted in* TURNER, FRONTIER IN AMERICAN HISTORY 259 ("Whenever social conditions tended to crystallize in the east, whenever capital tended to press upon labor or political restraints to impede the freedom of the mass, there was this gate of escape to the free conditions of the frontier.").

27. According to Turner, the harshness of frontier living forced settlers to abandon the trappings of life governed by social convention and the state. Instead, settlers got back to the basics—those things that were truly necessary to life. This allowed settlers to reinvent themselves in a distinctly American way:

> In short, at the frontier the environment is at first too strong for the man. He must accept the conditions which it furnishes, or perish, and so he fits himself into the Indian clearings and follows the Indian trails. Little by little he transforms the wilderness, but the outcome is not the old Europe, not simply the development of Germanic germs, any more than the first phenomenon was a case of reversion to the Germanic mark. The fact is, that here is a new product that is American.

TURNER, THE FRONTIER IN AMERICAN HISTORY, *supra* note 22, at 4. Turner further believed that the society built by Americans uniquely emphasized basic human virtues and avoided the superfluous trappings of European civilization. TURNER, *Problems of the West*, *supra* note 25, at 213 ("The United States is unique in the extent to which the individual has been given an open field, unchecked by restraints of an old social order, or of scientific administration of government.").

28. Turner's writing captures these thoughts with striking clarity:

> Most important of all has been the fact that an area of free land has continually lain on the western border of the settled area of the United

It would be remarkable if natural conditions guaranteed economic and social opportunity for even a brief period of any country's history. According to Turner's frontier thesis, the West provided these blessings to America from the time that Europeans arrived in North America to the settlement of the West Coast. The process of settling the Western Frontier, of finding economic opportunity and social progress in the bounty of free and unsettled land, became the defining feature of American society. Americans are American because they settled the West.[29] American society progresses because regular contact with the Western wilderness implies a continual return to basic values, their reaffirmation, and the improvement of American democracy. America is a better place, and Americans are even better people,[30] because of the Western Frontier. Indeed, America must have a frontier to remain authentically American.[31]

The frontier thesis became one of the most influential ideas of the 20th century. During the period before World War I, most historians accepted the thesis as true.[32] Even now, after considerable criticism from many cor-

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> States. . . . These free lands promoted individualism, economic equality, the freedom to rise, democracy. Men would not accept inferior wages and a permanent position of social subordination when this promised land of freedom and equality was theirs for the taking. Who would rest content under oppressive legislative conditions when with a slight effort he might reach a land where in to become a co-worker in the building of free cities and free States on the lines of his own ideal?

TURNER, *Contributions of the West*, *supra* note 26, at 259. *See also* TURNER, *Problems of the West*, *supra* note 25, at 205-06 (describing continual rebirth of American society through interaction with the Western frontier).

29. *See supra* note 23 and accompanying text.

30. Turner quotes an unnamed representative from western Virginia:

> The Old Dominion has long been celebrated for producing great orators; the ablest metaphysicians in policy; men that can split hairs in all abstruse questions of political economy. But at home, or when they return from Congress, they have negroes to fan them asleep. But a Pennsylvania, a New York, an Ohio, or a western Virginia statesman, though far inferior in logic, metaphysics, and rhetoric to an old Virginia statesman, has this advantage, that when he returns home he takes off his coat and takes hold of the plow. This gives him bone and muscle, sir, and preserves his republican principles pure and uncontaminated.

TURNER, FRONTIER IN AMERICAN HISTORY, *supra* note 22, at 31.

31. *Id.* at 37-38 (reflecting on the disappearance of the Western frontier and predicting that American energy previously spent on the frontier will "continually demand a wider field for its exercise").

32. *See* Richard W. Etulain, *Preface* to DOES THE FRONTIER EXPERIENCE MAKE AMERICA EXCEPTIONAL? at v (Richard W. Etulain ed., 1999) [hereinafter FRONTIER EXPERIENCE].

ners, the thesis remains influential with historians[33] and, perhaps more importantly, in popular culture.[34] Many Westerns—both novels and movies—tell stories about Americans struggling to carve lives from untamed land, uncomplicated virtues, and the triumph of good individuals in the absence of the state.[35] Indeed, the popularization of the frontier thesis is in large part responsible for its influence when applied to cyberspace.

For example, consider *Shane*, a novel by Jack Schaefer that was made into a movie of the same title.[36] The story is set in Wyoming of 1889. The reader learns that the novel's hero, Shane, is a gunman who divulges little of his past.[37] Shane literally wears the marks of his hard life in the West, but that life has molded him into a man of uncommon physical strength

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33. *Id.* ("[N]o essay or book about American history attracts as much attention, pro and con, as Turner's essay ["The Significance of the Frontier in American History"]. ").

34. *See* Martin Ridge, *The Life of an Idea: The Significance of Frederick Jackson Turner's Frontier Thesis*, 40 MONTANA, THE MAG. OF W. HIST. 2 (1991), *reprinted in* FRONTIER EXPERIENCE, *supra* note 32, at 74. Ridge writes:

> Turner's masterpiece, like Braque's cubist work—"Man with a Guitar"—has achieved a special place in American culture. It changed a vital part of the scholarly community, and its rhetoric has been absorbed into our everyday language. It changed the way most Americans continue to see themselves and their institutions. Moreover, it changed the way they are seen by others throughout the world. People who have never read "The Significance of the Frontier in American History" or heard of Frederick Jackson Turner—as is true of Braque and cubism—identify with it and recognize in it portions of a reality.

Id. at 84.

35. *See* Michael T. Marsden, *Savior in the Saddle: The Sagebrush Testament*, *in* FOCUS ON THE WESTERN 93 (John G. Nachbar ed., 1974) (noting that the Turner argument "is acted out time and again as Western after Western unfolds on movie screens across this land"). *See also* JOHN G. CAWELTI, THE SIX-GUN MYSTIQUE (2nd ed. 1984) (analyzing the popularity and influence of the Western genre). For classic Western novels, see JAMES FENIMORE COOPER, THE PIONEERS (James D. Wallace ed., Oxford Univ. Press 1991) (1823); OWEN WISTER, THE VIRGINIAN (1902); ZANE GREY, RIDERS OF THE PURPLE SAGE (1912). For classic Western movies, see *How the West was Won* (Cinerama and Metro-Goldwyn-Mayer 1963); *Shane* (Paramount Pictures 1953).

36. JACK SCHAEFER, SHANE: THE CRITICAL EDITION (James C. Work ed., 1984) (1949) [hereinafter SHANE: CRITICAL EDITION] (Reprinting a restored version of *Shane* along with a selection of scholarly essays; all citations are to this edition). There are, of course, many distinguishable variations of the Western genre in both literature and film. *See* CAWELTI, *supra* note 35, at 113-19 (listing Western films by subject). At least one other writer has noted the significance of the *Shane* story to the comparison of cyberspace to the Western frontier. BIEGEL, *supra* note 1, at 14-15 (discussing the movie version of *Shane*).

37. SHANE: CRITICAL EDITION, *supra* note 36, at 77.

and character.[38] Shane possesses direct manners and virtues so obvious that, despite his gunfighter's demeanor, good people trust him.[39]

In an attempt to leave his gunfighting days behind, Shane becomes a helper at the small homestead farm of Joe and Marian Starrett. Joe's son, Bobby, worships Shane as a hero, as do Joe and Marian in their own way.[40] At first, Shane's very presence seems to lighten the pressure the Starretts face from Fletcher, a cattle rancher bent on running the Starretts and 6 other homesteaders off the open range.[41] Fletcher's ranching business and his apparent disregard of the homesteaders' legal claims establish a threat to the life and community that the good and decent homesteaders want to build.

Over time Fletcher's intimidation increases, but Shane—forged by the Wild West into the great individual of supreme moral virtue and physical strength—champions the homesteaders. Eventually, Fletcher hires a gunman named Wilson to kill Joe because Joe is the homesteader with the grit to hold the others together. Shane, realizing that he cannot be a farmer, resumes gunfighting and kills Wilson and Fletcher in a showdown. Shane then rides out of town, leaving Joe to lead the homesteaders in the creation of homes and a prosperous community where young Bobby can grow up "strong and straight."[42]

Shane presents a glorified, idealized version of Turner's frontier thesis.[43] Shane's physical prowess includes gunfighting, a skill acquired only in the Wild West where the absence of the state forces individuals to protect themselves. Yet the Wild West has also made Shane uncommonly virtuous. The combination of physical and moral qualities taken from the West enables Shane to protect the homesteaders. Joe Starrett and his fellow homesteaders struggle to carve good lives from the Wild West. The

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38. *Id.* at 62-63. Shane wears clothes made of fine material, but they are patched and stained. The material marks him as a person of status, but the patches and stains place his origin outside of civilization. *Id.* Later, the narrator's father tells his son that "[t]here's more right about [Shane] than most any man you're ever likely to meet." *Id.* at 129.

39. *Id.* at 74-75.

40. From the outset, Marian is attracted to Shane. Their unrealizable affection for one another is portrayed as natural, indeed inevitable, because of Shane's superior qualities as a man. Even Joe recognizes that Shane is a better man than he. *Id*. at 203.

41. *Id.* at 133 ("The only shadow over our valley, the recurrent trouble between Fletcher and us homesteaders, seemed to have faded away.").

42. *Id.* at 263.

43. *See generally* James C. Work, *Settlement Waves and Coordinate Forces in* Shane, 14 W. AM. LITERATURE 191 (1979), *reprinted in* SHANE: CRITICAL EDITION, *supra* note 36, at 307 (discussing *Shane* as a story about the interaction between different groups of settlers amid the backdrop of the Wild West).

land itself accepts their presence with great reluctance, as Joe discovers in his vain efforts to remove a large stump from his yard.[44] Even the homesteaders' human antagonists represent a combination of human avarice and the Wild West. Fletcher's open range cattle business is one that could only have developed in the Wild West. Similarly, Wilson and his gunfighting skills exist only because of the Wild West. The absence of law enforcement removes the state from the equation, making self-reliance and individual initiative key factors in the story. In short, *Shane* is a tale of how the self-reliant initiative of a strong, virtuous person can overcome injustice and ensure the prosperity of an entire community.

The fusion of popular culture and the frontier thesis is highly significant. If only historians had considered the frontier thesis, it would have gained limited exposure and criticism would have blunted its force. As noted earlier, Turner's work expresses great optimism that a society forged in the West would be a great one devoid of imperfections associated with the Old World.[45] However, many historians who came after Turner have noted that he simply overlooked the American West's history of violence against indigenous peoples, racist sentiments against Mexican and Asian immigrants, subordination of women, and avaricious exploitation of the land. For them, Turner's thesis could not be right because the society predicted by Turner surely would have avoided these tragic mistakes.[46] Accordingly, many academic historians now consider the Turner thesis a myth.[47]

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44. SHANE: CRITICAL EDITION, *supra* note 36, at 82-84. Joe describes the stump to Shane: "That's the millstone round my neck. That's the one fool thing about this place I haven't licked yet. But I will. There's no wood ever grew can stand up to a man that's got the strength and the will to keep hammering at it." *Id*. The language quoted fairly rings with the notion that individual initiative is the characteristic needed to tame the West. It is also no coincidence that the stump gives way when Joe gets help from Shane, a man imbued with the raw power of the Wild West.

45. *See supra* notes 27-28 and accompanying text.

46. *See, e.g.*, RICHARD HOFSTADTER, THE PROGRESSIVE HISTORIANS: TURNER, BEARD, PARRINGTON 103-06 (1968) (criticizing Turner for allowing patriotism to overwhelm his objectivity); DONALD WORSTER, UNDER WESTERN SKIES 7-13 (1992) (criticizing Turner for being uncritical and narrow in his perspective); HENRY NASH SMITH, VIRGIN LAND: THE AMERICAN WEST AS SYMBOL AND MYTH 250-60 (1950) (describing and criticizing Turner's thesis); John Mack Faragher, *The Frontier Trail: Rethinking Turner and Reimagining the American West*, 98 AM. HIST. REV. 106 (1993) (reviewing five works of "new Western history").

47. *See* WORSTER, *supra* note 46, at 12-18 (describing a "new Western history" that is "beyond myth" and setting forth its agenda of paying due regard to the voices of "invaded and subject peoples of the West," the economic drive behind a "ruthless assault on nature," and the role of power and hierarchy in the West).

By contrast, popular culture has romanticized the frontier thesis and practically guaranteed its public acceptance. Movies and novels reach many more people than academic writings do. Criticism generally directed at academic writing rarely interferes with the public's perception of the romanticized West presented in Western movies and novels. Stories about the natural qualities of the Western Frontier, the inherent virtues it instilled, and the inevitable triumph of good, self-reliant people are told over and over again to an accepting public, hungry for more.[48] Popular culture capitalizes on the loss of the Western Frontier to create American nostalgia for the frontier's return. This nostalgia helps idealize the Western Frontier as a place where optimism should prevail because the very nature of the Western Frontier guarantees a good outcome. Frederick Jackson Turner could never have promoted his ideas this effectively.[49]

B. Cyberspace and the Western Frontier

Events of the 20th century and America's internalization of the frontier thesis have created conditions ripe for the application of the Western Frontier metaphor to the Internet. The upheavals of the twentieth century—two world wars, the Viet Nam experience, and the moral struggles of the civil rights movement—have contributed to a collective sense that America needs to revisit its fundamental values in order to chart its future course. Under the frontier thesis, such renewal would ordinarily occur in the wilderness of the Western Frontier, land that is now largely civilized. Even where significant tracts of land remain uninhabited, the state extends its reach, making it impossible for brave individuals to found new communities on values developed in the absence of the state.

Not surprisingly, Americans have been looking for a new frontier. Widely accepted national boundaries make the occupation of new lands impossible and rule out the possibility of actual land-based frontiers. Space and the ocean are candidates to be new frontiers, but so far the technical obstacles are too great. The Internet, however, appears to be just the ticket, and a number of American writers have promoted it that way—not just for America, but potentially the world.[50] Cyberspace may be vir-

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48. *Cf.* CAWELTI, *supra* note 35, at 110-13 (presenting a three-page list of 106 major Western films from 1903 to 1969). *Shane* itself was retold many times. It first appeared as a serial in a magazine, then as a novel, then as a movie, and finally as a television series. Furthermore, its general plot outline has been recycled in the movie *Pale Rider*, starring American tough guy Clint Eastwood.

49. *See* BIEGEL, *supra* note 1, at 12 ("It is generally agreed that the Wild West imagery of popular culture comes not from history books but from the Western film.").

50. As John V. Lombardi, former president of the University of Florida, has written:

tual space, but its characteristics resemble a romanticized Turnerian Western Frontier, where the state seems largely absent.[51] This seeming absence makes cyberspace a dangerous wilderness characterized by free pornography, "spam," identity theft, rampant copyright infringement, gambling, and hacking.[52] Its technological nature also makes cyberspace a difficult place to negotiate. Only computer-savvy settlers really know how to survive there.[53] At the same time, cyberspace contains abundant free land that

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> Cyberspace is the next frontier. Not space, not the undersea world, but cyberspace. Like the stylized world of the American wild West, cyberspace is a vast, unmeasured resource. Like the lands of the American frontier, it exists in an apparently trackless wilderness filled with unknown riches and opportunities, ungoverned and wild, available and unclaimed.

Lombardi, *supra* note 1, ¶ 6. Similarly, Paul Ashdown, a professor of journalism at the University of Tennessee, has noted:

> The Western space became outer space as we turned our attention from Gunsmoke and Bonanza to Star Trek and Star Wars. Ronald Reagan brought us briefly back to the Frontier in the 1980s but by then we had discovered cyberspace which was even better than virtual Dodge City or The Final Frontier somewhere west of the Cosmos.

Ashdown, supra note 1. See also Morriss, supra note 1; Barlow, Jack In, supra note 1.

51. *See* Kapor & Barlow, *supra* note 1, ¶ 6 (claiming that sovereignty over cyberspace is not well defined). *See also supra* notes 22-28 and accompanying text (describing the absence of the state from Turner's West).

52. *See, e.g.*, Catharine A. MacKinnon, *Vindication and Resistance: A Response to the Carnegie Mellon Study of Pornography in Cyberspace*, 83 GEO. L.J. 1959 (1995) (noting free availability of pornography in cyberspace and arguing that such availability harms women); Dianne Plunkett Latham, *Spam Remedies*, 27 WM. MITCHELL L. REV. 1649 (2001) (describing undesired mass e-mails called "spam" and advocating legislation to restrict its use); Scot M. Graydon, *Much Ado About Spam: Unsolicited Advertising, The Internet, and You*, 32 ST. MARY'S L.J. 77 (2000) (same); Kurt M. Saunders & Bruce Zucker, *Counteracting Identity Fraud in the Information Age: The Identity Theft and Assumption Deterrence Act*, 8 CORNELL J.L. & PUB. POL'Y 661 (1999) (exploring the problem of identity theft and the effect of legislation designed to combat the problem); Alfred C. Yen, *Internet Service Provider Liability for Subscriber Copyright Infringement, Enterprise Liability, and the First Amendment*, 88 GEO. L.J. 1833, 1834-35 (2000) (describing concern about copyright infringement on the Internet); Keller, *supra* note 2 (discussing gambling in cyberspace); Mary M. Calkins, *They Shoot Trojan Horses, Don't They? An Economic Analysis of Anti-Hacking Regulatory Models*, 89 GEO. L.J. 171 (2000) (describing and analyzing the problem of "hacking" as the unauthorized access of a computer).

53. In 1990, Mitch Kapor and John Perry Barlow, co-founders of the Electronic Frontier Foundation, wrote:

> In its present condition, Cyberspace is a frontier region, populated by the few hardy technologists who can tolerate the austerity of its savage computer interfaces, incompatible communications protocols, proprie-

bestows huge fortunes and social opportunities to those sufficiently brave and industrious to venture into its virtual wilderness.[54] Founders of new "dot-coms," venture capitalists, and even ordinary investors participate in an Internet gold rush that has gone through a cycle of boom and bust.[55] Others risk being stalked in order find love and friendship.[56] For them, the very technology that distributes pornography, pirated software, and junk e-mail also unites them with others previously separated by physical geography. They are pioneers who found diverse new communities in the wilderness of cyberspace.[57] Modern individuals who follow these Internet pioneers by logging on to the Internet therefore participate in the creation of a more prosperous and better society.

> tary barricades, cultural and legal ambiguities, and general lack of useful maps or metaphors.

Kapor & Barlow, *supra* note 1, ¶ 4. *See also* TURNER, FRONTIER IN AMERICAN HISTORY, *supra* note 27 (describing how settlers were forced to adapt to the harsh conditions of the West).

54. *See* Fitzgibbons, *supra* note 1, at *2 (characterizing cyberspace as a "land of opportunity"); Lastowka, *supra* note 2, at 855 ("Like the Old West, the Web combines a promise of territorial expansion and 'gold in the hills' with legends of a self-reliant and independent citizenry.").

55. *See* Janet Rae-Dupree, *Executives Rush the Net: Top Managers Give Up the Corner Office to Seek Their Fortunes in the Wild Web*, SAN JOSE MERCURY NEWS, Sept. 23, 1996, at 1E (reporting that executives are leaving traditional jobs for the Internet gold rush); Mike Allen, *Internet Prospectors Pan for Business Opportunities*, SAN DIEGO BUS. J., Dec. 6, 1999, at 17 (reporting comparison of frenzied purchase of Internet company stock to a gold rush); David Leonhardt, *M.B.A. Boom Fades as Candidates Seek Instead the Rewards of the Internet*, N.Y. TIMES, Nov. 28, 1999, §1 (Business/Financial Desk), at 40 (reporting on potential MBA students' "gold-rush mentality" about the Internet as seen by the Dean of the Dartmouth Tuck Business School). *See also* TURNER, *Problems of the West*, *supra* note 25, at 212 (characterizing the West as "another name for opportunity" with abundant resources—including mines—available to "the shrewdest and boldest").

56. *See* Amy C. Radosevich, *Thwarting the Stalker: Are Anti-Stalking Measures Keeping Pace with Today's Stalker?*, 2000 U. ILL. L. REV. 1371 (describing use of the Internet to stalk victims); RHEINGOLD, *supra* note 18, at 17-27 (discussing formation of community and friends on the Internet). *See also* SHERRY TURKLE, LIFE ON THE SCREEN: IDENTITY IN THE AGE OF THE INTERNET (1995).

57. *See* John Markoff, *Staking a Claim on The Virtual Frontier*, N.Y. TIMES, Jan. 2, 1994, § 4 (Week in Review Desk), at 5 (referring to "hardy bands of pioneers who staked out the first electronic communities"); Richard Sullivan, *All Fangled up in the Internet*, DALLAS MORNING NEWS, May 11, 1994, at 11C (describing Internet pioneers who have already founded "frontier communities"). *See also* TURNER, *Contributions of the West*, *supra* note 26, at 259 (referring to the founding of "free cities and free States" in the West).

C. The Western Frontier Metaphor and Legal Regulation of the Internet

The Western Frontier metaphor provides an inspiring account of the Internet, but this account does not offer neutral truth beyond debate. Instead, the Western Frontier metaphor operates as propaganda supporting minimal regulation of the Internet. This becomes clear upon a brief review of arguments for and against such minimal regulation.

At one end of the debate, some of those favoring minimal regulation[58] take the idea of cyberspace as a separate place so seriously that traditional government cannot effectively intrude.[59] For them, the absence of conventional geographical borders in cyberspace removes territory as a justification for sovereign jurisdiction.[60] Attempts by sovereign states to regulate the Internet must fail because the Internet's decentralized operation makes it impossible for any single state to control activity in cyberspace. This makes private ordering in cyberspace inevitable.[61]

More importantly, even if sovereign control of cyberspace could be established legally and practically, any such regime would be less desirable than private ordering because the Internet's inherent characteristics obviate the need for state regulation. In real space, state regulation is necessary because the physical limitations of real space force people to deal with those whom they would rather avoid. One cannot always choose or avoid

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58. For examples of arguments favoring this position, see David R. Johnson & David Post, *Law and Borders—The Rise of Law in Cyberspace*, 48 STAN. L. REV. 1367 (1996) [hereinafter Johnson & Post, *Law and Borders*]; David G. Post & David R. Johnson, *"Chaos Prevailing on Every Continent": Towards A New Theory of Decentralized Decision-Making in Complex Systems*, 73 CHI.-KENT L. REV. 1055 (1998) [hereinafter Post & Johnson, *Chaos Prevailing*]; David G. Post, *What Larry Doesn't Get: Code, Law and Liberty in Cyberspace*, 52 STAN. L. REV. 1439 (2000); Gibbons, *supra* note 1; Dawn C. Nunziato, *Exit, Voice, and Values on the Net*, 15 BERKELEY TECH. L.J. 753 (2000) (reviewing LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBERSPACE (1999)); Shipchandler, *supra* note 1. The most colorful statement of the libertarian position is John Perry Barlow's Declaration of the Independence of Cyberspace, *supra* note 7. *See also* BIEGEL, *supra* note 1, at 124 ("Commentators and in fact many companies continue to argue that self-regulation remains the most appropriate strategy . . .").

59. *See* Johnson & Post, *Law and Borders*, *supra* note 58, at 1379 ("Treating Cyberspace as a separate 'space' to which distinct laws apply should come naturally."); Gibbons, *supra* note 1, at 477 ("Cyberspace is a community of 71 million individuals which has so far relied on a distinct culture of shared norms and common values to control their behavior.").

60. *See* Johnson & Post, *Law and Borders*, *supra* note 58, at 1370-78.

61. *See id.* at 1372-73 (describing how sovereign attempts to regulate the Internet will fail); Gibbons, *supra* note 1, at 509 ("[T]he infrastructure of cyberspace is evolving too rapidly for governments to regulate efficiently.").

one's neighbors, and sometimes it is just too much trouble to shop at a store distant from one's home, even if the distant store offers better prices and service. These circumstances sometimes give rise to disputes that could, in theory, be resolved privately. However, experience has shown that state intervention is appropriate and helpful because state power forces individuals to stop antisocial behavior that others cannot avoid.[62]

Cyberspace, however, does not suffer from the physical problems of real space. Individuals in cyberspace can visit an infinite number of people and places because everyone is simply a few mouse clicks away. Thus, state intervention is not required in cyberspace because the natural characteristics of cyberspace allow individuals to avoid or discipline undesirable behavior more effectively than they can in real space. Bothersome people create less trouble in cyberspace because it is easier to avoid particular web sites than malodorous litter on the lawn at next door. No Internet business can treat its customers poorly because cyberspace makes it easy for them to escape. A few clicks of the mouse allow them to leave for a different business that offers better treatment.[63] Individuals will discipline those who behave inappropriately by moving, or threatening to move, within this virtual frontier, over time leading to an Internet free of undesirable behavior. In the strong version of this argument, this pattern of behavior creates a form of political utopia where all government takes place by the explicit consent of the governed because all Internet users will be able to associate with privately created Internet sites that embody their preferred political values.[64]

On the other hand, those who favor more robust legal regulation of the Internet[65] do not trust the "natural" characteristics of cyberspace to obviate

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62. *Cf.* ROBERT NOZICK, ANARCHY, STATE, AND UTOPIA ix (1974) ("Our main conclusions about the state are that a minimal state, limited to the narrow functions of protection against force, theft, fraud, enforcement of contracts, and so on, is justified . . .").

63. *See* Johnson & Post, *Law and Borders*, *supra* note 58, at 1398 (discussing ease of exit in cyberspace). *See also* Nunziato, *supra* note 58. For an interesting analysis of the Internet's facilitation of exit and its effect on the global economy, see Dan L. Burk, *Virtual Exit in the Global Information Economy*, 73 CHI.-KENT L. REV. 943 (1998).

64. *See* Johnson & Post, *Law and Borders*, *supra* note 58, at 1398 (discussing how ease of movement in cyberspace leads to government by true consent).

65. *See* LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBERSPACE (1999); ANDREW L. SHAPIRO, THE CONTROL REVOLUTION: HOW THE INTERNET IS PUTTING PEOPLE IN CHARGE AND CHANGING THE WORLD WE KNOW (1999); James Boyle, *Foucault in Cyberspace: Surveillance, Sovereignty and Hardwired Censors*, 66 U. CIN. L. REV. 177 (1997); Julie E. Cohen, *Lochner in Cyberspace: The New Economic Orthodoxy of "Rights Management"*, 97 MICH. L. REV. 462 (1998) (arguing against a laissez-faire policy towards the private contractual delineation of intellectual property rights); Jerry Kang, *Cyber-Race*, 113 HARV. L. REV. 1130 (2000); Keller, *supra* note 2 (advocating regulation

the need for traditional government. They worry that an unregulated Internet could lead to the excessive concentration of power in private hands because the absence of regulation implies no restraint on the use of technology by the powerful for private advantage.[66] They recognize the argument that the nature of cyberspace guarantees easy escape from oppression, but they doubt that the Internet works as advertised.[67] Accordingly, they believe that the state appropriately intervenes to guide the Internet's development.[68]

A significant point of disagreement between the two sides of the debate is the claim that the "natural" characteristics of cyberspace blunt the dangers that could follow from the unregulated use of technology by powerful private parties. Awareness of this disagreement exposes the ideological operation of the Western Frontier metaphor. According to Turner, the Western Frontier ensured American freedom and prosperity precisely because resources were abundant and the state was absent.[69] The Western Frontier metaphor constructs the Internet the same way. The minimally regulated Internet offers freedom and prosperity because cyberspace has a lot of "land" and very few state-imposed laws.[70] In Turner's romanticized West, people who faced oppression could easily find freedom by moving further west. That freedom allowed self-sufficient individuals to succeed precisely because the absence of the state allowed them to create better lives and civic institutions on their own.[71] Internet users who feel oppressed can do the same thing by clicking a mouse.[72] In fact, an Internet user can find a place of his own more easily than a Western pioneer could because there are no physical distances to cross in cyberspace. Cyberspace is therefore an improved version of the American West where the state can only inhibit self-sufficient individuals from ensuring their own freedom and prosperity. Accordingly, it would be wise to apply minimal regulation

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of online gambling); Neil Weinstock Netanel, *Cyberspace Self-Governance: A Skeptical View from Liberal Democratic Theory*, 88 CAL. L. REV. 395 (2000); Paul M. Schwartz, *Privacy and Democracy in Cyberspace*, 52 VAND. L. REV. 1607 (1999) (advocating rules concerning privacy on the Internet).

66. *See* SHAPIRO, *supra* note 65, at 25-52; Boyle, *supra* note 65, at 196-201 (describing use of the Internet for surveillance and control); Schwartz, *supra* note 65, at 1620-40 (describing use of technology to gather personal information).

67. *See* Netanel, *supra* note 65, at 410-52;

68. *See* LESSIG, *supra* note 65, at 210-34; Netanel, *supra* note 65.

69. *See supra* notes 24-28 and accompanying text.

70. *See* Johnson & Post, *Law and Borders*, *supra* note 58, at 1395-96 (noting that it is easy for Internet users to create new "territory" in cyberspace by setting up new discussion groups); Morriss, *supra* note 1.

71. *See supra* notes 26-28 and accompanying text.

72. *See* Nunziato, *supra* note 58, at 753-54.

to the Internet.[73] Granted, this perspective would not necessarily rule out all Internet regulation, but it does create a basic presumption against regu-

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73. For laissez-faire arguments that draw support from the Western frontier, see Morriss, *supra* note 1 (arguing that the West provided opportunities because the government left it generally unregulated, and advocating a similar policy for the Internet); Post, *supra* note 6, at 543 (claiming that the settlement of the New World led to a rethinking of sovereign power and arguing that cyberspace will have the same effect); Shipchandler, *supra* note 1 (comparing the Internet to the "Wild West" and using the comparison to argue against regulation of the Internet).

It is worth noting that many of these arguments also draw support from modern confidence in unregulated markets. Modern welfare economics operates on the premise that unregulated behavior under "perfect market conditions" automatically leads to a socially optimal allocation of resources. *See* ROBERT COOTER & THOMAS ULEN, LAW AND ECONOMICS 38 (2d ed. 1997) (describing how general equilibrium under perfect conditions is socially optimal); HARVEY S. ROSEN, PUBLIC FINANCE 46 (4th ed. 1995) ("[A] competitive economy 'automatically' allocates resources efficiently, without any need for centralized direction . . ."). Perfect market conditions include the absence of transaction costs, the complete absence of monopoly, costless access to all relevant information, and the complete internalization of costs and benefits. COOTER & ULEN, *supra*, at 38-41 (identifying sources of market failure); ROSEN, *supra*, at 52-54. Unfortunately, perfect market conditions never exist. *See* ROSEN, *supra*, at 54. Government must therefore occasionally intervene in otherwise unregulated markets to correct problems raised by market imperfections, but only when the relevant imperfections are serious enough to block transactions that would otherwise have occurred under perfect conditions. *See* COOTER & ULEN, *supra*, at 79-93 (describing how government can lower transaction costs); Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089 (1972) (analyzing the use of property and liability rules in light of market imperfections); Alfred C. Yen, *A Preliminary Economic Analysis of* Napster*: Internet Technology, Copyright Liability, and the Possibility of Coasean Bargaining*, 26 U. DAYTON L. REV. 247, 258-60 (2001) (explaining market imperfection and occasional need for government intervention). Our society demonstrates its faith in unregulated markets by making the assumption that most market imperfections are not serious enough to warrant government intervention. We therefore leave most transactions unregulated despite the acknowledged existence of market imperfections.

It is possible to argue that the Internet brings society closer to perfect market conditions, and that government regulation of Internet is therefore relatively unnecessary. *See* Gibbons, *supra* note 1, at 529-30 (claiming that Internet technology reduces transaction costs); Post & Johnson, *Chaos Prevailing*, *supra* note 58, at 1087-89 (arguing that low transaction costs of exit on the Internet increase the likelihood that low levels of government regulation will increase social welfare). While the Internet may improve markets, the Internet surely does not perfect them. Even if the Internet significantly lowers certain transaction costs, it still does not eliminate barriers to entry, ensure complete access to relevant information, internalize all externalities, or eliminate monopolies. Accordingly, economics can be used to support the libertarian position on Internet regulation, but the issue is far from settled. *See* Mark A. Lemley, *The Law and Economics of Internet Norms*, 73 CHI.-KENT L. REV. 1257 (1998) (providing a skeptical analysis of the claim that private ordering on the Internet will be efficient).

lation beyond the recognition of basic property rights and the enforcement of contract.[74]

D. Evaluating the Western Frontier Metaphor

An evaluation of the Western Frontier metaphor begins by recognizing how its influence pushes other perspectives from view. The value of this influence depends on whether the metaphor's lessons are well-considered. If the metaphor rests on a reasonable account of history, its lessons gain credibility because that account offers a real example of how abundant land and the state's absence once led to the success of self-reliant individuals and the creation of a better society. It is at least plausible to claim that history will repeat itself in cyberspace. However, if the metaphor's account of history is inaccurate, then the metaphor misleads because it forecasts a quasi-utopian future in cyberspace on the basis of a history that never existed. The claim that the Internet's abundant "land" and minimal regulation will lead to a better society becomes a theory without historical antecedent. Indeed, there would be reason to believe that the Western Frontier metaphor hides a more accurate and complicated history of the West that society might not want to repeat in cyberspace. Society could then find itself unhappy with policies that are heavily influenced by the existing Western Frontier metaphor.

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74. Indeed, Turner himself recognized the role of law in realizing the promise of the West. For example, the Homestead Act made western migration possible for many who otherwise would not have made the trip by guaranteeing settlers legal title to land they occupied. *See* FREDERICK JACKSON TURNER, Pioneer Ideals and the State University, Commencement Address at the University of Indiana (1910), *in* TURNER, FRONTIER IN AMERICAN HISTORY 276. However, he also believed that Americans influenced by the frontier could tolerate legal regulation only in limited amounts:

> In brief, the defenses of the pioneer democrat began to shift from free land to legislation, from the ideal of individualism to the ideal of social control through regulation by law. He had no sympathy with a radical reconstruction of society by the revolution of socialism; even his alliances with the movement of organized labor, which paralleled that of organized capital in the East, were only half-hearted.

Id. at 277. He also wrote:

> Legislation is taking the place of the free lands as the means of preserving the ideal of democracy. But at the same time it is endangering the other pioneer ideal of creative and competitive individualism. Both were essential and constituted what was best in America's contribution to history and to progress. Both must be preserved if the nation would be true to its past, and would fulfil[l] its highest destiny.

Frederick Jackson Turner, The West and American Ideals, Commencement Address, University of Washington (June 17, 1914), in Wash. Hist. Q., Oct. 1914, reprinted in Turner, The Frontier in American History 307.

It is therefore instructive to note that the Western Frontier metaphor's history is, at best, incomplete. As stories like *Shane* make clear, the operating image of the Western Frontier metaphor is a one where the virtuous prevail and evil is wiped out. Unfortunately, the West was not such place. Genocide, racism, and personal exploitation in the name of progress comprise a significant portion of Western Frontier history, but popular culture has cemented a romanticized version of the West that ignores or discounts this reality.[75]

This makes the Western Frontier metaphor problematic because it encourages ignorance of the very real possibility that the Internet will foster undesirable social developments. Internalization of the Western Frontier metaphor creates the belief that minimal legal regulation "naturally" works well for the Internet, when effective legal regulation might have prevented the myriad social problems of the actual Western Frontier.[76] This suggests that the Western Frontier metaphor could be improved by revising its history. If society's collective imagination could embrace the tragedies of the West as completely as its successes, the Western Frontier metaphor might give a fairly robust account of the potentials and pitfalls of cyberspace. However, these efforts alone will probably not be enough to correct the Western Frontier metaphor's misleading tug on Internet policy.

This difficulty arises because, as noted earlier, the history of the Western Frontier metaphor represents a fusion of popular culture and academic thought. Although academic criticism has already blunted the force of Turner's thesis among professional historians,[77] Turner's rosy perspective persists in popular culture because popular culture does not pay attention

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75. *See supra* Part III.A.

76. The problem identified here is similar to the one analyzed by Professor Julie Cohen in her article *Lochner in Cyberspace: The New Economic Orthodoxy of "Rights Management"*, *supra* note 65. In that article, Professor Cohen describes how "cybereconomists" have accepted as true a number of questionable premises about the economic efficiency of unregulated contracting and heavily defended property rights. Professor Cohen criticizes these premises as unconvincing, and describes how they function as "just-so stories" that make certain highly contestable policy choices—particularly a laissez-faire attitude towards the private delineation of intellectual property rights—seem natural and inevitable. *See id.* at 463-66.

The point being made by this Article is that our cultural acceptance of Turner's romanticized frontier thesis and its application to the Internet function the same way. We come to believe that the West really was the place where laissez-faire policies created a free and prosperous society when the truth of that claim is highly contestable. Once we believe this, we are well down the road to constructing the Internet in the image of the romanticized West and applying laissez-faire regulatory policies to it.

77. *See supra* notes 46-47 and accompanying text.

to the criticism. Unlike serious historians, moviemakers can ignore the accusation that their movies do not accurately depict the West. They can claim, appropriately, that movies are fictional entertainment, and their success is measured not by fidelity to historical fact but instead by their popularity with audiences. They cannot help it if audiences prefer optimistic depictions of the West, nor can they be held responsible if audiences internalize fictional portrayals of the West as true.[78]

Perhaps more importantly, there is real doubt about whether people—particularly Americans—could successfully accept a chastened view of the Western Frontier even if popular culture began broadcasting one.[79] Turner's frontier thesis swept the country in part because it offered an uplifting story that explained the existence and triumph of distinctly American virtues. That story has now become part and parcel of an American history that generally minimizes America's less admirable moments. It is, in fact, a central component of how Americans construct and identify themselves. A chastened view of the Western Frontier will always face marginalization because its acceptance would challenge the very essence of American identity.[80]

The difficulties of reforming the Western Frontier metaphor suggest that the metaphor itself needs to be dislodged from its prominence. Continued application of the unreformed metaphor creates an incomplete and misleading influence on policy and crowds out other metaphors that offer alternate perspectives on the Internet. Minimal regulation of the Internet might then pass from one of many possible strategies to an unquestionable

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78. Indeed, a moviemaker might claim that the primary consideration in producing any movie is economic profit, or ticket sales. People see movies to be entertained and feel good, so dark portrayals of the West would be financially risky. The possibility that we have literally been sold our rosy view of the West is a fascinating one that is beyond the scope of this Article.

79. Two movies that broadcast such a view were *Dances with Wolves* (Orion Pictures 1990), starring Kevin Costner, and *Little Big Man* (Paramount Pictures 1970), starring Dustin Hoffman. Despite their popularity and critical acclaim, neither movie has significantly changed the standard popular culture view of America's Western frontier.

80. Historian Donald Worster has captured well the difficulties Americans have when contemplating the Western frontier:

> Say the word "West" and, immediately, vistas of mustangs galloping across wide-open spaces under immense, unclouded skies fill our imaginations, and sober reason has to come panting after. Say the word and we are off living in a dream, experiencing its old powerful emotions but as ever finding it difficult to say how the dream ends. As a people, we are quick to invent fantasies but slower to find plausible, realistic endings for them.

WORSTER, *supra* note 46, at 79.

"truth" protected by an unchallenged Western Frontier ideology. We must therefore begin imagining the Internet from new perspectives that challenge the Western Frontier metaphor, and it is to this task that this Article now turns by offering feudal society as a metaphor for the Internet

IV. CYBERSPACE AND FEUDAL SOCIETY

A. Feudal Society

In Europe, feudalism[81] was a method of political and social organization that emerged from the natural and social conditions that prevailed during ninth and tenth century.[82] Constant invasion and local feuds had created social chaos that exacted a great toll on both the land and the population.[83] While order had to be restored, an individual monarch could not, as a practical matter, control large tracts of land by himself. Monarchs, therefore, had to find a way to delegate military and political responsibility to individuals who would remain loyal. Feudalism helped accomplish this.

The feudal state sprouted from a series of agreements between a king and his followers. The king, who claimed all of the country's land for himself, divided his land into parcels known as "fiefs" and granted them to his most loyal followers. In return, these "tenants-in-chief"[84] swore their loyalty to the king and promised to provide military service, money, prayer, or civil service.[85] The king and each tenant-in-chief formalized

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81. Any definition of feudalism has its shortcomings. First, no two societies practiced feudalism in exactly the same way. Second, feudalism evolved over its three centuries as the dominant form of political and social organization in Europe. Accordingly, historians have found it difficult to agree on a precise definition of feudalism. *See* Elizabeth Brown, *The Tyranny of a Construct: Feudalism and Historians of Medieval Europe*, 79 AM. HIST. REV. 1063 (1974). Nevertheless, it is possible to give a general account of feudal societies and some of their most important characteristics.

82. For descriptions and analyses of feudalism, see MARC BLOCH, FEUDAL SOCIETY (L. A. Manyon trans., 1961); JOSEPH R. STRAYER, FEUDALISM (1965); F. L. GANSHOF, FEUDALISM (Philip Grierson trans., 3rd Eng. ed. 1964); WALTER PHELPS HALL & ROBERT GREENHALGH ALBION, A HISTORY OF ENGLAND AND THE BRITISH EMPIRE (3d ed. 1953); DANIEL R. COQUILLETTE, THE ANGLO-AMERICAN LEGAL HERITAGE (1999); JOHN M. W. BEAN, THE DECLINE OF ENGLISH FEUDALISM 1215-1540 (1968); Richard J. Lazarus, *Debunking Environmental Feudalism: Promoting the Individual through the Collective Pursuit of Environmental Quality*, 77 IOWA L. REV. 1739 (1992).

83. See BLOCH, *supra* note 82, at 3-39; GANSHOF, *supra* note 82, at 3-4.

84. HALL & ALBION, *supra* note 82, at 66 (describing those who held fiefs directly from the king as "tenants-in-chief"); COQUILLETTE, *supra* note 82, at 96 (same).

85. HALL & ALBION, *supra* note 82, at 65-68 (describing the Norman-French practice of feudalism); COQUILLETTE, *supra* note 82, at 95-97 (describing imposition of feu-

their roles as "lord" and "vassal" in a ceremony of homage, during which the lord would accept the vassal's pledge of fealty.[86] Vassals who possessed fiefs could in turn subdivide their lands and become lords to vassals of their own. This process often continued through multiple layers of "mesne lords" who simultaneously acted as vassals to their superiors and lords to their inferiors.[87] Over time, this hierarchical pattern of grants became sufficiently complex to permit some vassals to swear allegiance to more than one lord at a time, although theoretically each vassal had sworn supreme allegiance to one lord over the others.[88]

Feudalism worked by allowing kings to capitalize on the abundance of land, which was important to the creation of wealth in medieval times.[89] Kings who granted fiefs did more than make their followers rich. They also ensured the loyalty of those to whom the king delegated the tasks of administering and defending the land. Possession of a fief entitled its holder to both occupy and exploit the land. Because their homes and prosperity depended on it, lords at every level of the system would administer and defend their lands to the best of their abilities. This close connection between an individual's private interest and his public responsibilities gave feudalism two of its most distinctive characteristics: the treatment of political authority as an incident of private property and the fragmentation of government.

First, the simultaneous transfer of private interests in land and political authority meant that private individuals often exercised significant amounts of state power as an incident of private property. Initially, lords did not always grant judicial, police and regulatory powers over fiefs and their inhabitants to vassals.[90] Over time, however, such delegation became

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dalism by William the Conqueror). The original obligation of service was military, but the practice of military service gradually deteriorated in favor of money because a lord's vassal would not necessarily be the best available warrior. Money payments were therefore preferred because they allowed the lord to establish his own private force of effective mercenaries. *See* STRAYER, *supra* note 82, at 51-53.

86. *See* GANSHOF, *supra* note 82, at 69-106 (describing various forms of vassalage, homage, and fealty); HALL & ALBION, *supra* note 82, at 66-67 (describing homage and fealty).

87. COQUILLETTE, *supra* note 82, at 97; HALL & ALBION, *supra* note 82, at 65-66.

88. *See* BLOCH, *supra* note 82, at 211-28 (discussing multiple vassalage); HALL & ALBION, *supra* note 82, at 66-67 (noting that vassals might hold land from more than one lord).

89. *See* HALL & ALBION, *supra* note 82, at 65 (referring to plentiful land held by European rulers).

90. *See* GANSHOF, *supra* note 82, at 156-67 (discussing varying degrees of unity between the granting of fiefs and the granting of political authority, police powers, and regulatory functions).

common as a matter of practical necessity.[91] Individuals accumulated power as a result of their land holdings, and not as the result of appointment to public office. Even in those cases where the right to administer state functions remained separate from possession of a fief, lords often granted those powers to other followers, thereby increasing the treatment of state power as a private possession.[92]

Second, the subdivision and transfer of fiefs to inferior vassals led to the fragmentation of government. The association of land with the right and authority to govern meant that lords gave away some of their power whenever they granted land to their vassals. Over time, this practice took significant power from the king and his tenants-in-chief and vested it in local lords who often administered justice over their subjects with relative impunity.[93]

While the above-described division of land and political authority provided the backbone of feudalism,[94] it was not the only way in which land was allocated and exploited because the roles of lord and vassal existed only among those who occupied feudal society's higher circles.[95] In order to recruit and maintain sources of labor necessary to make land productive, those holding fiefs relied on the manorial system.[96] The foundation for the manorial system was the economic relationship between fief holders as "lords of the manor" and the peasants or "serfs" who lived on the lord's land. The relationship between lord and serf superficially resembled

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91. STRAYER, *supra* note 82, at 36-42.

92. *See* GANSHOF, *supra* note 82, at 157.

93. *See* STRAYER, *supra* note 82, at 36-42 (describing fragmentation of government in feudal Europe and the practical independence of powerful lords); BLOCH, *supra* note 82, at 446 (listing fragmentation of authority as a key characteristic of European feudal society); GANSHOF, *supra* note 82, at xv (noting that feudalism was marked by "a dispersal of political authority amongst a hierarchy of persons who exercise in their own interest powers normally attributed to the state and which are often, in fact, derived from its break-up").

94. *See* JOSEPH R. STRAYER, MEDIEVAL STATECRAFT AND THE PERSPECTIVES OF HISTORY 63 (1971) ("Feudalism was a type of government in which political power was treated as a private possession and was divided among a large number of lords.").

95. HALL & ALBION, *supra* note 82, at 66 ("The donor of the fief was always the *lord*, and the recipient the *vassal*; but every man involved in this relationship belonged to the upper classes."); BLOCH, *supra* note 82, at 241 (describing relations of dependence other than vassalage existing in lower portions of feudal society); COQUILLETTE, *supra* note 82, at 98 (distinguishing free and unfree tenure).

96. *See* BLOCH, *supra* note 82, at 241 (describing the manorial system as the dominant form of social organization for lower classes in feudal society and the importance of the manorial system in generating wealth for lords); HALL & ALBION, *supra* note 82, at 69-70 (describing importance of the manorial system in generating wealth for upper classes of feudal society).

the one between lord and vassal. Like vassals, serfs received interests in land in exchange for service. However, the nature of the interest and service differed significantly from that of a vassal. A vassal held his fief as part of a relationship in which the king took an interest, while a serf held his interest as part of a relationship governed by the "custom of the manor."[97] Additionally, a vassal owed his lord only specified services, while a serf frequently owed his lord open-ended services.[98]

The intensely local nature of the relationship between serf and lord meant that the lord could and did exploit the serf for the lord's profit. Service to the lord meant that a serf spent most of his time tilling the lord's fields. Even when the serf found time to work his own land, the lord still took a portion of the serf's production and forced the serf to pay fees for mandatory use of the lord's mill, oven, and other facilities.[99] Moreover, serfs were "tied to the soil" and became the subjects of new lords if and when the manor changed hands.[100] This exploitation had limits, however. Abused serfs could and did escape to neighboring manors whose lords offered better treatment.[101] Even so, the life of a serf was one of exploitation and subjugation. Feudal society was clearly divided between its haves and have-nots.[102]

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97. *See* BLOCH, *supra* note 82, at 248 ("[T]he relations of the lord with the tenants were regulated only by 'the custom of the manor.'"); COQUILLETTE, *supra* note 82, at 98 (describing how the "unfree tenure" of serfs was protected only by the Lord of the Manor).

98. *See* COQUILLETTE, *supra* note 82, at 98 (describing how English serfs held land in return for "uncertain services").

99. *See* HALL & ALBION, *supra* note 82, at 70-71 (describing the exploitation of serfs); BLOCH, *supra* note 82, at 251 (describing the lord's monopolies); COQUILLETTE, *supra* note 82, at 98 (describing the exploitation of serfs).

100. *See* HALL & ALBION, *supra* note 82, at 69 (noting that serfs were "tied to the soil.").

101. As Marc Bloch wrote:

> Of course the lords sought to retain their peasants. What was the estate worth without labour to work it? But it was difficult to prevent desertions because, on the one hand, the fragmentation of authority was more than ever inimical to any effective police control and, on the other, the great abundance of virgin soil made it useless to threaten with confiscation a fugitive who was almost always certain of finding a new place for himself elsewhere.

BLOCH, *supra* note 82, at 263. *See also* COQUILLETTE, *supra* note 82, at 98 ("'Good' lords kept their serfs, while cruel lords saw their serfs 'disappear' to the lands of better masters, who would carefully fail to report their presence.").

102. *See* HALL & ALBION, *supra* note 82, at 69 ("The manorial relation, unlike the mutually advantageous political feudal relationship, was most unequal; for it gave almost everything to the lord and almost nothing to the peasant.").

B. Internet Governance

The development of the Feudal Society metaphor also requires a description of the Internet's governance. It is fashionable to say that no single entity could or should govern cyberspace because the Internet is too vast to submit to central authority. However, this statement is an exaggeration. While the Internet does have many users whose number and diversity sometimes render central control impracticable, some central coordination must exist so that computers attached to the Internet can share a common communications protocol.[103] The Internet therefore has always required a person, entity, or group to make decisions about basic technology that all computers on the network must use. The first such decision-makers were the scientists and engineers who developed the Internet on behalf of the United States government.[104] Over time, two private, nonprofit entities have taken over significant portions of this task and now provide limited oversight of Internet operations.

The first of these entities is the Internet Society ("ISOC"), a professional membership society whose members come from over 150 countries.[105] Today, the Internet Architecture Board ("IAB"), an advisory committee within ISOC, makes decisions about the standard technical architecture deployed on the Internet.[106] Although no sovereign's law mandates compliance with IAB standards, it would be impractical to connect a computer to the Internet without such compliance. The IAB's standards presently require implementation of a data communication protocol suite called TCP/IP (Transmission Control Protocol/Internet Protocol).[107] Any person can therefore—at least in theory—connect her computer to the Internet as long as that computer implements TCP/IP.[108]

The second of these entities is The Internet Corporation for Assigned Names and Numbers ("ICANN"), a nonprofit corporation recognized by a

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103. *See* GRALLA, *supra* note 15, at 2, 13 (describing how computers connected to the Internet communicate using the TCP/IP protocol suite).

104. *See* LEINER, ET AL., *supra* note 10.

105. *See id.*

106. *See* Internet Architectural Board, *IAB Overview*, *available at* http://www.iab.org/overview.html (last modified Nov. 3, 2000).

107. *See* GRALLA, *supra* note 15, at 13.

108. Similar decisions concerning the Internet application known as the World Wide Web are made by the World Wide Web Consortium ("W3C"), an organization comprised of 500 member organizations from around the world. *See* W3C, *About the World Wide Web Consortium*, *available at* http://www.w3.org/Consortium (last modified Nov. 16, 2002). The close relationship between the Internet and the World Wide Web means that those connecting to the Internet will likely also comply with technological specifications necessary to use the World Wide Web.

number of governments to administer the so-called Domain Name System ("DNS").[109] ICANN oversees the process and systems ensuring that each domain name maps to the correct IP address.[110] Information sent across the Internet finds its way to the proper computer because the receiving computer's IP address tells other computers where data packets should be sent.[111] In theory, Internet users could rely solely on numerical IP addresses to send e-mail and view web sites. However, the bland characteristics of numerical strings make them hard to remember. Using the TCP/IP protocol suite with the DNS solves this problem by allowing users to identify specific computers with ordinary words. ICANN administers and coordinates the DNS[112] by, among other things, maintaining servers that match domain names to fixed IP addresses,[113] accrediting domain name registrars,[114] and approving the establishment of new regional registries who distribute IP addresses.[115]

The DNS operates by establishing a hierarchy of Internet domains. The Top Level Domains ("TLDs") include the familiar .com, .edu, .org, .net, and .gov, as well as newly created ones like .biz and .info.[116] Various entities (generally private corporations) operate each of these domains by keeping a list that matches every domain name within the domain to its corresponding IP address. For example, VeriSign Global Registry Services currently manages the .com domain.[117] VeriSign owns and operates the

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109. *See* ICANN, *ICANN Fact Sheet*, *available at* http://www.icann.org/general/fact sheet.htm (last updated Feb. 17, 2001).

110. *See* InterNIC, *The Domain Name System: A Nontechnical Explanation—Why Universal Resolvability Is Important*, *available at* http://www.internic.net/faqs/ authoritative-dns.html (last updated Oct. 5, 2002) (discussing how IP addresses work with DNS).

111. *Id.*

112. *See id.* (describing the DNS and ICANN's administration of the DNS).

113. *See* ICANN, *ICANN Fact Sheet*, *supra* note 109 (setting forth ICANN's responsibilities).

114. *See* ICANN, *Registrar Accreditation: Overview*, *available at* http://www.icann.org/registrars/accreditation.htm (last updated June 19, 2001) (describing ICANN's accreditation of domain name registrars).

115. *See* ICANN, *ICP-2: Criteria for Establishment of New Regional Internet Registries*, *available at* http://www.icann.org/icp/icp-2.htm (last updated July 7, 2001) (setting forth ICANN's criteria for establishing new local Internet registries and describing their roles, including the allocation of IP addresses).

116. *See* Internet Assigned Numbers Authority, *Generic Top-Level Domains*, *available at* http://www.iana.org/gtld/gtld.htm (last updated Aug. 26 2002).

117. *See* Internet Assigned Numbers Authority, *Domain Name Services*, *available at* http://www.iana.org/domain-names.htm (last updated Nov. 7, 2002) (listing top level domains); Internet Assigned Numbers Authority, *Generic Top-Level Domains*, *available*

computer that authoritatively matches the IP address corresponding to aol.com, the domain associated with America Online. Thus, when a user enters aol.com into her web browser, her computer sends a request to the computer operated by VeriSign for the IP address associated with aol.com.[118] The VeriSign computer responds with the IP address, enabling the user's computer to communicate directly with the computer operated by America Online.

The TLDs occupy the uppermost level of the domain name hierarchy. Each TLD sits over other domains that govern domain names and IP addresses of their own. For example, a user accessing the University of Arizona James E. Rogers College of Law types "law.arizona.edu." This sends a request to Network Solutions, Inc., the operator of the TLD ".edu," which sits over the domain "arizona.edu" operated by the University of Arizona. Network Solutions effectively refers the user to the University of Arizona, which in turn operates a computer that matches an IP address with "law.arizona.edu." That computer will then give the IP address to the user, who can then communicate with the computer operated by or on behalf of the law school.[119]

The standards set up by ISOC and ICANN govern the connection of computers to the Internet and, by extension, the methods by which a person establishes an Internet presence. A person who wants to set up an Internet presence needs to accomplish two things. First, she connects to the Internet using a computer that implements TCP/IP. If she is an ISP or other large user of Internet resources, she could accomplish this by providing her own high-speed lines to become part of the Internet's backbone. If she desires only residential service, however, she will likely purchase the necessary connection from someone else and connect to the Internet near the bottom of its hierarchy of computers.

Second, she obtains an IP address and has it mapped to a domain name that will allow Internet users to communicate with her computer. Once again, she can choose to enter at various points in the Internet's hierarchy. If she desires her own name such as "SallyLawyer.com," she can register it with VeriSign or a registrar who does business with VeriSign. If she is content with a lesser domain name such as "SallyLawyer.LesserDomain.com," she can register that name with the operator

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at http://www.iana.org/gtld/gtld.htm (last updated Aug. 26, 2002) (listing existing and new top level domains and the registrars responsible for their operation).

118. As a technical matter, the request might also go to a different computer that simply copied information from the VeriSign computer. *See* InterNIC, *supra* note 110.

119. *See id.;* GRALLA, *supra* note 15, at 18-19, 33.

of the domain "LesserDomain.com."[120] Finally, she can simply "piggy-back" on a computer that already has a domain name. This would result in a URL like "LesserDomain.com/SallyLawyer.html" or an e-mail address like "SallyLawyer@LesserDomain.com."[121] Although all three of these methods are available to anyone who wants to use them, ordinary individuals generally use the latter method through a commercial ISP, while businesses and large institutions more frequently use one of the former methods.

C. The Feudal Character of Cyberspace

1. The Fragmentation and Privatization of State Power

The feudal character of cyberspace emerges from the hierarchical privatization of its government associated with the granting of Internet domains. In particular, ICANN is a private entity that controls a most precious commodity—cyberspace "land" in the form of domain names.[122] Like a feudal king, ICANN grants "cyberfiefs" to those who promise to pay money and abide by ICANN's rules in exchange for Internet domains.[123] Recipients of cyberfiefs need only comply with minimal technical standards such as TCP/IP before making their cyberfiefs operational. ICANN distributes these cyberfiefs in a manner reminiscent of the meth-

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120. *See* GRALLA, *supra* note 15, at 17.

121. *See id.* at 17, 169-71 (explaining e-mail addresses and URLs).

122. As a matter of theory, ISOC and ICANN function as technical standard setting bodies that merely facilitate coordination among various Internet users. This implies that ISOC and ICANN play only minor roles in larger questions of Internet policy. For example, ICANN's Fact Sheet states:

> As a technical coordinating body, ICANN's mandate is not to "run the Internet." Rather, it is to oversee the management of only those specific technical managerial and policy development tasks that require central coordination: the assignment of the Internet's unique name and number identifiers.

ICANN, *ICANN Fact Sheet*, *supra* note 109. In practice, however, the "technical" matters handled by ISOC and ICANN inevitably involve significant policy issues that push ISOC and ICANN towards the very role they disclaim. *See* Kesan & Shah, *supra* note 10, at 169-91; Joseph P. Liu, *Legitimacy and Authority in Internet Coordination: A Domain Name Case Study*, 74 IND. L.J. 587 (1999) (demonstrating how ostensibly "technical" decisions about domain names actually involve value choices usually resolved by government institutions).

123. It currently costs $35 to register a domain name in the .com TLD for one year. *See* VeriSign, Domain Name Registration Page, *available at* http://www.netsol.com/en_US/name-it (last visited Nov. 16, 2002). Those who register domain names also agree to, among other things, ICANN's Uniform Domain Name Dispute Resolution Policy, *at* www.icann.org/dndr/udrp/policy.htm (last updated May 17, 2002) (governing disputes about ownership of domain names).

ods used by feudal kings. As noted earlier, ICANN divides the available "cyberland" into TLDs such as .com, .edu, and .org. It then delegates the management of TLDs to TLD managers like VeriSign Global Registry Services. TLD managers then deal with various Internet domain name registrars, who in turn deal with general public.[124] This pattern of distribution makes TLD managers' status analogous to tenants-in-chief and domain name registrars' status analogous to mesne lords, and it effectively creates a class of "cyberlords" that includes TLD managers, registrars, ISPs, businesses, and others who obtain and exploit significant interests in "cyberland."

The hierarchical distribution of cyberfiefs means that, as in feudal society, every interest in cyberland is held from a superior computer operator who functions as lord over vassal or serf. This hierarchical distribution of cyberfiefs affects cyberspace in the same way that the granting of fiefs affected medieval Europe. State power becomes an incident of private property that gets fragmented through delegation to numerous private parties. This occurs because cyberlords generally delegate powers of government whenever they grant a cyberfief. Like feudal monarchs, they must do so because the Internet has become too unwieldy for any attempt to manage all aspects of its operation. New cyberlords therefore face very few restrictions on how they operate their computers. Cyberlords can post whatever content they like on their computers, permit or refuse communications from particular individuals and domains, limit the number of users their computers serve, or observe the behavior of users.[125] The political nature of these powers becomes even clearer upon examination of the role that cyberlords play in the ability of individuals to enter and experience cyberspace.

Ordinary individuals generally get Internet access by purchasing service from a commercial Internet Service Provider ("ISP") or employers who act as ISPs. The typical ISP is a cyberlord who sells access to the Internet through a computer or computers for which he has registered one or more domain names. Such an ISP typically provides the individual with a connection for the user's personal computer, an e-mail account, and hosting for the individual's web page on the ISP's Internet server. The ISP also takes complete control of the user's existence in cyberspace as soon as she logs on.

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124. *See supra* notes 112-118 and accompanying text.

125. *See* LESSIG, *supra* note 65, at 63-84 (discussing various "cyberspaces" and the characteristics chosen for them by their proprietors).

If the ISP chooses to do nothing, the user can employ whatever software she desires to experience cyberspace as she sees fit. She can view movie trailers, read about history, send e-mail, or "chat" with her friends. However, the ISP has the power and authority to alter this experience in whatever way it desires. For example, ISPs sometimes offer their users proprietary content such as news, stock quotes, or games. Like city planners, they can create meeting places, facilitate travel through cyberspace, and control the size of crowds.[126] ISPs can also keep their users from visiting certain parts of cyberspace, censor what they say and read, review their e-mail, monitor their behavior, and enforce codes of conduct. Moreover, an ISP can enforce its will because it controls the user's ability to enter cyberspace. An ISP can "sentence" users who defy its rules by denying access to certain materials, logging them off for specified amounts of time, deleting files kept on the ISP's server, or even terminating the user's account completely.[127] Moreover, it can do these things arbitrarily without providing notice, a hearing, or any other form of due process.[128] In "real space," the power to behave this way rests with the state. In cyberspace, however, it belongs to the cyberlord.[129]

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126. Perhaps the best example of this is America Online, which provides its users with special content, chat rooms, and Internet shortcuts not generally available to other Internet users. *See* LESSIG, *supra* note 65, at 66-71.

127. ISP user agreements that address these issues include Earthlink, Inc., *Earthlink Internet Service Agreement* [hereinafter *Earthlink Agreement*], *available at* http://www.earthlink.net/about/policies/dial/index.html (last modified March 7, 2000); NetZero, Inc., *NetZero Services and NetZero Site Terms and Conditions* [hereinafter *NetZero Terms and Conditions*], *available at* http://www.netzero.net/legal/serv_terms.html (last visited Nov. 16, 2002); America Online, Inc., *America Online Member Agreement*, § 7 [hereinafter *AOL Agreement*], *available at* http://legal.web.aol.com/aol/aolpol/memagree.html (last visited Nov. 16, 2002); AT&T, *AT&T Broadband Web Site Agreement* [hereinafter *AT&T Agreement*], *available at* http://www.attbroadband.com/services/other/TermsConditions.html (last visited Nov. 16, 2002). These agreements demonstrate that ISPs have the authority and technical power to perform the actions described. Such authority and power exist even in the absence of user agreements because existing law does not regulate the terms and conditions of Internet service.

128. *See* Rita Ferrandino, *Sweaty Scenes from the Life of an AOL Censor*, VILLAGE VOICE, Mar. 27, 2001, *available at* http://www.villagevoice.com/issues/0112/ferrandino.php (last visited Nov. 16, 2002) (describing activities of a person who enforced America Online's Terms of Service against the service's users). Some writers advocate the use of this power to have ISPs serve as Internet policemen. *See* Gibbons, *supra* note 1, at 523-34 (suggesting cooperation between ISPs for the purpose of enforcing standards of behavior in cyberspace as a desirable form of Internet self-regulation).

129. *See* LESSIG, *supra* note 65, at 24-42, 63-80 (describing how those in control of computers connected to the Internet can impose control on other Internet users); Joel R. Reidenberg, *Governing Networks and Rulemaking in Cyberspace*, 45 EMORY L.J. 911, 919 (1996) ("Networks themselves take on political characteristics as self-governing enti-

Almost every cyberlord exercises the same power as ISPs by dictating the experience of those who connect to his computer. In some cases, the appearance of the virtual state is clear because the cyberlord creates a virtual community that comes with a governing "constitution."[130] In other cases, the appearance of state power seems nonexistent because the site offers users a limited experience such as pure text or technical connection to the Internet's backbone. However, it is still the cyberlord's choice, and not her inability, to offer the limited experience. The private power to shape and control the user's experience still remains.

The hierarchical organization of domain names and computers gives the Internet a distinctly feudal form of government. Cyberlords exercise the power of states as an incident of private property. Additionally, the continuous granting of cyberfiefs and their subsequent division means that this power resides in the hands of numerous cyberlords. The Internet's government, like that of a feudal society, is highly fragmented.

2. *The Development of Cybermanors*

The modern cyberlord faces management problems similar to those confronted by feudal lords. A cyberlord who wishes to earn a fortune in cyberspace has to acquire a cyberfief, but possession of a cyberfief is not enough to ensure prosperity. Like the feudal lord, the cyberlord needs to attract and hold people to make his cyberfief economically productive. This happens at every level of the Internet's feudal hierarchy. At the top, large cyberlords who provide direct connection to the Internet's backbone

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ties."); Gibbons, *supra* note 1, at 493 ("Similar to feudal fiefdoms, each region, subregion, college, or corporation is responsible for policing its part of cyberspace."); Paul Schiff Berman, *Cyberspace and the State Action Debate: The Cultural Value of Applying Constitutional Norms to "Private" Regulation*, 71 U. COLO. L. REV. 1263 (2000) (recognizing the power acquired by private parties on the Internet and analyzing the possibility of applying constitutional norms to regulate them).

130. An example of such a community is Cybertown, a virtual community ostensibly "governed" by a constitution. *See* Cybertown, Inc., *Cybertown Constitution*, *available at* http://www.cybertown.com/info/about/details/constitution.html (last visited Aug. 16, 2002). A famous incident involving a virtual rape in LamdaMOO clearly illustrates the similarity between the problems of governing such a site and the problems of "real space" government. In a nutshell, LamdaMOO is a virtual community in which users create characters who "live" in that space. One of LamdaMOO's inhabitants, a "Mr. Bungle," used his status and power to control certain female characters for the purpose of forcing them to participate in nonconsensual sexual activity. Mr. Bungle's behavior presented the LamdaMOO community and its operators with the problem of figuring out what, if anything, to do about Mr. Bungle's behavior. In the end, Mr. Bungle's character disappeared from the system, permanently banished by those in control. *See* Julian Dibbell, *A Rape in Cyberspace*, VILLAGE VOICE, Dec. 21, 1993, *available at* http://www.levity.com/julian/bungle_vv.html; LESSIG, *supra* note 65, at 74-78 (discussing the LamdaMOO incident).

look for other cyberlords who can profitably utilize Internet bandwidth. At the bottom, cyberlords try to attract ordinary individuals to do the same, but it is at this level that the cyberlord's business turns to exploitation.

At first blush, one might think that cyberlords could profit only if they somehow get their users to pay for the privilege of communicating with the cyberlord's computer. This sometimes happens. For example, Internet users generally pay ISPs a fee in return for their Internet service. However, the cyberlord that limits herself to the collection of user fees is unlikely to maximize profits. Users in cyberspace are consumers in real space, and each of a cyberlord's users represents an opportunity to sell or advertise something. ISPs and other web site operators must therefore attract and retain as many users as they can while connecting their users' "cyberlives" to profits whenever possible.[131] A profit maximizing strategy starts with the realization that users experience cyberspace through their computers,[132] that the cyberlord controls what the computer displays, and that the users' attention, activities, and personal presence become resources that generate revenue for cyberlords.[133]

The most obvious way to accomplish this is displaying advertisements to the user, which many commercial ISPs and web site operators do.[134]

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131. A manual for such a management strategy is provided in the book NET GAIN by John Hagel III and Arthur G. Armstrong. The authors, who both work for McKinsey & Company, Inc., advocate the use of what they term "virtual communities" to gain competitive advantages in Internet commerce. Among other things, they stress the importance of attracting users to the site, tracking their usage patterns, and creating disincentives for switching to rivals. JOHN HAGEL III & ARTHUR G. ARMSTRONG, NET GAIN: EXPANDING MARKETS THROUGH VIRTUAL COMMUNITIES 131-49 (1997). *See also* JOHN HAGEL III & MARC SINGER, NET WORTH: SHAPING MARKETS WHEN CUSTOMERS MAKE THE RULES (1999) (describing the "infomediary" as a model by which a business can profit from collection of customer information on the Internet).

132. This includes the computer's screen, audio speakers, keyboard, and any other input or output device.

133. *See* Suein L. Hwang, *Ad Nauseum: Surfers Have Been Ignoring Online Marketing; So Advertisers are Trying Some Creative New Approaches*, WALL STREET J., Apr. 23, 2001, at R8 (describing the importance of more effective targeting of advertisements to internet users), *available at* 2001 WL-WSJ 2861169; F. T. McCarthy, *We Have Lift-Off*, ECONOMIST, Feb. 3, 2001, (Business Special) (discussing the monetization of a consumer's attention or "eyeballs"), *available at* 2001 WL 7317530; Erick Schonfeld, *How Much are Your Eyeballs Worth?*, FORTUNE, Feb. 21, 2000, at 197 (describing how Internet companies are valued by the number of customers they have), *available at* 2000 WL 3461698; Kara Swisher, *Boom Town: AOL Time Warner's New Message to Subscribers: Crazy for You*, WALL STREET J., May 14, 2001, at B1 (describing the importance of subscriber attention), *available at* 2000 WL-WSJ 2863296.

134. For example, America Online displays an advertisement to each subscriber immediately after she logs in. The subscriber must then respond whether she is interested in

The value of such behavior should not be underestimated. Some ISPs apparently forego user fees altogether in favor of raising revenue from advertisers willing to pay for the display of their ads on users' screens.[135] Indeed, an aggressive ISP can constantly bombard its users with ads by displaying them upon login, on e-mail screens and in web browser windows.[136] At the extreme, a user could not be present in cyberspace without the companionship of advertisements. However, ISPs and other web site operators must always be mindful that the overly intrusive use of advertisements may drive users away to competitors. If too many users leave, the value of the cyberlord's advertisement program will decrease, and profits will decrease.

The savvy cyberlord can increase the revenue raised from advertisements by diligently collecting information about his users. Sometimes this information is voluntarily disclosed in exchange for services. For example, ISPs sometimes offer to track a user's stocks or pay her bills online. This can provide valuable clues about a user's wealth. Additionally, users leave many clues about themselves as they move through cyberspace. Some visit web sites devoted to sports. Others go to virtual bookstores. Still others look for stock tips. Cyberlords who record this information can direct advertisements to targeted audiences.[137] They can put ads for golf clubs on the screens of sports buffs, links to bookstores on the screens of bookworms, and ads for brokerage services on the screens of investors. The narrow targeting of these ads makes them more valuable to advertisers, so

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the product before she can access her account. Advertisements continue to appear on practically every screen viewed by the user. Earthlink displays advertisements on web browser pages that ordinarily appear when the customer begins surfing the Internet. Yahoo!, Lycos, and Excite display advertisements on practically every page viewed by their users. *See* Yahoo!, Inc., *Yahoo!*, *available at* http://www.yahoo.com; Lycos, Inc., *Lycos Home Page*, *available at* http://www.lycos.com; Excite Network, Inc., *My Excite*, *available at* http://www.excite.com.

135. *See* Schonfeld, *supra* note 133 (describing how NetZero forgoes subscription fees in return for higher advertisement revenue).

136. For example, America Online users are rarely without the company of advertisements when online, particularly when they are in chatrooms or viewing America Online's proprietary content. *See, e.g.*, America Online, Inc., *Welcome to AOL Anywhere*, *available at* http://www.aol.com. *See also* Schonfeld, *supra* note 133 (describing NetZero's aggressive use of advertisements).

137. *See* Hwang, *supra* note 133 (noting how web sites use tracking technology to improve the value of advertisements on the Internet); Chip Bayers, *The Promise of One to One (A Love Story)*, WIRED, May 1998 (reporting that web sites gather information about Internet users for the purposes of advertising and sales), *available at* http://www.wired.com/wired/archive/6.05/one_to_one.html; Schonfeld, *supra* note 133 (stating that NetZero monitors every move of its subscribers on the Internet for the purpose of delivering targeted advertisements).

the cyberlord can charge more for their display.[138] If a cyberlord records what his users buy in cyberspace, he has an even better idea of what could be sold to his users and profit from that information as well.[139] A cyberlord could even charge a merchant a percentage of all sales made to users who are directed to the merchant's web site by the cyberlord.[140] Even if a cyberlord chooses not to use this information himself, he can still profit by selling it to someone who will.[141]

Cyberlords can also raise revenue by effectively managing the personal presence that their users establish in cyberspace. Any web site operator can easily give users space on a server for the display of the user's web page.[142] Users create these pages for a wide range of reasons. Sometimes the reasons seem whimsical, as when individuals display pictures of their pets.[143] At other times the reasons are quite serious, as when users

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138. *See* Schonfeld, *supra* note 133 (noting that NetZero's superior targeting of advertisements increases its revenues); McCarthy, *supra* note 133 (reporting that Yahoo! targeted ads by observing user behavior, and that such ads sell for 30-60 times as much as untargeted ads); Paul C. Judge, *Will Online Ads Ever Click?*, FAST COMPANY, Mar. 1, 2001, at 182 (discussing importance of targeting for advertisements and role played by gathering of information about customers in effective advertising), *available at* 2001 WL 2074101.

139. *See* HAGEL & ARMSTRONG, *supra* note 131, at 131-49 (detailing business strategy for vendors to use Internet sites to increase effectiveness of marketing and sales efforts, particularly through the gathering of information about users).

140. *See* Swisher, *supra* note 133 (reporting the statement of Bob Pittman, the then co-chief operating officer of AOL Time Warner, that future revenue will come from subscription fees, add-on products, and the ability to "rent the relationship" to others).

141. *See* Thomas E. Weber, *Network Solutions Sells Marketers its Web Database*, WALL ST. J., Feb. 16, 2001, at B1 (reporting that Network Solutions, the unit of VeriSign that operates significant portions of the DNS, is offering its database of individuals and business who have registered domain names), *available at* 2001 WL-WSJ 2854616; Nick Wingfield & Glenn R. Simpson, *With so Much Subscriber Data, AOL Walks a Cautious Line on Privacy*, WALL ST. J., Mar. 15, 2000, at B1 (reporting that AOL possesses a large amount of data that would generate huge revenue if sold), *available at* 2000 WL-WSJ 3021761. *See also* Chris Gaither, *Microsoft Poised to Lead .Net Shift*, BOSTON GLOBE, July 29, 2002, at C1 (describing how Microsoft plans to exploit new markets for Web services, particularly the hosting of software on servers, "to allow a much richer exchange of information between vast repositories of corporate or personal information"), *available at* 2002 WL 4140792.

142. Practically all commercial ISPs offer this service to their subscribers. Additionally, a number of web site operators offer free web page hosting on the Internet. *See* Yahoo!, Inc., *Yahoo! GeoCities*, *available at* http://geocities.yahoo.com/home (offering web page hosting); Lycos, Inc., *Tripod*, *available at* http://www.tripod.lycos.com (same).

143. *See, e.g.*, Orchid Fung, *Welcome to the World Wide Web's First Golden Retriever WebRing!*, *available at* http://www.geocities.com/Heartland/1763/goldring.html (last updated Feb. 10, 2002) (connecting multiple sites devoted to golden retriever dogs).

advertise or operate businesses of their own.[144] Either way, users put up web pages in hopes of attracting visitors. These visitors represent a second audience to whom ads can be shown. The cyberlord can view the user's web page, determine the audience likely to view the page, and target advertisements to that audience.[145]

Really astute cyberlords, however, can accomplish even more by turning their users' personalities into sources of revenue. Of all the things that attract and hold people in cyberspace, human interaction has proven highly effective. This can hardly be surprising. After all, in real space, people generally form their most powerful and long lasting relationships with other people. Thus, a clever cyberlord provides users the opportunity to chat or otherwise interact "real time" with fellow users in the hope that these users will develop cyberspace relationships. Cyberlords who control access to such users can sell that access. Indeed, the value of such access increases with the number of users available and the intensity of the personal relationships formed. An individual who "sees" a dear friend only in cyberspace will pay more to maintain that connection and will spend more time connected to the cyberlord's site. The increased time spent in cyberspace makes the individual more available for exposure to advertisements and other commercial opportunities controlled by the cyberlord. Moreover, the user's increased presence itself attracts more users who in turn increase the value of the access controlled by the cyberlord.[146]

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144. *See e.g.*, Lycos, Inc., *Tripod Small Business*, *available at* http://www.tripod.lycos.com/smallbiz/index.html (last visited Nov. 16, 2002) (offering information and software tools for users to create small Internet businesses).

145. *See, e.g.*, Black Stone Productions, *About Black Stone Equine*, *available at* http://black_stone_equine.tripod.com (last updated Nov. 13, 2002) (business web page with banner advertisements placed by the host service provider); *The Portable Bistro Home Page*, *available at* http://portablebistro.tripod.com (last visited Nov. 16, 2002) (business web page with a "pop up" advertisement from the host service provider).

The practice of placing advertisements on users' web pages is reminiscent of the manorial practice of requiring serfs to till the lord's fields along with their own. *See* HALL & ALBION, *supra* note 82, at 71. The Internet equivalent of a plot of land is a web page. By making his own "plot of land" more attractive and more valuable, the cyberserf makes the cyberlord's web site more valuable too.

146. *See* CARL SHAPIRO & HAL R. VARIAN, INFORMATION RULES: A STRATEGIC GUIDE TO THE NETWORK ECONOMY 174 (1999) ("Whether real or virtual, networks have a fundamental economic characteristic: the value of connecting to a network depends on the number of *other* people already connected to it."); LARRY DOWNES & CHUNKA MUI, UNLEASHING THE KILLER APP: DIGITAL STRATEGIES FOR MARKET DOMINANCE 23-28 (1998) (discussing network effects and the rapid increase of a network's value as the number of users increases); John M. Gallaugher & Yu-Ming Wang, *Network Effects and the Impact of Free Goods: An Analysis of the Web Server Market*, INT'L J. ELECTRONIC

America Online's proprietary chatrooms offer an excellent example of this. These chatrooms, which only AOL subscribers can access, are organized around themes of common interest. Many of these themes are chosen by the subscribers themselves, and many of the chatrooms have "regulars" who routinely spend a number of hours there every day talking to online friends while also gaining exposure to the ads placed in chatroom windows. Some of AOL's subscribers use the service specifically to gain access to these chatrooms and the friends found there.[147] AOL understands that the value of its "estate" increases as it attracts more subscribers to its chatrooms and has even recruited its users as "volunteers" who build these communities in exchange for various perks that have included reduced-fee access.[148]

The foregoing shows that cyberlords manage their cyberfiefs like feudal manors. Like feudal serfs, "cyberserfs" live "cyberlives" managed by their lord for the lord's financial gain. As such, the cyberserf becomes an asset owned by the cyberlord's business. Indeed, as the term "buying eyeballs" suggests, cyberlords sometimes acquire existing cyberfiefs because they deem the cyberserfs valuable.[149] Even when businesses are not being bought and sold, cyberlords remain keenly aware that their relationships with cyberserfs are valuable assets that can be "rented" to others.[150] This does not, however, mean that cyberlords routinely abuse their cyberserfs. Just like their medieval counterparts, cyberlords have to limit the exploitation of their cyberserfs because overexploitation will drive cyberserfs to join the cybermanors of his competitors.[151]

COM., Summer 1999, at 66, 68-69 (reviewing literature about network externalities), *available at* http://www2.bc.edu/~gallaugh/research/ijec99/ijec99.html.

147. *See* DOWNES & MUI, *supra* note 146, at 103 (1998) (describing the value of AOL's chatrooms).

148. *See* Lisa Margonelli, *Inside AOL's "Cyber-Sweatshop"*, WIRED MAG., Oct. 1999, *available at* http://www.wired.com/wired/archive/7.10/volunteers.html. Credit is owed to Hector Postigo for drawing this to the author's attention at the Association of Internet Researchers Conference in October 2001. *See also* Hector Postigo, Final Conference Paper (Oct. 2001) (unpublished manuscript, on file with author).

149. *See* DOWNES & MUI, *supra* note 146, at 102-04 ("The real value in a digital community comes from its participants."). *See also supra* note 133.

150. *See supra* note 140.

151. *See supra* note 101 and accompanying text (describing possible loss of serfs as a meaningful limitation on the degree of exploitation that feudal lords could practice). *See also* HAGEL & ARMSTRONG, *supra* note 131, at 146-49 (making the imposition of switching costs that make it hard for users to leave a particular Internet community a key component of Internet business strategy).

V. THE EFFECT OF THE FEUDAL SOCIETY METAPHOR

The Feudal Society metaphor challenges the Western Frontier metaphor by diverting attention from romanticized images of the West to the darker ones of feudal Europe. Like America's Western Frontier, medieval Europe had abundant land that governments found difficult to control. However, these conditions did not give rise to a happy European version of the Western Frontier experience. Instead, Europe endured three centuries of feudal rule that declined only as the evolving modern state expanded its regulation of otherwise private feudal arrangements.[152] The Feudal Society metaphor contradicts the idea that plentiful land and minimal government regulation ensure widespread freedom and prosperity. Indeed, the metaphor implies that such conditions support the fragmentation of political authority and the private exercise of political power. By doing so, the metaphor draws attention to the many instances where, as in medieval Europe, weak states created political vacuums ultimately filled by powerful individuals and clans who governed for private gain. These historical examples make it difficult to accept the Western Frontier metaphor's historical prediction of a glorious future in cyberspace. Rather than presume that things will work out simply because cyberspace resembles the romanticized Western Frontier, society must choose the kind of cyberspace that it will have.[153]

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152. *See* STRAYER, *supra* note 82, at 67 (associating the end of feudalism with the rise of the sovereign state); COQUILLETTE, *supra* note 82, at 107-13, 565-69 (describing the role of the statutes *Quia Emptores* and *De Donis* in the decline of feudalism, and discussing the change from feudal society to liberal society).

153. The disintegration of political order and the rise of private warlords in Afghanistan and Somalia offer grim reminders of what can happen, even in the 21st century, when a country has abundant land and minimal government. The transformation of 20th century countries into 21st century quasi-feudal territories is related to Roberto Unger's observation that societies continually cycle through periods characterized by social custom, positive rules built on custom, the rule of law (i.e. liberal society), and the decline of law (postliberal society). *See* ROBERTO M. UNGER, LAW IN MODERN SOCIETY: TOWARD A CRITICISM OF SOCIAL THEORY 238-42 (1976). Daniel Coquillette has taken Unger's ideas about cycling and inserted new terminology, thereby suggesting that societies naturally start with a tribal phase in which local custom prevails, then experience feudalism, develop into liberal states, and finally pass through a postliberal phase in which the rule of law fails. Societies in the postliberal phase eventually return to the tribal phase. *See* COQUILLETTE, *supra* note 82, at 565. Ideas like this predict the development of phenomena like cyberspace which weaken the state and its rule of law, leading society back to the tribal phase and once again to feudalism. Of course, it remains to be seen whether cyberspace will actually have this effect. However, the possibility of this seems undeniable. If society deems such a path undesirable, it should consider what steps might be taken now to prevent the predicted demise of liberal society.

Admittedly, one basis for rejecting this idea is that the institutions and practices emerging in cyberspace do not perfectly mirror those of feudal Europe. Armed retainers do not exist in cyberspace,[154] and cyberserfs do not face the same degree of subordination that medieval serfs endured.[155] However, metaphors may provide insight without perfectly describing the things they illuminate. The Western Frontier metaphor offers insight despite its imperfections. The Feudal Society metaphor does likewise by suggesting a very complicated future for the denizens of a cyberspace dominated by unregulated private ordering. Instead of being free and prosperous, these denizens may find themselves controlled and exploited by superiors in a technological hierarchy of power. In order to prevent this, a society should use the Feudal Society metaphor to find examples of

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154. *See* STRAYER, *supra* note 82, at 13 (including armed retainers in definition of feudalism); BLOCH, *supra* note 82, at 446 (noting the importance of the military in medieval feudalism). One could think of computer security experts as the Internet equivalent of armed retainers. Internet computer operators live with the constant threat of attacks in the form of viruses, worms, and hacks. Computer security experts write anti-virus programs and construct security systems to defend against these attacks, thereby providing services similar to those provided by feudal armed retainers. However, one should also keep in mind that computer security experts do not swear oaths of loyalty to their employers, so the similarity between modern computer security experts and feudal armed retainers is limited.

155. If one strictly limits the comparison to humans who lived as medieval serfs and the humans who become cyberserfs when they log on to the Internet, this statement is true. However, if a person's cyberspace identity has significance independent of any real space person, as suggested by at least one academic, things look different. *See* Curtis E. A. Karnow, *The Encrypted Self: Fleshing Out the Rights of Electronic Personalities*, 13 J. MARSHALL J. COMPUTER & INFO. L. 1 (1994). Although every cyberspace identity corresponds to a real space person, there are clearly cyberspace identities with no true real space counterpart because people deliberately assume cyberspace identities that are different from those they have in real space. For example, a person may choose to conceal his or her racial identity or gender. Others might reveal personal struggles with substance abuse or family history only in cyberspace because conversations about those issues cannot easily be linked to a real space life. Still others could fabricate entire personas for purposes of a cyberspace life. *See* Kang, *supra* note 65, at 1133-34 (recounting an Asian American man's experiences in cyberspace while under the identity of an African American man).

The existence of separate cyberspace identities means that those virtual people exist totally within the confines of cyberspace. As such, the exploitation they face in cyberspace is not necessarily offset by the mitigating circumstances of real space. When an ISP deletes certain cyberspace identities, no real space counterpart carries on. In cases like these, an ISP acquires a great deal of power over a cyberspace person because the ISP has the power and authority to terminate the user's account and by extension the cyberspace person's very existence. This degree of power seems relatively comparable to the power of feudal lords over serfs.

emerging feudal practices, and then focus on these problems and how they can be blunted by the application of law.

A. User Exit and Emerging Feudal Practices

ISP regulation is one example of how the Feudal Society metaphor might affect the application of law to cyberspace. As noted earlier, supporters of minimal Internet regulation often argue that easy exit in cyberspace gives users the power to avoid ISPs and others who treat them poorly. Cyberlords will ultimately fail in their efforts to exploit because exploited cyberserfs will surely leave. Accordingly, there is no good reason to regulate the operations of ISPs.[156]

The Feudal Society metaphor implies that this conclusion is a bit premature. While genuinely free exit would help control exploitative behavior in cyberspace, the Feudal Society metaphor suggests that cyberlords will try to defeat free exit by creating "sticky" relationships that increase the value of their cybermanors.[157] Cyberlords who exploit barriers to exit will not only profit from the increased number of cyberserfs that they control, but also from the willingness of those cyberserfs to tolerate more onerous conditions than those tolerated by cyberserfs who are truly free to leave. Indeed, as noted below, the decision to leave an ISP sometimes has sufficient costs to undercut an "exit cures everything" strategy to Internet policy. It therefore makes sense to consider passing laws that dismantle existing barriers to exit and prevent future creation of such barriers.

Consider first the exit options available to a casual Internet user, the kind who occasionally visits cyberspace to read about bicycle racing in Europe and get e-mail from one or two friends. Such a person would probably consider most ISPs fungible because they all would give her an e-mail account and allow her to read about bicycle racing. Leaving one ISP for another would therefore cost her very little, and she would theoretically be very prone to switching as long as the new ISP treats her better.

In practice, however, an ordinary Internet user cannot easily find a new ISP who offers a better deal. Despite the existence of many ISPs,[158] industry consolidation means that most users will encounter only a small number of ISPs who offer relatively similar packages.[159] Moreover, users

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156. *See supra* notes 63-64 and accompanying text.

157. *See supra* Part IV.C.2.

158. Gregg Keizer, *The Best and Worst ISPs*, PC WORLD, Nov. 1, 2000, at 148 (reporting that 7,400 ISPs exist), *available at* 2000 WL 9395596.

159. *See* Kathryn Balint, *The Ins and Outs of Choosing a Service Provider*, SAN DIEGO UNION-TRIB., June 13, 2000, at 6 (reporting that six ISPs—America Online, Mi-

considering a switch will have to scrutinize lengthy user and privacy policies that they will find difficult to understand because their casual use of the Internet makes them unfamiliar with the nuances of Internet service.[160] ISPs can add to these problems by imposing requirements for termination of an account. For example, ISPs sometimes refuse to accept e-mail terminations of an account. Instead, users must cancel by U.S. mail, registered mail, or telephone.[161] ISPs also use customer service representatives to talk canceling users out of their decisions.[162] These impediments may not seem terribly burdensome, but they are enough to exploit human inertia and indifference. As noted earlier, a casual user of the Internet has little at stake in her choice of ISPs. She is willing to move for a better deal, but her indifference makes it unlikely that another ISP can offer anything of great value. Consequently, small inconveniences and costs can slow the exit rate of casual users.

Barriers that affect whether serious Internet users will change ISPs are different than the ones described above. Not surprisingly, serious users are a cyberlord's most valuable cyberserfs. They see more ads and they are more likely to buy lots of merchandise. They spend more time creating attractive web pages that bring more users to the ISP's site. ISPs therefore have particular reason to hold on to serious users. However, as will be shown here, the circumstances that deter casual Internet users from switching have less effect on serious Internet users. Nevertheless, the feudal organization of the Internet helps ISPs hold on to these valuable cyberserfs.

Like casual users, serious Internet users are willing to switch ISPs if they can get a better deal from someone else. However, serious users approach their decisions differently because they are more likely to have made a commitment to a particular cyberspace identity. For example, seri-

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crosoft Network, EarthLink, CompuServe, AT&T WorldNet, and NetZero—account for nearly 75% of the nation's total online audience), *available at* 2000 WL 13970183.

160. For example, the NetZero user agreement and privacy policy occupy twelve single spaced pages, enough to deter many laypersons from thorough review.

161. *See AOL Agreement*, *supra* note 127, at § 7 (stating that cancellation must take place by telephone, fax or U.S. mail); *Earthlink Agreement*, *supra* note 127, at § 10 (same).

162. *See* Balint, *supra* note 159 (reporting that America Online customers find it difficult to terminate their subscriptions in part because of the sales pitch given upon attempts to cancel); Federal Trade Commission, *Juno Online Services Settles FTC Charges of Internet Service Advertisements* (May 15, 2001) (FTC News Release) (reporting consent agreement between FTC and Juno Online Services, Inc. concerning practices "that made it unreasonably difficult for some customers to cancel" service), 2001 WL 513200.

ous Internet users often have a web page on their ISP's server and many friends or business contacts who reach them by e-mail.

In one sense, it is easier for a serious Internet user to switch ISPs. His familiarity with the Internet increases the likelihood that he will receive accurate information about rival ISPs and understand the nuances of various user agreements. His intensity of Internet use means that he has more to gain or lose from a better deal, and this will make him more willing to fight his way through the obstacles that deter casual Internet users.

In another sense, however, it is much more difficult for a serious Internet user to switch ISPs and change communities in cyberspace. For example, a person who has developed a cyberspace identity loses it when he changes ISPs. E-mail addresses generally incorporate the ISP's domain name, as do the URLs of web pages.[163] These domain names belong to ISPs because ISPs have claimed ownership through the relevant TLD registry. Users who switch ISPs can therefore no longer use the names by which they are known and found in cyberspace.[164]

For casual users, loss of an e-mail address is no big deal because it is easy to give a new e-mail address to a short list of correspondents. By contrast, someone with hundreds or thousands of e-mail correspondents could easily lose touch with a number of them.[165] Most heavy e-mail users do not have the e-mail addresses of everyone who sends e-mail to them, so at the very least a certain percentage of those correspondents will find that the user has "disappeared."[166] Similar problems may arise when a web page is moved from one server to another. This does not mean that switching ISPs is an insurmountable problem for serious Internet users. Serious users can and do switch ISPs. However, it is clear that the decision to switch ISPs has costs for serious users, and these costs seem large enough to impede their exit rate.

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163. The web page's URL usually contains the ISP's domain name (i.e. www2.bc.edu/~yen), and an e-mail address ends with the ISP's domain (i.e. yen@bc.edu). *See* GRALLA, *supra* note 15, at 16, 144-45. 160-71.

164. *See* LESSIG, *supra* note 65, at 202 (describing how users have difficulty changing communities in cyberspace). An example of this if offered by an AOL volunteer who is reluctant to be publicly identified when speaking about AOL for fear of losing her AOL account and online identity. Margonelli, *supra* note 148.

165. *See* Lemley, *supra* note 73, at 1269 n.55 (noting that distribution of an e-mail address to numerous correspondents makes it harder to leave an ISP).

166. *See* David Coursey, *ISP Switch? Learn My Secrets for Holding on to Your E-mail*, ZDNet AnchorDesk (describing loss of e-mail addresses as a problem when switching ISPs and partial solutions for handling the problem), *available at* http://www.zdnet.com/anchordesk/stories/story/0,10738,2767997,00.html (June 4, 2001).

The Feudal Society metaphor shows that ISPs will try to create, maintain, and exploit barriers to user exit because those barriers increase the value of cyberfiefs.[167] If free user exit is to play a significant role in preventing the exploitation of individuals in cyberspace, it seems worthwhile to seriously consider using law to lower barriers to user exit. If an ISP's ownership of domain names, URLs, and e-mail addresses raise the costs of switching, the state could lower the relevant costs by requiring ISPs to automatically forward e-mails and redirect users looking for relocated web pages. It might even be appropriate to give users limited licenses to use domain names, URLs, and e-mail addresses after leaving an ISP. Additionally, if casual users find it difficult to determine whether their ISPs are offering good deals, a state could force ISPs to disclose basic information about service to users in standard formats that make comparison shopping easy.[168]

B. Contracts of Adhesion and Emerging Feudal Practices

Enforcement of adhesion contracts between cyberlords and cyberserfs is another example of how the Feudal Society metaphor might affect the application of law to cyberspace. Consider the standard agreement between an ISP and its subscriber. ISPs generally set the terms of these agreements on a "take it or leave it" basis, and they expressly permit ISPs to collect information about their users, enforce codes of conduct, change the agreement unilaterally, and terminate a user's account without notice.[169] When one applies the Feudal Society metaphor, these agreements bear some resemblance to feudal pledges of loyalty and fealty, and they

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167. Proponents of a laissez-faire approach may argue that sophisticated Internet users can easily avoid these problems by registering and administering their own Internet domains. It is true that users who register their own domain names can establish identities not owned by their ISPs. However, there are still problems with this as a panacea to the problem of cyberserfhood. First, it is unlikely that casual users will know enough about the Internet to register their own domains and configure the necessary technology. Second, by the time they become the serious users who are able to do this, they then must face the loss of their ISP-owned name. Again, the point is not that exit is impossible, but that significant obstacles to exit exist.

168. The federal government already imposes similar requirements on consumer mortgage lenders. 15 U.S.C. §§ 1601-1693 (2000) (regulating disclosure of finance charges and annual percentage rate); 12 U.S.C. §§ 2601-2617 (2000) (regulating disclosures about closing costs). Such disclosures help consumers choose among deals that might otherwise be impossible to compare.

169. *See Earthlink Agreement*, *supra* note 127 (containing terms granting the ISP broad rights to monitor and control the subscriber's Internet use); *NetZero Terms and Conditions*, *supra* note 127 (same); *AOL Agreement*, *supra* note 127 (same); *AT&T Agreement*, *supra* note 127 (same).

signal the cyberserf's acceptance of a cyberlife in service to the cyberlord.[170]

To what extent should contracts like these be enforced? As adhesion contracts, they vary from the ideals of contract law. The parties do not negotiate over the contract's terms. Additionally, the contracts are often presented at a time when the offeree is unlikely to review the terms of the deal. Finally, adhesion contracts are often lengthy documents that ordinary individuals may find difficult to understand. These problems indicate that adhesion contracts rarely embody the genuine assent of the offeree, and the likelihood exists that ISPs use their service agreements to impose conditions that the users neither agree to, know of, nor understand.[171]

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170. For example, the America Online Member Agreement and AT&T Broadband Agreement grant broad licenses to the ISP concerning the use of the subscriber's intellectual property. *See AOL Agreement*, *supra* note 127, § 3 (containing provision that the user grants AOL the "complete right to use, reproduce, modify, distribute, etc. the content in any form, anywhere."); *AT&T Agreement*, *supra* note 127, § 2 ("You agree to grant to AT&T Broadband a nonexclusive, royalty-free, worldwide, perpetual license, with the right to sublicense, to reproduce, distribute, transmit, create derivative works of, publicly display and publicly perform any materials and other information (including, without limitation, ideas contained therein for new or improved products and services) you submit to public areas of the Service (such as bulletin boards, forums and newsgroups) by all means and in any media now known or hereafter developed."). The NetZero subscriber agreement states that NetZero will collect information about where users go and "may" make that information available to third parties. *See NetZero Terms and Conditions*, *supra* note 127, § 1.0. A "cookie" is a text file that:

allows Web sites to recognize particular users on future visits, enabling Web sites to provide personalized information or to automate the log in process. On some sites, cookies are essential for navigation. Cookies were originally designed to be contained within a specific site; however, when set by an ad server . . . they can be read by any server in the ad company's domain, no matter what URL the browser is displaying or what site is on the screen. Thus, one company can collect information on a particular individual's activities on any number of sites.

Richard Raysman & Peter Brown, *Protecting Consumer Privacy: Are You Prepared?*, N.Y.L.J., Apr. 11, 2000, at 3, *reprinted in* Jane Kaufman Winn & James R. Wrathall, *Who Owns the Customer? The Emerging Law of Commercial Transactions in Electronic Customer Data*, 56 BUS. LAW. 213, 223 (2000). *See also* Jerry Kang, *Information Privacy in Cyberspace Transactions*, 50 STAN. L. REV. 1193, 1227-29 (1998) (describing use of cookies); Schwartz, *supra* note 65, at 1624-26 (same).

171. *See* Todd D. Rakoff, *Contracts of Adhesion: An Essay in Reconstruction*, 96 HARV. L. REV. 1174, 1179 (1983) (defining and analyzing contracts of adhesion); Saul Litvinoff, *Consent Revisited: Offer, Acceptance, Option, Right of First Refusal, and Contracts of Adhesion in the Revision of the Louisiana Law of Obligations*, 47 LA. L. REV. 699, 757-58 (1987) (describing problems of consent in adhesion contracts).

Despite these problems, courts generally enforce adhesion contracts in cyberspace.[172] However, courts leave open the possibility that particular provisions of adhesion contracts will be found unenforceable if those provisions are unconscionable or violate public policy.[173] Therefore, the viability of feudal practices in cyberspace depends in part on how courts perceive various contractual provisions.

The existing general enforcement of adhesion contracts in cyberspace is consistent with the Western Frontier metaphor's dominance. That metaphor constructs cyberspace as a place where exploitation of ordinary individuals is very unlikely—certainly less likely than in real space. Due to the improbability of exploitation, courts correctly refuse to invalidate or curtail the provisions of adhesion contracts between cyberlords and cyberserfs.

By contrast, the Feudal Society metaphor suggests that cyberspace does not automatically protect ordinary individuals from exploitation. Indeed, it suggests that such exploitation is spreading in cyberspace and that computer technology facilitates exploitative feudal practices. If society wants to prevent this, a sensible response would be to construct or inter-

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172. *See* Rakoff, *supra* note 171, at 1191-92 (discussing general enforceability of adhesion contracts). *See also* ProCD, Inc. v. Zeidenberg, 86 F.3d 1447 (7th Cir. 1996) (enforcing a so-called "shrinkwrap" license that accompanied a CD-ROM containing a database of telephone numbers); Hill v. Gateway 2000, Inc., 105 F.3d 1147 (7th Cir. 1997) (enforcing a software license that came with a personal computer); *In re* RealNetworks, Inc., No. 00 C 1366, 2000 U.S. Dist. LEXIS 6584, 2000 WL 631341 (N.D. Ill. May 8, 2000) (holding a "clickwrap" agreement valid and enforceable); Hotmail Corp. v. Van$ Money Pie, Inc., No. C98-20064, 1998 U.S. Dist. LEXIS 10729, at *16-17, 1998 WL 388389, at *6 (N.D. Cal. Apr. 16, 1998) (concluding that plaintiff had strong likelihood of success with respect to enforcing an online contract of adhesion). A recent case of interest is Specht v. Netscape Communications Corp., 150 F. Supp. 2d 585 (S.D.N.Y. 2001). The *Specht* court held that the mere act of downloading software over the Internet was not enough to bind users to a license. *Id*. at 595-96. At the same time, however, the court endorsed the general enforceability of adhesion contracts, including clickwrap agreements. *Id*. at 592. *Specht* indicates that ISPs can create enforceable agreements as long as they induce customers to specifically indicate assent to the terms of adhesion contracts. *See id*. at 595-96. The ease with which most users click "I accept" means that, as a matter of practice, ISPs and other Internet entities should have little trouble binding individuals to adhesion contracts on the Internet. For an interesting and thoughtful analysis of how adhesion contracts affect the use and availability of information on the Internet, see Michael J. Madison, *Legal-Ware: Contract and Copyright in the Digital Age*, 67 FORDHAM L. REV. 1025 (1998).

173. *See ProCD*, 86 F.3d at 1449 ("Shrinkwrap licenses are enforceable unless their terms are objectionable on grounds applicable to contracts in general (for example, if they violate a rule of positive law, or if they are unconscionable)."); *In re* RealNetworks, 2000 U.S. Dist. LEXIS 6584, at 14-21 (considering, but rejecting, claim of unconscionability).

pret contract law to prohibit or regulate contractual provisions that support feudalism in cyberspace. This does not necessarily mean that unilateral changes to agreements, limited remedies, choice of forum clauses, unlimited licenses of intellectual property from cyberserf to cyberlord, mandatory consent to data collection, or low limitations of liability could *never* be part of a contract between a cyberlord and cyberserf.[174] The Feudal Society metaphor merely tells us that the present routine acceptance of such provisions is probably unwarranted. In order to curb potentially exploitative methods, courts should therefore seriously consider scrutinizing the provisions of adhesion contracts in cyberspace more closely than they have in the past.

C. Intellectual Property and Emerging Feudal Practices

A third example of the Feudal Society metaphor's insight is its illumination of how intellectual property operates in cyberspace. Intellectual property is typically understood as law that encourages innovative and creative activity by reducing the likelihood of free riding.[175] However, the Feudal Society metaphor suggests that intellectual property also plays a role in the privatization of state functions and the ability of cyberlords to control cyberserfs.

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174. For examples of such provisions, see *AOL Agreement*, *supra* note 127 (unilateral changes in terms of service, limited remedies, choice of forum clauses, and broad intellectual property licenses); *AT&T Agreement*, *supra* note 127 (unilateral changes in terms of service, choice of forum clauses, and broad intellectual property licenses); and *NetZero Terms and Conditions*, *supra* note 127 (collection of personal information, limits on liability).

175. *See* U.S. CONST. art. I, § 8, cl. 8. (Congress shall have power "[t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Rights to their respective Writings and Discoveries . . . ."). Also see Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 429 (1984) in which the Court states that

[t]he monopoly privileges that Congress may authorize are neither unlimited nor primarily designed to provide a special private benefit. Rather, the limited grant is a means by which an important public purpose may be achieved. It is intended to motivate the creative activity of authors and inventors by the provision of a special reward, and to allow the public access to the products of their genius after the limited period of exclusive control has expired.

The Court in Mazer v. Stein, 347 U.S. 201, 219 (1954) stated:

[t]he economic philosophy behind the clause empowering Congress to grant patents and copyrights is the conviction that encouragement of individual effort by personal gain is the best way to advance public welfare through the talents of authors and inventors in 'Science and useful Arts.'

1. *The DMCA and Creation of Private Judiciaries*

Title II of the Digital Millennium Copyright Act ("DMCA")[176] provides an example of how intellectual property law can be constructed to encourage the development of private judiciaries. The DMCA addressed the question of whether ISPs could be held liable for copyright infringement committed by their users.[177] However, rather than clarifying the substantive law about such liability, the DMCA permits ISPs to avoid such liability as long as they assume the role of private courts that hear complaints of copyright infringement.

Among other things, ISPs who want to take advantage of the DMCA's safe harbor provisions must designate an agent to receive written complaints of copyright infringement committed by the ISPs users.[178] These complaints must follow a specified format. Once ISPs receive such formal complaints, they must "expeditiously" disable access to the alleged infringing material and notify the affected user of the complaint and the action taken.[179] The user then has the opportunity to respond with a denial of the initial allegation that requires the ISP to restore access to the material in question.[180] However, if the complainant continues to press the action by filing an action in court, the ISP must again disable access to the infringing material.[181] The DMCA generally protects ISPs who follow these procedures from liability for their users' infringements.[182]

The DMCA encourages ISPs to behave like courts of first resort in cases of copyright infringement on the Internet. Copyright plaintiffs file a statutorily prescribed complaint.[183] ISPs then investigate the allegation and, if the allegations seem plausible, essentially grant the plaintiff a temporary restraining order against the defendant by disabling access to the alleged infringing material.[184] Such action is probably enough to resolve many cases without resort to the public judicial system because defendants will often not contest the allegations made against them. In those cases where defendants choose to fight, the plaintiff can still enforce its virtual

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176. 17 U.S.C. § 512 (2002).

177. An extensive analysis of the relevant issues can be found in Alfred C. Yen, *Internet Service Provider Liability for Subscriber Copyright Infringement, Enterprise Liability, and the First Amendment*, 88 GEO. L. J. 1833 (2000).

178. 17 U.S.C. § 512(c)(2) (1998).

179. 17 U.S.C. § 512(c)(1)(C), (g)(2)(A).

180. 17 U.S.C. § 512(g)(2)(C), (3)(C).

181. 17 U.S.C. § 512(g)(2)(C).

182. 17 U.S.C. § 512(c); Yen, *supra* note 177, at 1881-85 (describing requirements of the DMCA).

183. 17 U.S.C. § 512(c)(3).

184. 17 U.S.C. § 512(c)(1)(C).

temporary restraining order by filing the appropriate action in a formal court of law.[185]

Although the above-described procedures might seem sensible, they are actually quite problematic. People who litigate disputes in public courts expect judges to have no self-interest in the outcome. Indeed, judges ordinarily recuse themselves in cases where their personal finances may be at stake. By contrast, ISPs have an obvious financial interest in the cases they are asked to hear because the DMCA prohibits liability against ISPs who remove material from the Internet in response to complaints from copyright holders.[186] This interest encourages ISPs to resolve initial doubts in favor of plaintiffs to the detriment of defendants. Additionally, these procedures benefit copyright plaintiffs since they can get more from private courts than they could get from public courts. The ease with which plaintiffs obtain virtual temporary restraining orders from ISPs stands in sharp contrast to what plaintiffs must do for real ones from public courts, where due process would otherwise require a hearing and posting of a bond.[187]

The private justice meted out by ISPs under the DMCA has the very shortcoming associated with feudal justice. Feudal lords or henchmen sitting in manorial courts would surely keep the lords' interest in mind when deciding cases,[188] and so it is with ISPs under the DMCA. By contrast, the end of feudalism is associated with the rise of the liberal state and the rule of law.[189] Modern liberal states expect formal disputes to be settled by judges who refer to legal rules without regard to their personal interest. Accordingly, the private justice mechanism created by the DMCA represents a step away from the liberal state back towards a feudal system of justice. It may therefore be desirable to curtail or eliminate intellectual property laws like the DMCA that encourage or require self-interested judicial behavior by private parties.

2. Intellectual Property Cases and the Control of Cyberserfs

The connection between intellectual property and the fight over cyberserfs can be seen in the three highly publicized cases of *A&M Records*,

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185. 17 U.S.C. § 512(g)(2)(C).

186. 17 U.S.C. § 512(c).

187. *See* Yen, *supra* note 177, at 1885-89 (analyzing the safe harbor provisions of the DMCA).

188. *See* BLOCH, *supra* note 82, at 359-60 (describing desire of lords to sit in judgment in part because it was in the lords' financial interest).

189. COQUILLETTE, *supra* note 82, at 565.

Inc. v. Napster, Inc.,[190] *Amazon.com, Inc. v. Barnesandnoble.com, Inc.*,[191] and *eBay, Inc. v. Bidder's Edge, Inc.*[192] In *Napster*, the defendant Napster, Inc. operated a directory service that facilitated the swapping of MP3 files over the Internet.[193] Napster users would use the Internet to log on to the Napster service and send a search request to Napster for a particular song or artist. Napster would respond with a list of all logged on Napster users who had the relevant files available for downloading. The user could then download the desired music directly from another user.[194] Napster proved extremely popular, attracting some 36 million users.[195] Many of these users committed copyright infringement.[196] However, a consortium of record companies and music publishers chose not to enforce their rights directly against Napster's users. Instead, they sued Napster for vicarious and contributory copyright infringement, alleging that Napster itself was liable for the misbehavior of its users.[197] The plaintiffs successfully obtained a preliminary injunction against Napster.[198] After settlement negotiations with the consortium collapsed, Napster sought to show the recording industry had engaged in copyright misuse.[199] Napster filed for bankruptcy in June 2002.[200] The case is ongoing.

The *Amazon.com* case involved a dispute over Amazon's patented "single-action" method for selling merchandise over the Internet.[201] It allowed customers to buy items with a single mouse-click and made use of the Amazon.com web page more convenient than competitors' pages that required multiple clicks for purchases.[202] The defendant Barnesandnoble.com adopted a similar method for taking orders without Amazon's

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190. 239 F.3d 1004 (9th Cir. 2001).
191. 239 F.3d 1343 (Fed. Cir. 2001).
192. 100 F. Supp. 2d 1058 (N.D. Cal. 2000).
193. *Napster*, 239 F.3d at 1011.
194. *Id.* at 1011-13.
195. *See* Andrew Morse, *Judging Napster*, INDUSTRY STANDARD, Oct. 27, 2000, *available at* http://www.thestandard.com/article/0,1902,19760,00.html.
196. *Napster*, 239 F.3d at 1013-14.
197. *Id.* at 1011.
198. *Id.* at 1027.
199. Dawn C. Chmielewski, *Judge Will Let Napster Probe Labels' Conduct*, SAN JOSE MERCURY-NEWS, Feb. 23, 2002, at 3, *available at* 2002 WL 14897580.
200. *What's News, Business and Finance*, WALL ST. J., June 4, 2002, at A1, *available at* 2002 WL-WSJ 3396602.
201. Amazon.com, Inc. v. Barnesandnoble.com, Inc., 239 F.3d 1343, 1347 (Fed. Cir. 2001).
202. *Id.* at 1347-50.

consent, and Amazon sued for patent infringement.[203] Amazon obtained a preliminary injunction,[204] but the Federal Circuit vacated the district court's order.[205] The case settled in March 2002.[206]

In *eBay*, the plaintiff eBay operated a popular web site that offered auctions for various items.[207] The defendant Bidder's Edge, Inc. ran a web site that allowed users to view prices on multiple auction sites, including eBay's, simultaneously.[208] This made it easier for users to comparison shop because it obviated the need to visit multiple sites.[209] Bidder's Edge obtained its information about eBay by using software robots that sent repeated requests for items and prices to eBay.[210] eBay objected to the defendant's practice, and sued, alleging causes of action in trespass, false advertising, trademark dilution, computer fraud and abuse, interference with prospective economic advantage, and unjust enrichment.[211] eBay succeeded in obtaining a preliminary injunction on a trespass claim against Bidder's Edge,[212] but the case has since been settled.[213]

Ordinarily, these cases would be viewed as three legally distinct intellectual property disputes whose parties happen to include Internet businesses. Intellectual property laws, such as copyright and patent laws, exist to provide incentives for the creation of socially valuable works and inventions.[214] Given the philosophy behind the granting of intellectual property rights, resolution of these cases therefore involves consideration of how property rights affect incentives for the creation of content distributed over the Internet, Internet business methods, and the maintenance of web sites. A court might find for the recording industry in *Napster* because doing so gives copyright holders incentives to create music and distribute it online. A court might hold Amazon's patent valid because it believes that such innovation would not occur without patent protection. eBay may

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203. Amazon.com, Inc. v. Barnesandnoble.com, Inc., 73 F. Supp. 2d 1228, 1231 (W.D. Wash. 1999), *vacated by* 239 F.3d 1343 (Fed. Cir. 2001).

204. *Id*. at 1249.

205. *Amazon.com*, 239 F.3d at 1366.

206. *Amazon Settles Suit Against Online Rival Over Buying Shortcut*, WALL ST. J., Mar. 8, 2002, B5, *available at* 2002 WL-WSJ 3388159.

207. eBay, Inc. v. Bidder's Edge, Inc., 100 F. Supp. 2d 1058, 1060 (N.D. Cal. 2000).

208. *Id*. at 1061-62.

209. *Id.* at 1062.

210. *Id.* at 1060-63.

211. *Id.* at 1063.

212. *Id.* at 1073.

213. *See* Greg Wiles, *eBay, Bidder's Edge Settle Suit on Web Trespassing, Copyright*, BLOOMBERG NEWS, Mar. 1, 2001, *available at* LEXIS, Bloomberg - All Bloomberg News.

214. *See supra* note 175.

have ultimately won because a court believed that such businesses could not be profitably maintained without a prohibition against the commercial use of information by others.

By contrast, the Feudal Society metaphor ties these cases together by drawing our attention to the common struggle for the control of cyberserfs. By using what the plaintiff claimed as intellectual property, each defendant was luring users away. The music industry wanted Napster users to visit the industry's web sites, Barnesandnoble.com shoppers were ones that Amazon.com thought it had "captured" by pioneering Internet book selling, and eBay wanted to keep Bidder's Edge users at the eBay site. Each plaintiff sued because it feared that the loss of cyberserfs would destroy its cybermanor. These observations show that a wide variety of intellectual property disputes may not really be about incentives for invention or creation, but about the allocation of power to control people who use the Internet. If that is so, the stakes in such cases have changed and we may need to rethink the desirability of strong intellectual property rights in cyberspace. It is one thing to decide cases about the control of economic rights related to innovation. It seems to be something quite different to decide cases about the right to control people in their travels through cyberspace. Perhaps some otherwise plausible claims of intellectual property should be limited in order to control undesirable, quasi-feudal practices.

II. CONCLUSION

This Article has shown the value of consciously developing alternate, complementary metaphors for cyberspace. The basic insight here is easily understood. If single metaphors necessarily miss valuable insights, an effective way to suggest the missing insights is the deployment of multiple metaphors with complementary insights.

INNOVATION VS. EVASION: CLARIFYING PATENT RIGHTS IN SECOND-GENERATION GENES AND PROTEINS

Antony L. Ryan[†] *and Roger G. Brooks*[‡]

ABSTRACT

"Protein engineering" enables molecular biologists to create modified proteins with properties different from those found in nature. These "second generation" proteins present both promise and peril for the biotechnology industry. On the one hand, an increasing number of pharmaceutical products contain modified proteins, many with important clinical advantages. These innovative products should not be blocked by patents on the natural gene or protein. On the other hand, companies can now create modified proteins that behave no differently from the patented analogs in their competitors' products. This threatens to make gene and protein patents so easy to evade as to render them almost meaningless.

This Article examines the patent-law question posed by protein engineering: do patents on genes and proteins cover second-generation analogs? Gene and protein patents are usually construed narrowly enough that infringement is governed by the doctrine of equivalents. Unfortunately, the case law does not satisfactorily explain how to determine whether a modified gene or protein is equivalent to its natural analog.

In this Article, the authors propose using the "known interchangeability" test to analyze infringement by second-generation genes and proteins under the doctrine of equivalents. The known interchangeability test, unlike alternatives such as the function-way-result test, is an objective measure of the functional similarities or differences between the patented and accused products. The authors contend that the known interchangeability test therefore strikes the right balance between innovation and evasion.

I. INTRODUCTION

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The recent sequencing of the human genome has generated considerable debate over the patentability of naturally occurring human genes. The issue has received attention at the highest political levels,[1] and the United States Patent and Trademark Office (PTO) has reacted by issuing new guidelines for the review of patents on genes.[2] But the remarkable scientific accomplishment represented by the Human Genome Project is just the first step toward clinical application of that knowledge.

At the outset, medical breakthroughs will require the identification and characterization of the proteins expressed by human genes.[3] Going further, in some cases scientists will be able to create modified proteins with properties superior to those of their naturally occurring analogs. This process of "protein engineering" involves altering the nucleotide sequence of the gene so it expresses a protein with a different amino acid sequence, which in turn may alter the protein's properties.[4] Such "second generation" proteins are an important and growing segment of the biopharmaceutical market, and in some cases may yield important clinical advantages over their natural analogs.

The potential utility and value of these engineered proteins raises a question less visible than the patentability of human genes, but scarcely less important for the pharmaceutical industry: whether gene and protein patents, once issued, will cover variant genes and proteins that differ slightly in their nucleotide or amino acid sequence. On the one hand, such dominance would be undesirable if it impeded the development of clinically superior second-generation proteins. On the other hand, the increasing ease of protein engineering raises the spectre that all gene and protein patents could be easily evaded by making slight variations to the nucleotide or amino acid sequence. Thus, defining a clear and sensible boundary as to when a natural-sequence patent may dominate second-generation analogs will be critical to pharmaceutical companies' continuing ability to

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1. *See, e.g.*, Remarks on Completion of the First Survey of the Human Genome Project, 36 WEEKLY COMP. PRES. DOC. 1499 (July 3, 2000) (statement of President Clinton); *Gene Patents and Other Genomic Inventions: Hearing Before the Subcomm. on Courts and Intellectual Property of the House Comm. on the Judiciary*, 106th Cong. (2000).
2. *See* Utility Examination Guidelines, 66 Fed. Reg. 1092 (Jan. 5, 2001); Guidelines for Examination of Patent Applications Under the 35 U.S.C. 112, ¶ 1, "Written Description" Requirement, 66 Fed. Reg. 1099 (Jan. 5, 2001).
3. *See, e.g.*, Stanley Fields, *Proteomics in Genomeland*, 291 Science 1221 (2001); Carol Ezzell, *Beyond the Human Genome*, SCI. AM., July 2000, at 64; Andrew Pollack, *The Next Chapter in the Book of Life Is Written in the Proteins*, N.Y. TIMES, July 4, 2000, at F1.
4. For background on protein engineering, see Part II below.

invest in the development of recombinant DNA products. That boundary, however, is not yet clear.

The issue generally arises in two ways. First, the discoverer of a natural sequence may apply for a patent that encompasses analogs within its literal claim scope—either by claiming all genes or proteins with a certain structural similarity or by claiming sequences based on the protein's function. Once issued, such a broad patent can be challenged in infringement litigation for lack of enablement or written description. Second, the holder of a narrower patent to the natural sequence may claim that the second-generation gene or protein, although outside the literal claim scope, infringes the patent under the doctrine of equivalents. At present, it is unclear how courts will decide whether the two gene or protein sequences are equivalent.

The difficulties often created when radically new technology is forced into existing patent-law categories are here compounded by the fact that some of the underlying patent law doctrines have recently become unsettled. Earlier this year, in *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*,[5] the Supreme Court upheld the doctrine of equivalents by rejecting the Federal Circuit's expansive application of prosecution history estoppel, which threatened to preclude any finding of equivalence for most patents. More recently, in *Enzo Biochem, Inc. v. Gen-Probe Inc.*,[6] the Federal Circuit re-affirmed its precedent on the application of the written description doctrine to gene patents, but applied that precedent in a manner that renders uncertain when a person who discovers a gene may obtain claims to analog sequences.

In this article, we propose an analytical framework for determining whether variant nucleotide or amino acid sequences infringe patents covering their natural analogs. In Part II, we review briefly the background principles of protein engineering and patent law. In Part III, we analyze the existing case law. The most significant precedent is *Genentech, Inc. v. Wellcome Foundation Ltd.*,[7] the only case in which the Federal Circuit has ruled on (and, in that case, rejected) a claim that a second-generation protein infringed a patent on a naturally occurring protein. Unfortunately, *Genentech* offers limited guidance to infringement analyses with different fact patterns.

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5. 535 U.S. 722 (2002).
6. 296 F.3d 1316 (Fed. Cir. 2002) (panel opinion on petition for rehearing). The opinions on denial of a petition for rehearing en banc can be found at 42 Fed. Appx. 439 (Fed. Cir. 2002).
7. 29 F.3d 1555, 1569 (Fed. Cir. 1994).

In Part IV, we attempt to reconcile the case law on the patentability of claims that encompass gene or protein sequences that the inventor never actually created. We suggest that the patentability of such claims depends on the state of knowledge concerning how changes to a nucleotide or amino acid sequence affect the function of the resulting protein. Given the present state of the art, we conclude that, in most cases, claims literally covering variant sequences are not patentable. As a result of this conclusion, we believe that some form of the doctrine of equivalents is necessary to provide meaningful protection to gene and protein patents. It is equally important, however, that the doctrine not extend too far and read on variant genes and proteins with substantially improved properties.

In Part V, we propose a framework for the doctrine of equivalents in the area of protein engineering. Unfortunately, the existing case law on the application of the doctrine of equivalents to gene or protein patents is analytically rough at best, providing poor tools for judges to resolve the hard cases to come, and making it impossible for lawyers to advise their clients of probable outcomes with any confidence. We identify one thread from the existing precedent—the "known interchangeability" test—that can and should be developed into a reasonably clear rule of discrimination.[8] We also discuss why some other approaches to equivalence found in the case law or in academic commentary can only create confusion if applied to gene and protein patents.

II. BACKGROUND

The properties of a protein are largely defined by the protein's amino acid sequence. The three-dimensional structure (or "conformation") of a protein determines its biological and chemical properties. And, with few qualifications, the amino acid sequence determines the specific three-dimensional structure into which the protein folds. Thus, "function is derived from three-dimensional structure, and three-dimensional structure is specified by the amino acid sequence."[9]

The amino acid sequence of a protein is in turn defined by the nucleotide sequence in the gene that codes for that protein. More than one nu-

8. *Cf.* Paul R. Michel, *The Role and Responsibility of Patent Attorneys in Improving the Doctrine of Equivalents*, 40 IDEA 123, 129 (2000) (urging that "the notion of 'known interchangeability' . . . be developed from a mere factor in a list of criteria to a true test").

9. HARVEY LODISH ET AL., MOLECULAR CELL BIOLOGY 51 (4th ed. 2000); *see also* BRUCE ALBERTS ET AL., MOLECULAR BIOLOGY OF THE CELL 111-13 (3d ed. 1994); THOMAS E. CREIGHTON, PROTEINS: STRUCTURES AND MOLECULAR PROPERTIES 31 (2d ed. 1993).

cleotide sequence can code for the same amino acid sequence, due to the redundancy of the genetic code, but a given nucleotide sequence is translated into a single amino acid sequence.[10]

In nature, individual organisms may have a gene with a nucleotide sequence slightly different from the normal gene for that species—a variation known as an "allele." Some such genetic variations are "silent"—that is, they result in no change to the amino acid sequence of the protein. Others result in amino acid changes, sometimes with no effect on the properties of the protein, but in other cases resulting in significant loss of biological activity. A number of serious, and even fatal, genetic diseases in humans are caused by the mutation of a single nucleotide.[11]

Since the early 1980s, researchers have had the ability to artificially modify genes. The 1993 Nobel Prize in Chemistry was awarded to Michael Smith for his invention of the technique of site-directed mutagenesis, the technique now commonly used to make targeted changes to the nucleotide sequence of a gene.[12] Such genetic mutations may, by design, result in changes to the amino acid sequence of the encoded protein, thus creating "muteins"—proteins not known to occur in nature. Protein engineering, the science of designing and creating muteins, is now an important area of research.[13]

At present, the capabilities of protein engineering are significantly limited because, while scientists can change a protein sequence with precision, they normally cannot know in advance the resulting effects (if any) on the biological and chemical properties of the protein. "It is presently not possible . . . to deduce reliably the three-dimensional folded structure of a protein from its amino acid sequence, and without knowing its detailed folded structure, it is not possible to understand the molecular basis of a protein's function."[14] Thus, most successful second-generation proteins are discovered by a process including trial and error.

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10. *See* ALBERTS ET AL., *supra* note 9, at 104-06.
11. For example, sickle-cell anemia is caused by the mutation of a single nucleotide of the beta-globin gene. LODISH ET AL., *supra* note 9, at 258-59.
12. Ivan Amato, *Chemistry: Changing the Landscape of the Possible*, 262 SCIENCE 507 (1993).
13. *See, e.g.*, PROTEIN ENGINEERING: PRINCIPLES AND PRACTICE (Jeffery L. Cleland & Charles S. Craik eds., 1996); PROTEIN ENGINEERING: A PRACTICAL APPROACH (Anthony R. Rees et al. eds., 1992).
14. ALBERTS ET AL., *supra* note 9, at 174; *see also* T.J. Graddis & D.L. Oxender, *An Introduction to Protein Engineering*, *in* CONCEPTS IN PROTEIN ENGINEERING AND DESIGN: AN INTRODUCTION 1, 12 (Paul Wrede & Gisbert Schneider eds., 1994) (stating that information about three-dimensional structure is considered "essential" to predict the effect of a contemplated amino acid substitution).

Despite this limitation, successful muteins have been developed. The first approved pharmaceutical product based on a mutein was Betaseron, a bacterially produced analog of human beta interferon differing from the natural sequence by only a single amino acid.[15] Mutein-based drugs now on the market include Eli Lilly's Humalog (an analog of human insulin), Genentech's TNKase (an analog of human tissue plasminogen activator) and Amgen's Infergen (an analog of human alpha interferon).[16] These pharmaceutical products now aid many thousands of patients each year, and produce annual sales in the hundreds of millions of dollars.

Predictably, owners of patents to the analogous natural-sequence genes or proteins have contended that the high-value mutein-based drugs are covered by their patents. In the first instance, patent-holders have asserted that analogous muteins literally infringe claims of their natural-sequence patents. In the United States, this approach has been a dead end. The Federal Circuit has construed gene or protein claims as limited to the precise sequence or sequences actually described in the patent.[17] Claims that expressly cover variant sequences not disclosed in the specification have generally been found invalid under the enablement and written description requirements.[18] Yet, in *Enzo Biochem, Inc. v. Gen-Probe Inc.*,[19] the Federal Circuit created some uncertainty in this area by remanding for factual

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15. The mutein was developed by David Mark, Leo Lin and Shi-Da Yu Lu at Cetus Corporation in the early 1980s. *See* U.S. Patent No. 4,588,585 (issued May 13, 1986). The pharmaceutical product containing this mutein was approved by the Food and Drug Administration (FDA) for the treatment of relapsing-remitting multiple sclerosis in 1993. *See* FDA Press Release, FDA Licenses Interferon Beta-1b (July 23, 1993), *available at* http://www.fda.gov/bbs/topics/new/new00424.html. Betaseron is manufactured by Chiron Corporation and sold by Berlex Laboratories.
16. *See* Humalog (Insulin lispro Injection) Prescribing Information (May 1, 2000), *available at* http://pi.lilly.com/humalog-prescribing.pdf; TNKase (Tenecteplase) Prescribing Information (June 2000), *available at* http://www.gene.com/gene/products/information/pdf/tnkase-prescribing.pdf; Infergen (Interferon alfacon-1) Prescribing Information (Nov. 30, 1998), *available at* http://208.254.60.143/md/pi/pi.htm.
17. *See* Schering Corp. v. Amgen Inc., 222 F.3d 1347, 1351-54 (Fed. Cir. 2000); Genentech, Inc. v. Wellcome Found. Ltd., 29 F.3d 1555, 1563-65 (Fed. Cir. 1994). European patent law has developed differently. *See* David E. Huizenga, Comment, *Protein Variants: A Study on the Differing Standards for Biotechnology Patents in the United States and Europe*, 13 EMORY INT'L L. REV. 629, 642-54 (1999).
18. *See* Regents of the University of California v. Eli Lilly & Co., 119 F.3d 1559 (Fed. Cir. 1997), *cert. denied*, 523 U.S. 1089 (1998); Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200 (Fed. Cir.), *cert. denied*, 502 U.S. 856 (1991).
19. 296 F.3d 1316 (Fed. Cir. 2002).

determination of whether the written description supported a claim covering specifically disclosed nucleotide sequences as well as mutated variants.[20] Nonetheless, it still appears that the principal recourse for the holder of a natural-sequence patent lies in the doctrine of equivalents, which holds that, even if a product does not literally satisfy all the elements of a claim, it may nevertheless infringe the claim if the product practices the claimed invention with only insubstantial variations.[21]

As a result, the doctrine of equivalents takes on special significance for gene and protein patents. That was made clear by the reaction to the Federal Circuit's *Festo* decision, which, until it was reversed by the Supreme Court, limited the number of cases in which the doctrine of equivalents could apply by expanding the scope of prosecution history estoppel.[22] In an amicus brief submitted to the Supreme Court urging the importance of the doctrine of equivalents, one biotechnology company declared that "[w]ithout a doctrine of equivalents, a gene patent would be valueless unless it claimed every equivalent sequence of nucleotides."[23] Similarly, Judge Michel warned that the Federal Circuit's *Festo* decision might "drastically limit the scope of protection for biotechnology patents."[24] In particular, Judge Michel expressed his concern that, to avoid a protein claim for which the doctrine of equivalents was unavailable, competitors "will only have to substitute at a particular location in the chain an interchangeable amino acid for the particular amino acid recited in the patent claim as occupying that location."[25]

III. CASE LAW

The doctrine of equivalents is especially important for biotechnology claims because an inventor cannot patent the biological function of a gene or protein based solely on the discovery of a single nucleotide or amino acid sequence with that function. This principle was first developed in cases involving the invalidity defenses of enablement and written descrip-

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20. *Id.* at 1327.
21. *See* Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 39-40 (1997); Graver Tank & Mfg. Co. v. Linde Air Prods. Co., 339 U.S. 605, 608 (1950).
22. Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 234 F.3d 558 (Fed. Cir. 2000) (en banc), *rev'd*, 535 U.S. 722 (2002).
23. Brief of Amicus Curiae Chiron Corp. in Support of Petitioner at 13, Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 535 U.S. 722 (2002) (No. 00-1543).
24. *Festo*, 234 F.3d at 617 (Michel, J., concurring in part and dissenting in part), *rev'd*, 535 U.S. 722 (2002).
25. *Id.*

tion. In *Amgen, Inc. v. Chugai Pharmaceutical Co.*,[26] the Federal Circuit held invalid for lack of enablement a claim to "a DNA sequence encoding a polypeptide having an amino acid sequence sufficiently duplicative of that of erythropoietin [EPO] to allow possession of [a particular] biological property."[27] Noting that "the number of claimed DNA encoding sequences that can produce an EPO-like product is potentially enormous," the court held that Amgen's disclosure in the patent specification of "[d]etails for preparing only a few EPO analog genes" provided "inadequate support for Amgen's desire to claim all EPO gene analogs."[28]

Similarly, in *Regents of the University of California v. Eli Lilly & Co.*,[29] the Federal Circuit held invalid for lack of written description a claim to a nucleotide sequence "having the structure of the reverse transcript of an mRNA of a vertebrate, which mRNA encodes insulin."[30] The University of California patent claimed all vertebrate insulin genes, even though the specification disclosed only the rat insulin gene. The court held that the specification did not provide an "adequate written description" and observed that a gene patent "requires a kind of specificity usually achieved by means of the recitation of the sequence of nucleotides that make up the cDNA."[31] Thus, claims to a functionally defined set of genes or proteins, unlimited by the structure of the specific nucleotide or amino acid sequences disclosed, are invalid.

A closely related situation arises when an inventor submits a patent claim covering the particular sequence disclosed in the specification as well as analogs. In *Enzo Biochem, Inc. v. Gen-Probe Inc.*,[32] the Enzo patent included a claim to a composition containing any of three nucleotide sequences deposited in a public repository, "discrete nucleotide subsequences thereof," or "mutated discrete nucleotide sequences" that met a particular hybridization test.[33] The Federal Circuit, on petition for rehearing, held that "reference in the specification to deposits of nucleotide sequences" satisfied the written description requirement, even though the specification did not set forth the actual sequence.[34] The court declined,

26. 927 F.2d 1200 (Fed. Cir.), *cert. denied*, 502 U.S. 856 (1991).
27. *Id.* at 1204 (Claim 7 of U.S. Patent No. 4,703,008 (issued Oct. 27, 1987)).
28. *Id.* at 1213.
29. 119 F.3d 1559 (Fed. Cir. 1997), *cert. denied*, 523 U.S. 1089 (1998).
30. *Id.* at 1563 (Claim 1 of U.S. Patent No. 4,652,525 (issued Mar. 24, 1987)).
31. *Id.* at 1568-69; *accord* Fiers v. Revel, 984 F.2d 1164, 1171 (Fed. Cir. 1993).
32. 296 F.3d 1316 (Fed. Cir. 2002).
33. *Id.* at 1326 (Claim 4 of U.S. Patent No. 4,900,659 (issued Feb. 13, 1990)).
34. *Id.* at 1326. The original panel opinion had held to the contrary. *See* Enzo Biochem, Inc. v. Gen-Probe Inc., 285 F.3d 1013 (Fed. Cir. 2002). For criticism of that opinion, see Harold C. Wegner, *An* Enzo *White Paper: A New Judicial*

however, to decide as a matter of law whether the written description supported Enzo's claim, which was directed not only to the deposited sequences, but also to mutations of those sequences. The court "regard[ed] that question as an issue of fact that is best resolved on remand."[35]

This aspect of *Enzo* may have limited repercussions. The opinion does not ultimately decide the question of written description in that case, and the court expressly noted that the related question of enablement had not been raised by the defendants.[36] Moreover, as we discuss in greater detail below, *Enzo* did not involve the relationship between amino acid structure and protein function.[37]

The leading Federal Circuit case addressing the doctrine of equivalents in connection with a gene or protein patent is *Genentech, Inc. v. Wellcome Foundation Ltd.*[38] Genentech sought to enforce its patents on the human tissue plasminogen activator protein (t-PA), and on the gene coding for that protein, against two competitors. A representative claim was to "[a] DNA isolate consisting essentially of a DNA sequence encoding human tissue plasminogen activator."[39] Defendant Wellcome made met-t-PA, a product that differed by a single amino acid from native human t-PA, apparently as a result of a cloning error. Defendant Genetics Institute made a product called FE1X, which lacked two of the five domains of the t-PA amino acid sequence and also had two specific amino acid substitutions. The district court construed the claims of the Genentech patents as limited to "the defined human t-PA or a naturally occurring allelic variation of human t-PA" and held that the defendants did not literally infringe.[40] The case was tried to a jury, which found that both defendants infringed the Genentech patents under the doctrine of equivalents, and the district court denied the defendants' motions for judgment notwithstanding the verdict.[41]

On appeal by Genetics Institute (Wellcome dropped its appeal), the Federal Circuit reversed. The court noted that "there are at least four possible definitions set forth in the specification" of the Genentech patents: a

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Standard for a Biotechnology "Written Description" Under 35 U.S.C. § 112, ¶ *1*, 1 J. MARSHALL REV. INTELL. PROP. L. 254 (2002).

35. *Enzo*, 296 F.3d at 1327.
36. *Id.* at 1327 n.2.
37. *See infra* Part IV.
38. 29 F.3d 1555 (Fed. Cir. 1994).
39. *Id.* at 1558 (Claim 1 of U.S. Patent No. 4,766,075 (issued Aug. 23, 1988)).
40. Genentech, Inc. v. Wellcome Found. Ltd., 14 U.S.P.Q.2d 1363, 1370 (D. Del. Mar. 8, 1990).
41. *See* Genentech, Inc. v. Wellcome Found. Ltd., 798 F. Supp. 213, 215-16 (D. Del. 1992).

"narrow structural definition" limited to the amino acid sequence of natural t-PA; two "broader structural definition[s]" requiring only particular regions known to be essential for biological activity; and finally a "functional definition" covering any protein with the characteristic biological activity of natural t-PA.[42] The court decided among these definitions by "avoid[ing] those definitions upon which the PTO could not reasonably have relied when it issued the patent."[43] Consistent with the enablement holding in *Amgen v. Chugai*,[44] the court held that the broader definitions were not enabled by the specification because those definitions covered "an infinite number of permutations of natural t-PA," and "[t]here is no basis provided in the specification for determining which of these permutations are operative and which are not."[45] Accordingly, the court construed the claim term "human tissue plasminogen activator" to mean "natural t-PA."[46]

Turning to the doctrine of equivalents, the Federal Circuit ruled that Genetics Institute's product, FE1X, was not equivalent as a matter of law. In applying the "function, way, result" test, the court acknowledged that it was "confronted with a problem: The issue of whether the 'way' or 'result' prongs are met is highly dependent on how broadly one defines the 'function' of human t-PA."[47] If the "function" were defined broadly enough, it would sweep in "any operative variant" of natural t-PA. In light of the specification and the prior art, however, the court ruled that the "function" of natural t-PA included "fibrin binding," a particular biological activity.[48] The court decided that the two proteins "possess dramatically different properties and structure," based on evidence that: (i) the "fibrin binding affinity of FE1X is less than half" that of natural t-PA; (ii) the "mode of binding" is different because FE1X compensates for the deletion of two domains of natural t-PA by a separate amino acid substitution; and (iii) FE1X "behaves significantly differently than human t-PA in the human body," notably in that it has a half-life about ten times as long.[49]

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42. Genentech, Inc. v. Wellcome Found. Ltd., 29 F.3d 1555, 1563-64 (Fed. Cir. 1994).
43. *Id.* at 1564.
44. 927 F.2d 1200, 1213 (Fed. Cir. 1991).
45. *Genentech v. Wellcome*, 29 F.3d at 1564. The court also suggested that the broader definitions might run afoul of the definiteness and written description requirements. *See id.* at 1565 n.25.
46. *Id.* at 1565.
47. *Id.* at 1567.
48. *Id.* at 1567-68.
49. *Id.* at 1568-69.

In a separate concurring opinion, Judge Lourie stated that he would not have relied on the "function, way, result" test, which he said "fail[s] to fully elucidate the issue, especially when the patented material is a chemical."[50] Instead, Judge Lourie would have relied on the facts that FE1X is structurally substantially different from natural t-PA in that it has 15% fewer amino acids, "has ten times the half-life of natural t-PA" and "was not copied, since the accused FE1X is a very different material, independently invented and developed."[51]

Since *Genentech v. Wellcome*, the Federal Circuit has decided only one other case involving whether a mutein infringes a claim to a natural protein. In *Schering Corp. v. Amgen Inc.*,[52] Schering sought to enforce a patent (issued to Biogen and exclusively licensed to Schering) on a "polypeptide of the IFN-α [alpha interferon] type" against Amgen's Infergen product, which is a "consensus interferon" with an amino acid sequence that is a rough average of the sequences of all the known alpha interferon sub-types. The district court construed the claim term "a polypeptide of the IFN-α type" as limited to the "single, naturally occurring" protein, "now referred to as IFN-α-1," described in the specification of Biogen's patent.[53] Schering decided not to proceed under the doctrine of equivalents and consented to having final judgment entered for Amgen.[54]

On appeal, the Federal Circuit affirmed the district court's claim construction, reasoning that "[b]ecause, at the time of the [patent] application, neither [the inventor] nor others skilled in the art knew of the existence of, let alone the identity of, the specific polypeptides now identified as subtypes of IFN-α, those subtypes cannot be within the scope of the claims."[55] Although the doctrine of equivalents was not before the Federal Circuit in *Schering*, the Federal Circuit's construction of the protein claim as limited to the specific amino acid sequence disclosed in the specification re-affirms the teachings of *Genentech v. Wellcome*.

Thus, the Federal Circuit has not yet held that a gene or protein analog infringes a claim on a specific nucleotide or amino acid sequence. It seems unlikely, however, that this is the final word. No Federal Circuit case has yet confronted an attempt to evade a gene patent with a silent nucleotide substitution. No Federal Circuit case has yet confronted a mutein that has biological properties practically indistinguishable from that of its natural

50. *Id.* at 1570 (Lourie, J., concurring).
51. *Id.*
52. 222 F.3d 1347 (Fed. Cir. 2000).
53. Schering Corp. v. Amgen Inc., 18 F. Supp. 2d 372, 393 (D. Del. 1998).
54. *See* Schering Corp. v. Amgen Inc., 35 F. Supp. 2d 375 (D. Del. 1999).
55. *Schering*, 222 F.3d at 1353-54.

analog—though it is probable that innumerable such "neutral muteins" could be derived from almost any protein. And of course, between the "practically indistinguishable" and the "dramatically different" lies a continuum of gradations. Almost certainly, courts will be confronted with these harder cases in the coming years.

Three cases that have not reached the Federal Circuit illustrate the range of factual scenarios that will arise. In the recent case, *Amgen, Inc. v. Hoechst Marion Roussel, Inc.*,[56] the district court held that the accused protein infringed Amgen's patent under the doctrine of equivalents even though it differed by one amino acid from the claimed sequence. Based on sequencing the human EPO gene, Amgen had obtained a patent on "the 166 amino acid sequence of human EPO shown in Fig. 6," without realizing that the amino acid at position 166 is cleaved off before the protein is secreted from the cell.[57] The defendants produced a protein with the identical amino acid sequence for the first 165 positions, but without the amino acid at position 166. The court found that the accused protein "has the same conformational structure and biological activity" as the claimed protein.[58] Although the defendants argued in the abstract that "a change in even just one amino acid can have a significant effect on the clinical function of a protein," they introduced no evidence that the amino acid at position 166 of human EPO had such an effect.[59] The court therefore held that the accused protein infringed under the doctrine of equivalents.[60]

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56. 126 F. Supp. 2d 69 (D. Mass. 2001), *appeal pending*, No. 01-1191 (Fed. Cir.). This case, generally known as *Amgen v. TKT*, has attracted considerable public interest. *See*, *e.g.*, Andrew Pollack, *Two Paths to the Same Protein*, N.Y. TIMES, Mar. 28, 2000, at C1.
57. *Amgen*, 126 F. Supp. 2d at 86.
58. *Id.* at 133.
59. *Id.* at 134.
60. The earlier case of *Hormone Research Foundation, Inc. v. Genentech, Inc.*, 708 F. Supp. 1096 (N.D. Cal. 1988), presented a related and interesting situation. As a result of sequencing errors in the course of an effort to sequence natural human growth hormone ("HGH"), a patent was obtained which literally recited the sequence of a mutein varying by four amino acids from natural HGH. This patent was asserted against Genentech's natural-sequence HGH product. The Federal Circuit rejected the argument that the claims should be construed to literally cover proteins with a sequence "similar" to that disclosed in the specification, but did so for reasons particular to the details of the prosecution history of the Hormone Research Foundation patent. Hormone Research Foundation, Inc. v. Genentech, Inc., 904 F.2d 1558 (Fed. Cir. 1990). The court remanded for trial on the issue of infringement under the doctrine of equivalents, and the case was subsequently settled.

A similar case is reportedly pending in the Patents Court in England, involving a U.S. patent. As described in an amicus brief submitted to the Supreme Court in *Festo*,[61] the licensee of an antibody protein patent (covering a sequence of 1320 amino acids) altered a single amino acid, allegedly with "no significant impact" on the protein's biological activity, and then asserted noninfringement and refused to pay royalties. This case highlights the potential for copyists to make amino acid substitutions solely to try to evade a patent on the natural sequence.

A fact situation with both important similarities and important differences was presented by *Hoffmann-La Roche Inc. v. Berlex Laboratories, Inc.*,[62] a case taken into private arbitration and settled without published opinion.[63] Roche sought to enforce a patent (issued to Genentech) on a composition claiming "a nonglycosylated polypeptide having the amino acid sequence of a mature human [beta] interferon."[64] The specification, and some of the claims, recited that 166-amino-acid sequence. Berlex sells a pharmaceutical product containing a beta interferon mutein, in which one of the 166 amino acids (the cysteine at position 17) is replaced by a different amino acid (a serine).[65] Roche claimed first that its patent should be construed to literally cover analog sequences in addition to the naturally occurring amino acid sequence, which would have meant that Berlex's mutein literally infringed. Berlex rejoined that the patent specification did not provide a written description of the innumerable potential analogs, nor did it enable a person skilled in the art to make a functional analog protein. The claim would therefore be invalid if it were that broad, and should instead be construed narrowly.

Roche further asserted that, even if the claim were construed as limited to the naturally occurring sequence, Berlex's mutein infringed under the doctrine of equivalents. Roche argued that the mutein was equivalent to the claimed protein because both exhibited anti-viral activity, the essential biological function of human beta interferon. Berlex countered that its mutein had properties substantially improved over those of the claimed protein. This contention was based on research showing that the amino

61. Brief of Amicus Curiae Celltech Group PLC in Support of Petitioner at 6, Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 535 U.S. 722 (2002) (No. 00-1543).
62. No. 96-3554 (D.N.J. filed July 25, 1996).
63. The authors, together with lead counsel Richard W. Clary, a partner of Cravath, Swaine & Moore, represented Berlex. The outcome of the arbitration is confidential.
64. U.S. Patent No. 5,460,811 (issued Oct. 24, 1995), Claim 1. The claim refers to "fibroblast interferon," now known as beta interferon.
65. This is the Betaseron product. S*ee supra* note 15.

acid substitution led to higher specific activity and greater stability, as compared to the claimed protein.[66] Berlex maintained that the improved properties of the mutein rendered it nonequivalent to the claimed protein.

IV. LITERAL COVERAGE OF UNTRIED SECOND-GENERATION GENES AND PROTEINS

There are two ways in which the holder of a patent on a naturally occurring gene or protein may argue that an engineered analog sequence infringes the patent literally. In Part IV.A, we discuss the construction of claims directed to protein function, and defend the Federal Circuit's holding that such claims are limited to the sequence described in the specification. In Part IV.B, we discuss the validity of claims expressly directed to variant sequences not described in the specification, and argue that claims involving prediction as to the functionality of the resulting mutein will usually be invalid.

A. The Construction of Claims Directed to Protein Function

The lesson from both *Genentech v. Wellcome* and *Schering* is that claims to a gene or protein, referred to by common name or function (such as "a DNA sequence encoding human tissue plasminogen activator" or "a polypeptide of the IFN-α type") rather than by sequence, will be construed as limited to the specific nucleotide or amino acid sequences disclosed in the specification.[67] This result is predicated on the lack of enablement for variant nucleotide or amino acid sequences that the inventor has not made or tested.[68]

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66. *See* David F. Mark et al., *Site-Specific Mutagenesis of the Human Fibroblast Interferon Gene*, 81 PROC. NAT'L ACAD. SCI. USA 5662 (1984). The claimed protein is non-glycosylated (*i.e.*, it lacks certain sugar side chains usually occurring on the naturally produced protein), and as a result does not exhibit the specific activity and stability of the natural (and glycosylated) human beta interferon protein as expressed in the human body. Apparently, in solution improper chemical bonds ("disulfide bonds") form between the non-glycosylated beta interferon protein molecules, causing the molecules to clump together and lose much of their bioactivity. The creators of Berlex's mutein solved this problem by replacing one of three cysteines in the natural amino acid sequence, a substitution which largely eliminated the formation of improper disulfide bonds. *See id.* at 5665-66.
67. *See* Schering Corp. v. Amgen Inc., 222 F.3d 1347, 1351-54 (Fed. Cir. 2000); Genentech, Inc. v. Wellcome Found. Ltd., 29 F.3d 1555, 1563-65 (Fed. Cir. 1994).
68. Thus, we see no need in this context to reach the interesting questions regarding the scope of the written description doctrine disputed by some judges on the Federal Circuit in *Enzo*. *See* Enzo Biochem, Inc. v. Gen-Probe Inc., 42 Fed.

That is a sound rule.[69] An inventor should not be entitled to a patent literally covering nucleotide or amino acid sequences not specifically described in the specification. Given the *a priori* unpredictability of the properties of novel proteins, claims to all sequences with a particular biological activity are not sufficiently described or enabled. For a medium-length protein, thousands of unique variants can be created, each differing from the natural sequence by only a single amino acid. Allowing just two amino acid substitutions already yields millions of alternative sequences.[70] Many of these variant proteins will be functionally indistinguishable from the natural-sequence protein, and most of the rest will be biologically inactive or unacceptable for clinical use due to side effects such as immunogenicity. But, in a few cases, currently unpredictable in advance, the amino acid substitution may result in an improvement. The astronomical number of potential combinations, however, means that disclosure of the natural sequence does not meaningfully enable the reader to identify or make any of those potential improved molecules. This counsels against permitting claims to a functionally defined set of genes or proteins.

A contrary rule would stifle innovation. A gene or protein patent with functional coverage would discourage others from seeking alternative natural or synthetic sequences with the same basic biological activity but improved properties. At the same time, the holder of a gene or protein patent has little incentive to develop an improved version of that gene or protein. Thus, if gene and protein patents dominated all variant nucleotide or amino acid sequences, no one would have an economic incentive to experiment with variants, and protein engineering would be forestalled for the length of the patent term.[71]

In theory the "reverse doctrine of equivalents" could provide some relief. For example, in *Scripps Clinic & Research Foundation v. Genentech,*

Appx. 439, 440 (Fed. Cir. 2002) (Lourie, J., concurring in denial of rehearing en banc); *id.* at 445 (Rader, J., dissenting from denial of rehearing en banc).

69. For criticism of the Federal Circuit's case law in this area, see Janice M. Mueller, *The Evolving Application of the Written Description Requirement to Biotechnological Inventions*, 13 BERKELEY TECH. L.J. 615, 639-99 (1998); Harris A. Pitlick, *The Mutation of the Description Requirement Gene*, 80 J. PAT. & TRADEMARK OFF. SOC'Y 209 (1998).

70. *See* Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1213 (Fed. Cir. 1991) .

71. We disagree with a commentator who argues that the incentive to invent "has little to offer" regarding "whether a patent on a recombinant protein should protect variations and improvements of that protein." Yusing Ko, Note, *An Economic Analysis of Biotechnology Patent Protection*, 102 YALE L.J. 777, 795 (1992).

Inc.,[72] the Federal Circuit held that defendant Genentech was entitled to a trial on whether its recombinant human Factor VIII:C, although literally covered by Scripps' patent on human Factor VIII:C, was so different in purity and specific activity that it avoided infringement under the "reverse doctrine of equivalents."[73] The doctrine, however, has so rarely been successfully invoked that it cannot provide enough comfort to justify major investment. Moreover, a defendant who invokes this doctrine would still face the burden of proving lack of infringement.[74]

Alternatively, one critic of the Federal Circuit's case law on enablement has proposed that a patentee be permitted "to claim all of the modifications that code for proteins with similar biological activity and that are substantially homologous to the native protein,"[75] except for "protein modifications which may be similar in structure yet superior in biological activity."[76] While we are sympathetic to this author's goal, his proposal does not accord with the law on enablement. The specification of a typical patent claiming a naturally occurring protein does not enable the creation of muteins with equivalent biological activity any more than it enables the creation of muteins with superior biological activity. Instead of tampering with the doctrine of enablement, we suggest that the best way to strike the necessary balance for gene and protein inventions is to limit the claims to a narrow literal claim scope but use the doctrine of equivalents to prevent infringers from avoiding the patents through insubstantial changes, as we discuss later.[77]

B. The Validity of Claims Directed to Variant Nucleotide or Amino Acid Sequences

A more difficult question is whether patent applicants can broaden the literal scope of their patent coverage by claiming variant nucleotide or

72. 927 F.2d 1565 (Fed. Cir. 1991).
73. *Id.* at 1581.
74. *See* 5A DONALD S. CHISUM, PATENTS § 18.04[4], at 18-392; § 18.04[4][d], at 18-400 (1998).
75. Kenneth G. Chahine, *Enabling DNA and Protein Composition Claims: Why Claiming Biological Equivalents Encourages Innovation*, 25 AIPLA Q.J. 333, 368 (1997).
76. *Id.* at 337.
77. Some commentators have criticized the Federal Circuit's case law on obviousness and enablement for making it relatively easy to obtain a gene or protein patent, but rendering those patents "extremely narrow, at least in literal scope." Dan L. Burk & Mark A. Lemley, Biotechnology's Uncertainty Principle 29 (Mar. 18, 2002 working paper), *available at* http://papers.ssrn.com. We agree with the premise, but believe that the doctrine of equivalents can solve the problem of claim scope.

amino acid sequences that the applicants have neither made nor tested.[78] A common approach for gene claims is to claim all nucleotide sequences that hybridize to the defined sequence.[79] That is the type of claim at issue in *Enzo*, where the claim encompassed the specifically disclosed sequences and "mutated" sequences within a particular "hybridization ratio."[80] Unfortunately, the *Enzo* court did not attempt to reconcile its disposition of the written description challenge to a hybridization-type gene claim with Federal Circuit case law invalidating gene or protein claims based on protein function.[81]

We suggest that the key to understanding this aspect of *Enzo* is that nucleic acid hybridization is much better understood than the structure/function relationship for proteins. The claims in *Enzo* were to a genetic probe and not, as in *Amgen* and *Eli Lilly*, a nucleotide sequence encoding a functional protein. The effects of changes in the nucleotide sequence on nucleic acid hybridization are easy to predict.[82] Thus, a specification can describe and enable hybridizing variants to a specifically disclosed nucleotide sequence. By contrast, scientists cannot predict *a priori* how a change in amino acid sequence will affect the function of the resulting protein.

More problematic than the claims in *Enzo*, then, are claims directed to variant amino acid sequences, or variant nucleotide sequences that code for proteins that retain the function of the native protein. The Patent Office has rejected claims to variant sequences that retain biological activity, when the specification provides no guidance as to the effect of particular nucleotide or amino acid substitutions.[83] In some cases, however, the Patent Office has approved claims covering variant sequences when the specification provided guidance as to what types of modifications fall

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78. *See* Stephen G. Whiteside, Note, *Patents Claiming Genetically Engineered Inventions: A Few Thoughts on Obtaining Broad Property Rights*, 30 NEW ENG. L. REV. 1019, 1059-64 (1996).
79. *See* Mark J. Stewart, Note, *The Written Description Requirement of 35 U.S.C. § 112(1): The Standard After* Regents of the University of California v. Eli Lilly & Co., 32 IND. L. REV. 537, 559-60 (1999).
80. Enzo Biochem, Inc. v. Gen-Probe Inc., 296 F.3d 1316, 1322 (Fed. Cir. 2002). (Claim 4).
81. *See* Regents of the University of California v. Eli Lilly & Co., 119 F.3d 1559 (Fed. Cir. 1997); Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200 (Fed. Cir. 1991).
82. For discussion of nucleic acid hybridization, see ALBERTS ET AL., *supra* note 9, at 300-07.
83. *See Ex parte* Maizel, 27 U.S.P.Q.2d 1662, 1664-65 (Bd. Pat. App. & Interf. Apr. 23, 1993); *Ex parte* Hudson, 18 U.S.P.Q.2d 1322, 1323 (Bd. Pat. App. & Interf. Dec. 21, 1990).

within the claim scope. For instance, a number of patents have issued with claims to a specified amino acid sequence along with any variant sequence involving a "conservative amino acid substitution." The specification of such patents typically includes boilerplate guidance on how to make variant proteins, often with a listing of "exemplary substitutions" for each of the twenty amino acids.[84]

In the absence of any case law, this type of expansive claim drafting is no doubt prudent. Yet patent-holders should not be able to circumvent the sound rule of *Genentech v. Wellcome* and *Schering* merely by referring to the possibility of making variant proteins. Indeed, it is doubtful that claims of this sort could hold up under scrutiny for written description and enablement.[85] For persons skilled in the art, it generally remains unpredictable what effect even so-called "conservative amino acid substitutions" would have on a protein's biological activity.[86] Indeed, claims of this type appear to be inconsistent with the Patent Office's new Written Description Guidelines, which permit claims to "functional characteristics when coupled with a *known or disclosed correlation between function and structure*."[87] The Federal Circuit relied upon this statement from the Guidelines in *Enzo*.[88]

To be sure, if science makes it possible to predict—with reasonable certainty—the effect of specific amino acid substitutions on the biological activity or other important properties of proteins, there could be an expansion of what may fairly be claimed beyond sequences actually made and

84. *See, e.g.*, U.S. Patent No. 5,864,020, Claim 1 (issued Jan. 26, 1999) (claiming the specified amino acid sequences for mature murine and human hepatoma transmembrane kinase receptor (Htk) ligands, as well as the naturally occurring amino acid sequence for mature Htk ligand from [any other] animal species; "allelic variants of [those] sequences"; and sequences "having a single preferred conservative amino acid substitution as defined in Table 1").
85. *See Eli Lilly*, 119 F.3d 1559 (Fed. Cir. 1997); *Chugai Pharm.*, 927 F.2d at 1212-13.
86. *See* MANUAL OF PATENT EXAMINING PROCEDURE § 2144.08, at 2100-141 (8th ed. 2001) ("The effect of a conservative substitution on protein function depends on the nature of the substitution and its location in the chain. Although at some locations a conservative substitution may be benign, in some proteins only one amino acid is allowed at a given position."); *see also supra* note 14 and accompanying text.
87. Guidelines for Examination of Patent Applications Under the 35 U.S.C. 112, ¶ 1, "Written Description" Requirement, 66 Fed. Reg. 1099, 1106 (Jan. 5, 2001) (emphasis added).
88. Enzo Biochem, Inc. v. Gen-Probe Inc., 296 F.3d 1316, 1324 (Fed. Cir. 2002).

tested.[89] The predictability of the art is an important factor in the enablement analysis.[90] For now, though, claims to protein analogs that the inventor did not actually make and test should generally be held invalid.

Two exceptions to this general rule come to mind. First, some proteins are already well characterized, and their three-dimensional structure determined, such that scientists know to a reasonable certainty which amino acids are essential for biological activity, and which are inessential. Over time, more proteins will fall into this category.[91] In such cases it may well be possible to appropriately describe, enable and claim various families of analog molecules. Second, the general rule should not apply if the inventor has made and tested analogs structurally related to those he claims. In such cases, the trial and error of making muteins has elucidated a principle of amino acid substitution that allows the inventor to claim an appropriately defined genus of muteins encompassing ones he never actually made.[92]

V. THE APPLICATION OF THE DOCTRINE OF EQUIVALENTS TO SECOND-GENERATION GENES AND PROTEINS

Given the limited ability to obtain a patent that literally reads on variant sequences, the patent-holder who seeks to enforce a gene or protein patent against a variant sequence likely must rely on the doctrine of equivalents. The critical question, then, is how "equivalence" should be determined for such patents. In Part V.A, we review various problems with the existing case law on the doctrine of equivalents when applied to gene or protein patents. In Part V.B, we suggest that the "known interchangeability" test for equivalence is the best way to resolve infringement claims involving second-generation genes and proteins.

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89. *See* Enzo Biochem, Inc. v. Calgene, Inc., 188 F.3d 1362, 1374 n.10 (Fed. Cir. 1999) ("In view of the rapid advances in science, we recognize that what may be unpredictable at one point in time may become predictable at a later time.").
90. *See In re* Wands, 858 F.2d 731, 737 (Fed. Cir. 1988). For discussion of the importance of the perception of biotechnology as an "unpredictable art," see Stewart, *supra* note 77, at 556-58.
91. *See* Chahine, *supra* note 74, at 359-60.
92. *See Ex parte* Mark, 12 U.S.P.Q.2d 1904, 1905-07 (Bd. Pat. App. & Interf. 1989) (upholding claims to any human beta interferon mutein "having at least one of [its three] cysteine residues substituted by another amino acid and said mutein exhibiting the biological activity of said native protein," based on a disclosure of the structural significance of cysteines to the particular protein and the inventors' creation and testing of certain cysteine-depleted muteins); *cf. In re* Alton, 76 F.3d 1168 (Fed. Cir. 1996) (remanding to the Board of Patent Appeals and Interferences on adequacy of written description for human gamma interferon mutein).

A. Problems with the Doctrine of Equivalents

1. *The All-Elements Rule Should Apply to the Sequence as a Whole*

We should note at the outset a potential pitfall in applying the doctrine of equivalents to gene or protein patents. Under the "all elements" rule as taught by the Supreme Court in *Warner-Jenkinson Co. v. Hilton Davis Chemical Co.*,[93] "[e]ach element contained in a patent claim is deemed material to defining the scope of the patented invention, and thus the doctrine of equivalents must be applied to individual elements of the claim, not to the invention as a whole."[94] Accordingly, some commentators suggest that each nucleotide in a gene patent and each amino acid in a protein patent may constitute a separate claim element.[95] But most amino acids in any particular protein do not perform a known function of their own; rather, the amino acid sequence as a whole determines the protein's three-dimensional structure, which in turn is essential to its function. Thus, it makes no sense to consider each amino acid to be a separate claim element.

Moreover, to do so would lead to absurd results. For example, the holder of a protein patent could get to the trier of fact on an equivalence claim against a variant protein in which one amino acid had been substituted for another, but the same patent-holder would lose as a matter of law if the variant protein had instead been made by leaving out one amino acid altogether. For example, in *Amgen v. TKT*, where the defendants omitted the amino acid in the 166th and final position without affecting the protein's properties,[96] the doctrine of equivalents would be unavailable if that single amino acid were considered a "claim element" in its own right. Thus, in a gene or protein patent, the entire sequence should be considered a single element.

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93. 520 U.S. 17 (1997).
94. *Id.* at 29.
95. *See* Lawrence S. Graham, Note, *Equitable Equivalents: Biotechnology and the Doctrine of Equivalents After* Warner-Jenkinson Co. v. Hilton Davis Chemical Co., 6 J.L. & POL'Y 741, 783 (1998); Robert D. Bajefsky & Howard W. Levine, *Impact of 'Hilton Davis' on Biotech Is Unclear*, NAT'L L.J., June 16, 1997, at C9.
96. Amgen, Inc. v. Hoechst Marion Roussel, Inc., 126 F. Supp. 2d 69, 133 (D. Mass. 2001), *appeal pending*, No. 01-1191 (Fed. Cir.).

2. *The Function-Way-Result Test Produces Arbitrary and Unpredictable Results*

The leading test for equivalence—and the test applied by the Federal Circuit in *Genentech v. Wellcome*—is the function-way-result test.[97] However, this three-part analysis is highly indeterminate, and is particularly unsuited for measuring the scope of equivalence for biotechnology patents.

The question of equivalence under the function-way-result test often depends entirely on how the "function" of the patented gene or protein is characterized. For example, in *Genentech v. Wellcome*, the Federal Circuit reversed the district court on equivalence because the Federal Circuit chose a narrower definition of the "function" of human t-PA.[98] Many gene and protein patents will raise the same issue: the more specific the articulation of the patented gene's or protein's "function," the less likely the variant gene or protein will be found to have the same "function."[99] In other words, the outcome of the three-part analysis will often depend entirely on the first step, namely which of the different "functions" proffered by the parties the court decides to accept. Thus, the outcome of function-way-result analysis in this context is highly manipulable and unpredictable.

The Federal Circuit has attempted to add some certainty to the selection of the "function" of a claim limitation by instructing courts to look at "the intended function as seen in the context of the patent, the prosecution history, and the prior art."[100] In many likely future cases involving gene and protein patents, however, these sources will refer both to broader and narrower "functions," and the court's selection of one of these "functions" for purposes of equivalence analysis will remain troublingly arbitrary.

Moreover, basing the "function" on the patent specification and the prior art raises a problem of timing. The Supreme Court held in *Hilton Davis*[101] that equivalence is determined at the time of infringement.[102] If the "function" for purposes of equivalence analysis is based on what was known to a person skilled in the art at the time of invention, then any properties of the patented gene or protein discovered between the time of

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97. *See* Genentech, Inc. v. Wellcome Found. Ltd., 29 F.3d 1555, 1567 (Fed. Cir. 1994).
98. *See id.*
99. *See* 5A CHISUM, *supra* note 73, § 18.04[5], at 18-407.
100. *Genentech*, 29 F.3d at 1567; *see also* Zenith Labs., Inc. v. Bristol-Myers Squibb Co., 19 F.3d 1418, 1425 (Fed. Cir. 1994).
101. 520 U.S. 17 (1997).
102. *Id.* at 37.

invention and the time of infringement would have to be disregarded. Even more important, any new properties of the variant gene or protein would be irrelevant to the equivalence analysis. Thus, a protein analog with a significant new property not shared by the patented protein would infringe, whereas another protein analog with no new properties but a substantial difference in the existing property of the patented protein would not. That outcome is inconsistent with the Supreme Court's decision in *Hilton Davis* that equivalence is determined at the time of infringement.[103]

Additionally, the function-way-result analysis is particularly problematic in biotechnology cases because the "way" component frequently collapses into the "result" component. Scientific understanding of the way proteins act at the molecular level is not yet well developed. As the Federal Circuit cautioned in *Genentech v. Wellcome*, "[w]e are mindful that the state of science in this area of endeavor is very imprecise."[104] Consequently, even if a protein analog exhibits very different "results" from the natural protein, scientists may not know the "way" in which the differences arise. Thus, in many biotechnology cases the "way" prong will be meaningless. The Supreme Court's observation in *Hilton Davis* that the function-way-result test is more "suitable for analyzing mechanical devices" than it is for analyzing "other products or processes" has particular application to biotechnology cases.[105]

3. A "Hypothetical Claim" Analysis Is Unduly Restrictive

Another mode of analyzing equivalence that the Federal Circuit sometimes uses is "hypothetical claim" analysis. This approach is based on the premise that a patent-holder should not be permitted to use the doctrine of equivalents to obtain coverage for which the PTO would not have awarded literal claims in light of the prior art. Accordingly, the Federal Circuit has suggested that "it may be helpful to conceptualize the limitation on the scope of equivalents by visualizing a *hypothetical* patent claim, sufficient in scope to *literally* cover the accused product. The pertinent question then

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103. In a sense, this issue is the flip side of the issue in *Hilton Davis*. In that case, the Supreme Court held that "after-arising equivalents" could still infringe. *Id*. at 37. Here, the issue is whether later-arising nonequivalence can lead to a finding of noninfringement.

104. *Genentech v. Wellcome*, 29 F.3d at 1569.

105. *Hilton Davis*, 520 U.S. at 39-40; *see also Genentech*, 29 F.3d at 1570 (Lourie, J., concurring).

becomes whether that hypothetical claim could have been allowed by the PTO over the prior art."[106]

At least in the case of patents on natural gene or protein sequences, "hypothetical claim" analysis usually does not bar the assertion of equivalence against a variant sequence with the same biological properties. If the inventor was the first to isolate the natural protein, a hypothetical claim to a protein with the particular biological properties characteristic of that protein would not be anticipated or rendered obvious by the prior art, and therefore could have been allowed.

Several commentators, however, have proposed for gene and protein patents an "expanded hypothetical claim analysis" that would ask not just whether the hypothetical claim reads on the prior art, but also whether the specification enabled the full scope of such a claim.[107] That proposal should not be adopted. The Federal Circuit has already held in *Genentech v. Wellcome* that protein claims reaching beyond specifically recited sequences would be invalid for lack of enablement because the effects of untried sequence variations are inherently unpredictable.[108] Thus, requiring full enablement of the hypothetical claim (as of the time of the application) would bar application of the doctrine of equivalents to any variant sequence not specifically described in the specification. Under this test, even an amino acid substitution with absolutely no effect on biological properties of the protein—made for the sole purpose of evading a patent on the natural sequence—would escape infringement. That result cannot be justified.

4. The Separate Patentability of the Accused Sequence Should Not Be Determinative

Finally, as part of a doctrine of equivalents inquiry, courts often look to whether the accused product is separately patentable. The Federal Circuit has held that a finding by the PTO that the accused product is separately patentable due to improved properties is evidence that it is not

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106. Wilson Sporting Goods Co. v. David Geoffrey & Assocs., 904 F.2d 677, 684 (Fed. Cir.) (emphasis in original), *cert. denied*, 498 U.S. 922 (1990); *see also* K-2 Corp. v. Salomon S.A., 191 F.3d 1356, 1367-68 (Fed. Cir. 1999).

107. *See* Laura A. Handley, *Refining the Graver Tank Analysis with Hypothetical Claims: A Biotechnology Exemplar*, 5 HARV. J.L. & TECH. 31 (1991); Michael T. Siekman, *The Expanded Hypothetical Claim Test: A Better Test for Infringement for Biotechnology Patents Under the Doctrine of Equivalents*, 2 B.U. J. SCI. & TECH. L. 6 ¶¶ 17, 22, 39, 46 (1996). To date, no court has required the "hypothetical claim" to meet written description or enablement requirements. *See* 5A CHISUM, *supra* note 73, § 18.04[2][d][ii][D], at 18-376.

108. 29 F.3d at 1564-65.

equivalent to the claimed product: the same unexpected advantages that render the accused product nonobvious over the prior art also render it nonequivalent.[109] On the other hand, the Federal Circuit has insisted that "separate patentability does not avoid equivalency as a matter of law."[110] The court has reasoned that, "where defendant has appropriated the material features of the patent in suit, infringement will be found even when those features have been supplemented and modified to such an extent that the defendant may be entitled to a patent for the improvement."[111]

Despite the Federal Circuit's caveat, some commentators have urged that separate patentability, and in particular whether a variant nucleotide or amino acid sequence would be obvious over the claimed gene or protein, should determine infringement under the doctrine of equivalents.[112] This, however, would unduly restrict the scope of patents on natural sequences because it is relatively easy to obtain a patent on a novel nucleotide or amino acid sequence.

Although "structural similarity between claimed and prior art subject matter . . . creates a *prima facie* case of obviousness," that presumption may be rebutted by "data showing that the claimed compositions possess unexpectedly improved properties or properties that the prior art does not have."[113] If the applicant for a patent on a variant sequence cannot point to *any* novel or improved property or provide a reason why the results of a particular amino acid substitution would be unexpected, the application may be denied for obviousness. For example, in *Ex parte Anderson*,[114]

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109. *See* Zygo Corp. v. Wyko Corp., 79 F.3d 1563, 1570 (Fed. Cir. 1996); National Presto Indus., Inc. v. West Bend Co., 76 F.3d 1185, 1191-92 (Fed. Cir. 1996); Hoganas AB v. Dresser Indus., Inc., 9 F.3d 948, 954 & n.28 (Fed. Cir. 1993).

110. Fiskars, Inc. v. Hunt Mfg. Co., 221 F.3d 1318, 1324 (Fed. Cir. 2000); *see also* Hoechst Celanese Corp. v. BP Chem. Ltd., 78 F.3d 1575, 1582 (Fed. Cir. 1996).

111. Atlas Powder Co. v. E.I. Du Pont de Nemours & Co., 750 F.2d 1569, 1580 (Fed. Cir. 1984) (citing Bendix Corp. v. United States, 600 F.2d 1364 (Ct. Ce. 1979)).

112. *See* Qing Lin, Note, *A Proposed Test for Applying the Doctrine of Equivalents to Biotechnology Inventions: The Nonobviousness Test*, 74 WASH. L. REV. 885 (1999); *see also* Siekman, *supra* note 105 ¶¶ 9-14; Sean Johnston, Comment, *Patent Protection for the Protein Products of Recombinant DNA*, 4 HIGH TECH. L.J. 249, 273 (1990).

113. *In re* Dillon, 919 F.2d 688, 692-93 (Fed. Cir. 1990) (en banc), *cert. denied*, 500 U.S. 904 (1991); *see also* MANUAL OF PATENT EXAMINING PROCEDURE § 2144.09 (8th ed. 2001). *Dillon* involved a chemical compound. For an argument that the "structural similarity" holding of *Dillon* should not apply to proteins and their analogs, which are typically much more complex, see KENNETH J. BURCHFIEL, BIOTECHNOLOGY AND THE FEDERAL CIRCUIT § 6.9, at 110-18 (1995).

114. 30 U.S.P.Q.2d 1866 (Bd. Pat. App. & Interf. Mar. 14, 1994).

where the applicants isolated a naturally occurring allele coding for a protein differing by one amino acid from the protein encoded by the nucleotide sequence in the prior art, the Board of Patent Appeals and Interferences denied the application. The Board stated that "it is well known in the art that usually the substitution of one amino acid for another in a nonessential region of the protein will have no effect on the biological activity of the protein."[115] But in most instances it will not be difficult to overcome a *prima facie* obviousness rejection by identifying a property—perhaps irrelevant to the intended use of the claimed protein—in which the two sequences differ, or by arguing that the results of a particular amino acid substitution were unexpected. It is "hard to make arguments of nonobviousness stick with regard to biotechnological invention."[116]

A further problem with an obviousness test for equivalence is one of timing. Equivalence is measured at the time of infringement,[117] whereas obviousness is evaluated retroactively at "the time the invention was made."[118] Thus, an infringer who makes a protein with a minor variant that at the time of infringement was known to be equivalent could escape liability so long as the effect of his amino acid substitution was not obvious at the time the natural sequence was discovered—perhaps many years earlier. Alternatively, a person skilled in the art might wrongly believe at the time of the invention that a novel protein had improved properties, but might realize by the time of infringement that it was equivalent to the natural analog after all. In either of these situations, the mutein should infringe under the doctrine of equivalents because the mutein offers no improvement over the claimed protein at the time of infringement and would be used only to evade the patent. The proposed obviousness test would only lead the fact-finder astray.

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115. *Id.* at 1869; *see also In re* Mayne, 104 F.3d 1339, 1343-44 (Fed. Cir. 1997) (affirming a rejection on obviousness grounds where the applicant failed to carry his burden to show that a fusion protein had any unexpected properties); *Ex parte* Gray, 10 U.S.P.Q.2d 1922, 1926 (Bd. Pat. App. & Interf. Mar. 14, 1989) (holding that a recombinant human protein with an additional methionine residue as a result of bacterial expression was obvious in light of the native human protein).

116. John M. Golden, *Biotechnology, Technology Policy, and Patentability: Natural Products and Invention in the American System*, 50 EMORY L.J. 101, 129-30 (2001). For a helpful analysis of the case law on the obviousness of variant genes or proteins, see Philippe Ducor, *Recombinant Products and Nonobviousness: A Typology*, 13 SANTA CLARA COMPUTER & HIGH TECH. L.J. 1, 48-56 (1997).

117. Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 37 (1997).

118. 35 U.S.C. § 103 (2000).

Separate patentability of the variant gene or protein should not therefore be determinative of infringement under the doctrine of equivalents. A PTO finding of nonobviousness is relevant, but not dispositive of equivalence.

B. The Known Interchangeability Test for the Doctrine of Equivalents

In contrast to the unsuccessful approaches reviewed above, we suggest that the "known interchangeability" test, a well established strand of the case law on the doctrine of equivalents, is a promising methodology for evaluating equivalence to a gene or protein patent.

In *Graver Tank & Manufacturing Co. v. Linde Air Products Co.*,[119] the Supreme Court held that "[a]n important factor" in the doctrine of equivalents "is whether persons reasonably skilled in the art would have known of the interchangeability of an ingredient not contained in the patent with one that was."[120] More recently, the Federal Circuit in *Hilton Davis* held that the "function, way, result" test was not "'the' test for equivalency," and emphasized that other factors should also be considered when appropriate. One of the factors identified by the Federal Circuit as "important" was whether a person skilled in the art "would have known of the interchangeability" of the accused element with the patented element.[121]

The advantage of the known interchangeability test is that it properly focuses on the functional differences between the two genes or proteins. Two nucleotide or amino acid sequences are interchangeable if a person skilled in the art would be relatively indifferent as to which one was used. That is, if a person skilled in the art would have a marked preference for one sequence over the other, then the sequences are not equivalent even though one sequence may to some extent or under some circumstances be useable in place of the other. Known interchangeability is thus an *objective* measure of whether there is a substantial difference between the accused gene or protein and the patented one.

Objective factors are well suited for the finder of fact in patent cases. The Supreme Court has described known interchangeability as "one of the express objective factors noted by *Graver Tank* as bearing upon whether the accused device is substantially the same as the patented invention."[122] As an objective measure of equivalency, known interchangeability is

119. 339 U.S. 605 (1950).
120. *Id.* at 609.
121. Hilton Davis Chem. Co. v. Warner-Jenkinson Co., 62 F.3d 1512, 1518-19 (Fed. Cir. 1995) (en banc), *rev'd on other grounds*, 520 U.S. 17 (1997).
122. *Hilton Davis*, 520 U.S. at 36.

analogous to the "secondary considerations" of nonobviousness,[123] which are examined in light of the "real world facts."[124] In the obviousness context, the Federal Circuit has declared that "[t]he significance of a new structure is often better measured in the marketplace than in the courtroom."[125] So, too, with the doctrine of equivalents for gene or protein patents: whether a variant nucleotide or amino acid sequence is substantially improved over the claimed gene or protein will often be reflected in the variant sequence's success, or lack thereof, in the marketplace.

Knowledge of the interchangeability of the two sequences can come either from the prior art or from the work of the creator of the second sequence. Because the results of protein engineering are so unpredictable, there often will be no data on whether the accused sequence is interchangeable with the patented one until the work of the creator of the accused sequence. Permitting a finding of interchangeability based on the very work leading to the accused sequence is consistent with the determination of equivalence at the time of infringement[126] and is necessary to prevent easy evasion of a gene or protein patent through creation of a "neutral mutein."[127]

Some cases will be easy to decide using the known interchangeability test. A sequence with a "silent" nucleotide substitution (*i.e.*, one that produces no alteration in the amino acid sequence of the expressed protein) will always infringe a patent on the original gene under the doctrine of equivalents. A sequence with an amino acid substitution that has no perceptible effect on biological activity will likewise infringe a patent on the original protein.[128]

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123. Graham v. John Deere Co., 338 U.S. 1, 17-18 (1966).
124. Rosemount, Inc. v. Beckman Instruments, Inc., 727 F.2d 1540, 1546 (Fed. Cir. 1984).
125. Continental Can Co. USA v. Monsanto Co., 948 F.2d 1264, 1273 (Fed. Cir. 1991).
126. *See Hilton Davis*, 520 U.S. at 37 (holding that the proper time to determine equivalence is at the time of infringement).
127. *See generally* Martin J. Adelman & Gary L. Francione, *The Doctrine of Equivalents in Patent Law: Questions That* Pennwalt *Did Not Answer*, 137 U. PA. L. REV. 673, 728 (1989) (arguing that "the sole legitimate function of the doctrine" of equivalents is to "ensure[] that patent protection is not eviscerated by technology developed after the patent issues").
128. *See* Jeffrey P. Kushan, Comment, *Protein Patents and the Doctrine of Equivalents: Limits on the Expansion of Patent Rights*, 6 HIGH TECH. L.J. 109, 113 (1991) ("[F]ew would hesitate to label a 'conservative' amino acid substitution in a polypeptide sequence of a complex, patented protein, which was implemented for the sole purpose of escaping the literal scope of a patent claim, as

Conversely, a variant sequence with substantially improved biological activity would likely not be considered by a person skilled in the art to be interchangeable with the original sequence, and would not infringe. Presumably, the reason that Schering did not pursue infringement under the doctrine of equivalents in its case is that Amgen's "consensus interferon" has substantially higher anti-viral activity than the specific IFN-α-1 protein that the court found was covered by the patent claim.[129]

A variant nucleotide or amino acid sequence with an entirely new, and useful, property would likewise not be interchangeable with the original sequence—even if the two sequences were indistinguishable with respect to the properties of the original sequence—and would therefore not infringe.[130] There should not be a limit on the type of property that can serve to distinguish two sequences: proteins can differ not only in biological activities, but also in their stability, ease of purification, or other characteristics that may make one sequence a preferred pharmaceutical agent.

The known interchangeability test would decide *Genentech v. Wellcome* the same way as the Federal Circuit did, but with less difficulty. Genentech's claimed human t-PA is used in thrombolytic therapy (*i.e.*, to break down blood clots) for victims of heart attacks. The evidence was that the accused variant protein (FE1X) has a substantially longer half-life, "thereby eliminating the need for continuous infusion of t-PA product."[131] Although the FE1X variant itself apparently has never been approved in the United States, in the wake of *Genentech v. Wellcome* other drugs con-

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anything but an 'unimportant and insubstantial' modification." (footnotes and citations omitted)).

129. *See* Lawrence M. Blatt et al., *The Biologic Activity and Molecular Characterization of a Novel Synthetic Interferon-Alpha Species, Consensus Interferon*, 16 J. INTERFERON & CYTOKINE RES. 489, 491 (1996) (stating that Amgen's consensus interferon has an anti-viral activity as high as or higher than that of IFN-α2); *see also* EDWARD DE MAEYER & JACQUELINE DE MAEYER-GUIGNARD, INTERFERONS AND OTHER REGULATORY CYTOKINES 28 (1988) (describing the "relatively low antiviral activity of Hu IFN-α1" as compared to IFN-α2).

130. To be sure, "infringement under the doctrine of equivalents is not precluded merely because the accused device performs functions in addition to those performed by the claimed device." Insta-Foam Prods., Inc. v. Universal Foam Sys., Inc., 906 F.2d 698, 702 (Fed. Cir. 1990). The new property constituting a substantial improvement for purposes of infringement under the doctrine of equivalents must therefore be related to the purpose of the invention. For most gene and protein patents, any property relating to suitability for pharmaceutical use should be considered for purposes of known interchangeability.

131. Genentech, Inc. v. Wellcome Found. Ltd., 14 U.S.P.Q.2d 1363, 1369 (D. Del. Mar. 8, 1990); *see also* Genentech, Inc. v. Wellcome Found. Ltd., 29 F.3d 1555, 1569 & n.42 (Fed. Cir. 1994).

taining human t-PA muteins engineered to have longer half-lives—including several drugs sold by competitors, as well as Genentech's own TNKase—have come onto the market.[132] That is a desirable outcome from the perspective of patent policy.

Many other cases will likewise be easier to resolve using the known interchangeability test than with the function-way-result test. For example, in *Roche v. Berlex*,[133] the arbitration involving a mutein with a single amino acid substitution, the modification rendered nonglycosylated human beta interferon suitable for pharmaceutical use. The function-way-result test is not very helpful here. The "function" of the claimed protein certainly includes the anti-viral activity characteristic of human beta interferon, but it is unclear whether suitability for pharmaceutical use is also part of the "function." If the "function" is limited to anti-viral activity, it is not immediately apparent whether the higher specific activity of Berlex's mutein means that the mutein achieves that "function" in a different "way" or with a different "result."

By contrast, the known interchangeability test provides a clear, sensible outcome. Berlex's mutein is the basis of a successful pharmaceutical product, whereas Roche's claimed protein has not been used commercially, presumably because of the very problem of stability associated with it that prompted the research leading to the creation of the mutein. On these facts, the two proteins are not interchangeable, and the mutein does not infringe under the doctrine of equivalents.

Of course, there will be borderline cases not easily resolved by the known interchangeability test. How great an increase in biological activity is required before the variant sequence is no longer interchangeable with the claimed sequence? Is 10% enough? How about 20% or 30%? There can be no bright-line answer, and the resolution of a close case will turn on the testimony of scientific, pharmaceutical or medical experts as to whether a person skilled in the art would consider the difference substantial. Doctrine of equivalents cases are inherently fact-intensive, and there is no mathematical test that will provide an easy answer in every instance.

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132. Thus, in a case following *Genentech v. Wellcome*, 29 F.3d 1555 (Fed. Cir. 1994), involving a different human t-PA mutein, Genentech asserted various process patents but did not assert its patent on the human t-PA gene. *See* Genentech, Inc. v. Boehringer Mannheim GmbH, 47 F. Supp. 2d 91 (D. Mass. 1999).

133. *See supra* note 62.

VI. CONCLUSION

The known interchangeability test is well established in Supreme Court and Federal Circuit precedent and is particularly well suited to deciding doctrine of equivalents cases for gene and protein patents. Lawyers advising their clients on whether a gene or protein patent covers a mutein-based drug, and courts faced with such cases, will find that the known interchangeability test is analytically more useful in these situations than the function-way-result test that the Federal Circuit used in *Genentech v. Wellcome*. Under the known interchangeability test, gene and protein patents cannot be easily evaded by creating "neutral muteins," but, at the same time, such patents will not cover muteins with substantially improved or new properties. Recognition of these basic principles would help to bring some predictability to this evolving area of patent law, and would protect and enable ongoing investment in the important work of developing "second generation" recombinant pharmaceutical products.

CLOSING FEDERALISM'S LOOPHOLE IN INTELLECTUAL PROPERTY RIGHTS

Robert T. Neufeld†

ABSTRACT

For more than ten years the courts and Congress have grappled with the issue of subjecting states to suit in federal court for intellectual property infringement. Under the Supreme Court's *Florida Prepaid* decisions, states and state entities are currently insulated from suit by private entities in federal court for intellectual property infringement under the sovereign immunity preserved by the Eleventh Amendment. This holding has far-reaching effects on the ability of private parties to enforce their intellectual property rights because federal court is the preferred and, often, the only venue available for enforcing such rights. Furthermore, this state of the law is of increasing importance in view of the growing role that many states and state entities are taking in the intellectual property arena. Since the *Florida Prepaid* decisions, several different legislative remedies have been proposed in Congress, but none have yet been enacted into law. Congress has also commissioned a study by the General Accounting Office to gather statistics and opinions concerning the involvement of states in intellectual property law and the effect of the immunity from suit they currently enjoy in federal court. The results of this study, made available this past year, will impact the scope of the proposed legislation and whether, assuming it is enacted, the legislation survives judicial review.

I. INTRODUCTION

In 1993 and 1995, State Paving Corporation, a highway construction company, obtained two patents on improved technology for the design of sound barrier walls commonly placed adjacent to highways.[1] State Paving developed the new technology while working on a project for the State of

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1. State Contracting & Eng'g Corp. v. Florida, 258 F.3d 1329, 1332 (Fed. Cir. 2001).

Florida and incorporated the new design in an amendment to its contract with the state.[2] The State of Florida allegedly infringed both patents by using data from the new design in subsequent requests for bids on other state projects.[3] In August 1997, State Contracting & Engineering Corporation (State Contracting)[4] filed suit in the Southern District of Florida against the State of Florida and seven private contractors.[5] State Contracting claimed that the State of Florida directly infringed State Contracting's two patents, violated the Lanham Act in making false representations about the existence of State Contracting's patents, and committed an unconstitutional taking of State Contracting's property.[6] State Contracting based its right to sue the State of Florida on federal legislation granting private parties the right to sue states for intellectual property infringement.[7]

While the *State Contracting* suit was pending, the United States Supreme Court decided a pair of related cases concerning the right of a private party to sue a state for intellectual property infringement. In *Florida Prepaid Postsecondary Education Expense Board v. College Savings Bank*[8] and *College Savings Bank v. Florida Prepaid Postsecondary Education Expense Board*,[9] the Supreme Court held that Congress's attempts to abrogate state Eleventh Amendment immunity to patent and trademark infringement suits were unconstitutional, and that a state was therefore immune from suit in federal court for patent and trademark infringement claims. Relying on these two cases, the State of Florida filed a motion for summary judgment in *State Contracting*.[10] The district court granted summary judgment on the patent infringement and Lanham Act claims against Florida, which were clearly untenable after the Supreme Court's decisions.[11] The court granted summary judgment on the takings claim as

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2. *Id.* at 1331-32.

3. *Id.* at 1332.

4. State Paving Corp. had assigned its patent rights to State Contracting & Engineering Corp. *Id.* n.1.

5. *Id.* at 1332. The district court action is State Contracting & Eng'g Corp. v. Fla., No. 97-7014-Civ-Dimitrouleas (S.D. Fla. Mar. 2, 2000).

6. 258 F.3d at 1332.

7. *See infra* note 50.

8. 527 U.S. 627 (1999) (involving patent infringement claims against the State of Florida).

9. 527 U.S. 666 (1999) (involving claims against the State of Florida arising under the Lanham Act).

10. 258 F.3d at 1333.

11. *Id.* The Eleventh Amendment states that "[t]he Judicial power of the United States shall not be construed to extend to any suit in law or equity, commenced or prose-

well, holding that a state's sovereign immunity also trumps a takings claim.[12] In July 2001 the Federal Circuit affirmed the district court's decision.[13]

The federal statute defining jurisdiction for cases such as *State Contracting* provides that "[t]he district courts shall have original jurisdiction of any civil action arising under any Act of Congress relating to patents, plant variety protection, copyrights and trademarks. Such jurisdiction shall be *exclusive* of the courts of the states in patent, plant variety protection and copyright cases."[14] Courts have generally interpreted this jurisdictional mandate to mean that no action for infringement of a patent or copyright can be brought in state court.[15] In contrast, although federal court is

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cuted against one of the United States by Citizens of another State, or by Citizens or Subjects of any Foreign State." U.S. CONST. amend. XI.

12. *See id.* at 1337. The Federal Circuit affirmed this ruling on different grounds, citing *Quern v. Jordan*, 440 U.S. 332 (1979), for the holding that 42 U.S.C. § 1983 does not abrogate state sovereign immunity from suit in federal court. *Id*. at 1337-38. The Federal Circuit decision did not address the viability of a takings claim under the Fifth Amendment or a claim under the Fourteenth Amendment for deprivation of property without due process of law. *See* Philip Morris, Inc. v. Reilly, 60 U.S.P.Q.2d 1545 (1st Cir. 2001) (Selya, J., dissenting in part) (originally published at 267 F.3d 45, but subsequently withdrawn from the bound volume) (concerning a Massachusetts statute requiring the disclosure of certain trade secrets); CCC Info. Servs., Inc. v. MacLean Hunter Mkt. Reports, Inc., 44 F.3d 61, 74 (2d Cir. 1994) (stating that the position that a state legislature's adoption of copyrighted material vitiates the property right "raise[s] very substantial problems under the Takings Clause of the Constitution."); *see also* Christina Bohannan & Thomas F. Cotter, *When the State Steals Ideas: Is the Abrogation of State Sovereign Immunity from Federal Infringement Claims Constitutional in Light of* Seminole Tribe*?*, 4 FORDHAM L. REV. 1435, 1458, 1477 (1999) (analyzing a takings theory and a due process theory to support abrogation of sovereign immunity under the Remedy Clarification Acts of the early 1990s).

13. *State Contracting & Eng'g Corp*, 258 F.3d at 1340. It appears that the district court actually dismissed the patent infringement and Lanham Act claims against the state and granted summary judgment on the takings claims. *See id.* at 1333.

14. 28 U.S.C. § 1338(a) (2000) (emphasis added).

15. *But see* Jacobs Wind Elec. Co. v. Dep't of Transp., 626 So. 2d 1333, 1336 (Fla. 1993) (holding that a state court action against a state alleging a taking and conversion of property that is the subject of a patent is not preempted by federal law because "the relevant federal law did not provide a remedy against a certain class of individuals"). However, the viability of alleging takings claims in state court based on infringement of intellectual property is untested and it is questionable whether such an option is legally tenable. *See Florida Prepaid*, 527 U.S. at 658 n.10 (Stevens, J., dissenting) (questioning the Florida Supreme Court's interpretation of 28 U.S.C. § 1338). *See also* Green v. Hendrickson Publishers Inc., 770 N.E.2d 784, 787 (Ind. 2002) (applying *Holmes Group, Inc. v. Vornado Air Circulation Sys. Inc.*, 122 S.Ct. 1889 (2002), to conclude that federal courts no longer have exclusive jurisdiction over copyright counterclaims).

generally the preferred forum for resolving trademark disputes, state courts do have concurrent jurisdiction to hear such cases.[16]

The exclusivity of § 1338(a), combined with the Supreme Court's current interpretation of the breadth of the Eleventh Amendment, has created a constitutional wrinkle that severely limits the available judicial remedies against states that infringe patents or copyrights.[17] The current situation, in which states[18] can trample on the intellectual property rights of individuals and companies with impunity, appears to be an unintended consequence of our federal system. Both the legislative and judicial branches of our federal government have attempted to grapple with the problem through a line of case law, statutes, and proposed legislation.[19] The most recent legislative attempt to close this loophole, a bill entitled "Intellectual Property Protection Restoration Act of 2002," was introduced in the Senate in March 2002.[20]

The threshold issue in Congressional reform is whether the federal government should do anything to expand the limited remedies available to intellectual property owners when states infringe private intellectual property rights.[21] One of the principles of our federal system is that each

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16. *See* J. THOMAS MCCARTHY, MCCARTHY ON TRADEMARKS AND UNFAIR COMPETITION § 32:1 (2000); U.S. GENERAL ACCOUNTING OFFICE, GAO REP. NO. 01-811, STATE IMMUNITY IN INFRINGEMENT ACTIONS 18 (September 2001), *available at* http://www.gao.gov [hereinafter U.S.G.A.O. Report].

17. Applying the Supreme Court's reasoning in *Florida Prepaid* to the copyright context in *Chavez v. Arte Publico Press*, 204 F.3d 601 (5th Cir. 2000), the Fifth Circuit held that Congress's attempt to abrogate state sovereign immunity under the Copyright Remedy Clarification Act was, like the Patent and Plant Variety Protection Remedy Clarification Act, an improper exercise of power. *Id.* at 607.

18. Throughout the remainder of this article, unless explicitly indicated otherwise, the term "state" encompasses state governments as well as other state entities such as state universities, state hospitals, public service corporations, and other such state instrumentalities. Admittedly, the determination of whether an entity is an instrumentality of the state for purposes of Eleventh Amendment immunity is not always a simple one. *See* Earles v. State Bd. of Certified Pub. Accountants, 139 F.3d 1033, 1036-37 (5th Cir. 1998); Mancuso v. N.Y. State Thruway Auth., 86 F.3d 289, 293-96 (2d Cir. 1996).

19. *See infra* Parts II and III.

20. S. 2031, 107th Cong. (2002). This bill exists in two forms: an original version, already introduced in the Senate, and a substitute version, not yet introduced. *See infra* note 36 and accompanying text. Both versions will be referred to as "2002 Draft IPPRA" in the text of the article, but cited separately in the footnotes. Similar legislation previously has been introduced in Congress. *See* S. 1611, 107th Cong. (2001) (introducing the "Intellectual Property Protection Restoration Act of 2001"); S. 1835, 106th Cong. (1999) (introducing the "Intellectual Property Protection Restoration Act of 1999").

21. Remedies in federal court are not completely absent in that prospective injunctive relief can be obtained under the *Ex Parte Young* doctrine. *See, e.g.*, Salerno v. City

state is a sovereign entity and that, absent consent, a sovereign entity is inherently immune from suit brought by an individual in federal court.[22] At the same time, Congress can vitiate state sovereign immunity for states that commit certain constitutional violations under the enforcement powers of the Fourteenth Amendment.[23] The Court in *Florida Prepaid* questioned whether state acts of infringement necessarily rise to the level of a constitutional violation.[24] The majority reasoned that, in the rare instances when states infringe intellectual property, the victim could pursue a claim in state court or through other administrative mechanisms, thereby complying with constitutional due process requirements.[25] The Supreme Court in *Florida Prepaid* also based its conclusion, in part, on the assumption that the states rarely infringe intellectual property rights, and that wholesale abrogation of state immunity was therefore not proportionate to the harm caused by states engaging in such infringement.[26]

The opposing viewpoint, articulated by Justice Stevens' dissent in *Florida Prepaid*, contends that if states and state entities are participating in the intellectual property system, they should be subject to its constraints just as any other private entity.[27] The dissent argued that eliminating meaningful safeguards in the federal forum leaves states free to take intellectual property with little recourse for the owners of such property.[28] Proponents of this opposing view question the existence of adequate remedies

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Univ. of N.Y., 191 F. Supp. 2d 352, 357 (S.D.N.Y. 2001) (denying a motion to dismiss claims against individual state officers seeking prospective injunctive relief for alleged copyright infringement). Subsequent to the *Florida Prepaid* decisions, at least one federal court has allowed an action by a private entity against a state for a declaratory judgment of patent invalidity. *See* New Star Lasers, Inc. v. Regents of Univ. of Cal., 63 F. Supp. 2d 1240, 1243-45 (E.D. Cal. 1999) (denying defendant's motion to dismiss the action on sovereign immunity grounds). Nonetheless, state entities can operate free of exposure to liability for damages in federal court for intellectual property infringement.

22. *See Florida Prepaid*, 527 U.S. at 634 (quoting *Seminole Tribe. v. Florida*, 517 U.S. 44, 54 (1996)).

23. *See id.* at 637.

24. *Id.* at 643.

25. *See, e.g.*, Jacobs Wind Elec. Co. v. Dep't of Transp., 626 So. 2d 1333, 1338 (Fla. 1993) (Harding, J., dissenting) (identifying the procedure for filing a claims bill with the Florida legislature under FLA. STAT. ANN. § 11.065 (West 1998)). In *Florida Prepaid*, the Supreme Court found that Congress did not adequately consider the existence of remedies at the state level. *See* 527 U.S. at 643-44.

26. *See id.* at 640-41, 645-46.

27. *See* U.S.G.A.O. Report, *supra* note 16, at 5; *see generally Florida Prepaid*, 527 U.S. at 648 (Stevens, J., dissenting).

28. *See* 527 U.S. at 655-56 (Stevens, J., dissenting) (discussing *Chew v. California*, 893 F.2d 331 (Fed. Cir. 1990)).

at the state level.[29] The *Florida Prepaid* dissent argued that states are ill-equipped to handle intellectual property matters because intellectual property rights are a unique creature of federal law, derived from Article I of the U.S. Constitution.[30] Advocates of a federal solution claim that allowing the various state courts to interpret federal intellectual property law will foster confusion and conflicting rulings.[31] In support of this assertion, proponents of a uniform federal solution cite the impetus for creating the Federal Circuit as a single court that can interpret and apply a uniform and consistent body of law.[32]

Assuming that some federal action is required to protect intellectual property rights from state infringement, the second question is what action the federal government should take. The Intellectual Property Protection Restoration Act of 2002 (2002 Draft IPPRA) proposes the following actions: 1) abrogating state sovereign immunity to infringement suits, but under narrower circumstances than those included in previous legislation;[33] 2) expressly allowing suits against state officials under the *Ex Parte Young* doctrine;[34] and 3) modifying the intellectual property rights available to states.[35] A fourth provision, included in a substitute draft of the bill that was never formally introduced in Congress, proposes prohibiting a state from obtaining a patent, copyright registration, or trademark registration without waiving its immunity.[36]

This article first reviews the case law and statutes that have produced the current state of the law. Next, it describes the provisions of the proposed legislation currently before Congress. Finally, it considers whether the various portions of the proposed legislation are necessary, to what ex-

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29. *Id.* at 658-59 (Stevens, J., dissenting).

30. *Id.* at 659 (Stevens, J., dissenting).

31. *Id.* at 650-51 (Stevens, J., dissenting).

32. *Id.* at 651 (Stevens, J., dissenting).

33. Congress previously attempted to abrogate state sovereign immunity with respect to intellectual property claims in enacting the Patent and Plant Variety Protection Remedy Clarification Act, the Trademark Remedy Clarification Act, and the Copyright Remedy Clarification Act. *See infra* note 50. However, to the extent these three Acts abrogated state sovereign immunity, they were invalidated by the Supreme Court in *Florida Prepaid* and *College Savings Bank*, and by the Fifth Circuit Court of Appeals in *Chavez*.

34. In *Ex Parte Young*, 209 U.S. 123 (1908), the Supreme Court held that, the Eleventh Amendment notwithstanding, a state officer can be sued by a private party in federal court.

35. S. 2031, 107th Cong. (2002).

36. S. 2031, 107th Cong. (2002) (proposed substitute version, not yet introduced), *in* 64 BUREAU OF NAT'L AFFAIRS PAT., TRADEMARK & COPYRIGHT J. 39 (2002) [hereinafter Substitute 2002 Draft IPPRA].

tent they are likely to survive judicial scrutiny, and whether they achieve the stated goals of the 2002 Draft IPPRA.[37]

II. BACKGROUND

A. Prior to Florida Prepaid

Until 1985 it was generally assumed that states were subject to federal intellectual property laws.[38] Although not explicitly stated, the federal government presumably had power to enforce these laws over the states based on the Commerce Clause of Article I, the Patent Clause of Article I, and the enforcement powers of the Fourteenth Amendment.[39] In comparison, the U.S. Constitution and federal statutes both explicitly restrain the federal government from encroaching on the rights of intellectual property owners. The Fifth Amendment requires the federal government to pay compensation when it takes private property, including intellectual property.[40] When the federal government does infringe an owner's patent or copyright, the owner may file suit in the United States Claims Court.[41] Similarly, the Lanham Act allows a trademark owner to sue the federal government under 15 U.S.C. § 1122(a) (West 2001).

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37. Section 2 of the 2002 Draft IPPRA states:

> The purposes of this Act are to (1) help eliminate the unfair commercial advantage that States and their instrumentalities now hold . . . ; (2) promote technological innovation and artistic creation in furtherance of the policies . . . relating to intellectual property; (3) reaffirm the availability of prospective relief against State officials who are violating or who threaten to violate Federal intellectual property laws; and (4) provide compensation for harm resulting from infringements of Federal intellectual property by States or their instrumentalities, officers, or employees . . . .

S. 2031 § 2.

38. *See* Bohannan & Cotter, *supra* note 12, at 1454; U.S.G.A.O. Report, *supra* note 16, at 4; Mills Music v. Arizona, 591 F.2d 1278, 1284-85 (9th Cir. 1979). This decision was implicitly overruled by *Atascadero State Hospital v. Scanlon*, 473 U.S. 234 (1985), as recognized in *Lane v. First National Bank*, 687 F. Supp. 11, 14 (D. Mass 1988), *aff'd* 871 F.2d 166 (1st Cir. 1989).

39. *See Mills Music*, 591 F.2d at 1284-85; Bohannan & Cotter, *supra* note 12, at 1455-56.

40. The Fifth Amendment states, in pertinent part, "nor shall private property be taken for public use, without just compensation." U.S. CONST. amend. V, § 1, cl. 4; *see generally* Ruckelshaus v. Monsanto Co., 467 U.S. 986, 1003-04 (1984) (holding that trade secrets are property rights protected by the Fifth Amendment).

41. 28 U.S.C. § 1498 (2000). Injunctive relief is not an available remedy against the United States in such an action. *See* Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank, 527 U.S. 627, 663-64 n.15 (1999) (Stevens, J., dissenting).

In 1985, the Supreme Court held in *Atascadero State Hospital v. Scanlon*[42] that only a clear and unmistakable abrogation by Congress can vitiate a state's Eleventh Amendment immunity from suit in federal court.[43] In *Atascadero*, an individual sued a California state hospital in federal court under Section 504 of the Rehabilitation Act of 1973.[44] The Supreme Court held that the Rehabilitation Act's general language concerning suit in federal court was not an explicit abrogation of the Eleventh Amendment.[45] Specifically, the language in the statute providing for remedies against "any recipient of Federal assistance" was not a sufficiently unequivocal abrogation, despite the unique role of states as recipients of federal aid.[46] Furthermore, the state hospital did not implicitly consent to suit in federal court by receiving funds under the Rehabilitation Act.[47] Appellate courts applying *Atascadero* subsequently found Congress had not clearly abrogated state Eleventh Amendment immunity from suits for infringement of intellectual property.[48] As a result, states could no longer be sued for damages in federal court for infringing patents, trademarks, or copyrights.[49] In response to this development in intellectual property law, Congress passed legislation in 1990 and 1992 to explicitly abrogate, in the intellectual property domain, the Eleventh Amendment's grant of immunity to the states.[50]

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42. 473 U.S. 234 (1985).

43. *Id.* at 243.

44. *Id.* at 236.

45. *Id.* at 245-46.

46. *Id.*

47. *Id.* at 246-47.

48. *See, e.g.*, Chew v. California, 893 F.2d 331, 334 (Fed. Cir. 1989) (holding that Congress had not expressly abrogated state sovereign immunity with the reference "whoever" in 35 U.S.C. § 271(a) of the patent statute); BV Eng'g v. UCLA, 858 F.2d 1394, 1396-97 (9th Cir. 1988) (finding that the Copyright Act of 1976 did not abrogate the states' Eleventh Amendment immunity).

49. While the potential availability of avenues to pursue infringement claims against states at the state level was noted in *Chew*, 893 F.2d at 336 n.5, the subsequent discussion herein casts considerable doubt on the existence of forums to pursue such claims at the state level. *See infra* Part IV.A.

50. Copyright Remedy Clarification Act, Pub. L. No. 101-553 (1990) (codified as 17 U.S.C. § 511 (2000)); Trademark Remedy Clarification Act, Pub. L. No. 102-542 (1992) (codified as 15 U.S.C. § 1122 (2000)); Patent and Plant Variety Protection Remedy Clarification Act, Pub. L. No. 102-560 (1992) (codified as 35 U.S.C. § 296 (2000)). Each Act contained similar abrogation and remedial provisions. For example, 17 U.S.C. § 511(a) provided that "[a]ny State, any instrumentality of a State, and any officer or employee of a State or instrumentality of a State acting in his or her official capacity, shall not be immune, under the Eleventh Amendment . . . from suit in Federal court . . . for a violation of any of the exclusive rights of a copyright owner."

B. The *Florida Prepaid* Decision

Despite Congress's efforts to resolve the matter, a pair of related cases concerning alleged state infringement of intellectual property came before the Supreme Court in 1999. The two cases, *Florida Prepaid* and *College Savings*, raised the issue of whether Congress had properly abrogated the Eleventh Amendment's grant of immunity to suits for infringement.[51] The Supreme Court held that Congress did not have the power to abrogate state immunity under Article I, and had not properly done so using the enforcement powers of the Fourteenth Amendment.

In *Florida Prepaid*, a patent infringement suit, plaintiff College Savings Bank sued the Florida Prepaid Postsecondary Education Expense Board (Board), a state-created entity that administered tuition prepayment contracts.[52] College Savings Bank claimed that the Board was infringing College Savings Bank's patent on a financing method for college expenses.[53] While the suit was pending in 1996 in district court in New Jersey, the Supreme Court handed down its decision in *Seminole Tribe v. Florida*, holding that Congress may not use Article I to abrogate state sovereign immunity.[54] The Board moved to dismiss the action on immunity grounds, arguing that the Patent and Plant Variety Remedy Clarification Act's abrogation provisions were unconstitutional.[55] College Savings Bank argued in response that the enforcement powers in Section 5 of the Fourteenth Amendment gave Congress the power to abrogate state sovereign immunity, and the district court agreed.[56] Finding that patents are

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51. *See* Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank, 527 U.S. 627, 635 (1999) (considering the Patent and Plant Variety Protection Remedy Clarification Act); Coll. Sav. Bank v. Fla. Prepaid Postsecondary Educ. Expense Bd., 527 U.S. 666, 672 (1999) (considering the Trademark Remedy Clarification Act).

52. *Florida Prepaid*, 527 U.S. at 631.

53. *Id.*

54. 517 U.S. 44 (1996) (holding that, in determining whether a Congressional action abrogating state sovereign immunity is valid, a court must answer two queries in the affirmative: (1) whether there is an unequivocal expression of intent to abrogate; and, (2) whether Congress's action is based on a valid exercise of power).

55. *See* 527 U.S. at 633. The Patent and Plant Variety Protection Remedy Clarification Act expressly provided that states, state instrumentalities, and state officers acting in their official capacities were subject to suit in federal court for infringement of patents. Pub. L. No. 102-560 (1992) (codified as 35 U.S.C. § 296 (2000)).

56. *See* Coll. Sav. Bank v. Fla. Prepaid Postsecondary Educ. Expense Bd., 948 F. Supp. 400, 425-26 (D.N.J. 1996). In contrast, the district court found the Trademark Remedy Clarification Act's abolition of Eleventh Amendment immunity to be an inappropriate exercise of power by Congress. *Id.* at 427-28. On appeal, the Third Circuit affirmed the district court's ruling on the Lanham Act claims. Coll. Sav. Bank v. Fla. Prepaid Postsecondary Educ. Expense Bd., 131 F.3d 353 (3d Cir. 1997).

property subject to the protections of the Due Process Clause, the Federal Circuit affirmed the denial of the motion to dismiss.[57] The Supreme Court granted certiorari.[58]

1. *The majority opinion*

Using the framework set forth in *Seminole Tribe*, the Supreme Court examined whether the Patent Remedy Act's abrogation of Eleventh Amendment immunity was constitutional. The Supreme Court answered the first query in *Seminole Tribe*, whether Congress has "unequivocally expresse[d] its intent to abrogate," in the affirmative based on the explicit language of the statute.[59] As for the second query, whether Congress had the power to abrogate the states' immunity, the Court examined the professed bases for the abrogation. The legislative history showed Congress relied on the Patent Clause and Commerce Clause of Article I and the enforcement powers of the Fourteenth Amendment to overcome the Eleventh Amendment.[60] The Court quickly dispensed with the first two grounds based on the *Seminole Tribe* holding that Article I cannot be used to abrogate state sovereign immunity.[61]

Turning to the Fourteenth Amendment, Chief Justice Rehnquist acknowledged the Court's recognition in *Seminole Tribe* that the Fourteenth Amendment "fundamentally altered the balance of state and federal power struck by the Constitution."[62] However, Section 5 of the Fourteenth Amendment empowers Congress to create only legislation that is "appropriate."[63] In *City of Boerne v. Flores*,[64] the Court interpreted the "appropriate" modifier as limiting Congress's enforcement power to remedial legislation.[65] That is, appropriate legislation "deters or remedies constitutional violations," but does not define or create constitutional rights.[66]

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57. *See* Coll. Sav. Bank v. Fla. Prepaid Postsecondary Educ. Expense Bd., 148 F.3d 1343, 1352 (Fed. Cir. 1998).

58. Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank, 525 U.S. 1064 (1999) (mem.).

59. 527 U.S. at 635.

60. *See* S. REP. NO. 102-280, at 7-8 (1992); H.R. REP. NO. 101-960, at 39-40 (1990); *see also Florida Prepaid*, 527 U.S. at 642 n.7.

61. 527 U.S. at 636.

62. *Id.* at 637 (quoting *Seminole Tribe v. Florida*, 517 U.S. 44 (1996) (holding that the Fourteenth Amendment extends federal power "to intrude upon the province of the Eleventh Amendment . . . allow[ing] Congress to abrogate [sovereign] immunity")).

63. *Id.*

64. 521 U.S. 507 (1997).

65. *Id.* at 519.

66. *Id.* at 518.

Focusing on the alleged underlying conduct that the Patent Remedy Act was intended to address, the majority found scant evidence in the legislative record to indicate a pattern of patent infringement by the states.[67] The Court's opinion cited the House Report, which identified only two examples of patent infringement suits against states, and the Federal Circuit's opinion, which identified only eight such suits between 1880 and 1990.[68] Furthermore, the Court explained that infringement of intellectual property only rises to the level of a constitutional violation where the state provides no remedy or inadequate remedies.[69] As to this issue, the majority found that Congress "barely considered the availability of state remedies" and that the limited testimony on the matter indicated the remedies available in some states were "uncertain."[70] The Court concluded that the legislative record indicated "not that state remedies were constitutionally inadequate, but rather that they were less convenient than federal remedies, and might undermine the uniformity of patent law."[71]

The Court also observed that only intentional infringement would be a deprivation within the ambit of the Fourteenth Amendment.[72] The Court found that in passing the Patent Remedy Act "Congress did not focus on instances of intentional or reckless infringement on the part of states. Indeed, the evidence before Congress suggested that most state infringement was innocent or at worst negligent," and thus not a due process violation under the Fourteenth Amendment.[73] The opinion acknowledged that the intent of the alleged infringer is irrelevant in an action for direct patent infringement.[74] Although one could argue it is incongruous to make intent a prerequisite for a due process violation when it is not a requirement for a claim of infringement,[75] the Court was primarily concerned with evidence of intentional, ongoing state conduct to justify abrogation of immunity.[76]

The majority's opinion devoted little discussion to the issue of whether state courts could in fact hear patent or copyright infringement claims in

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67. *See Florida Prepaid*, 527 U.S. at 640-41.
68. *Id.* at 640.
69. *Id.* at 643.
70. *Id*.
71. *Id.* at 644.
72. *Id.* at 645.
73. *Id.*
74. *Id.*; *see also* 35 U.S.C. § 271(a) (2000).
75. *See id.* at 653 (Stevens, J., dissenting) ("I disagree with the Court's assumption that [the constitutional distinction between negligent and intentional misconduct] necessarily applies to deprivations of patent rights").
76. *See id.* at 645.

view of the exclusivity of federal jurisdiction in these areas.[77] Instead, the Court focused on Article I arguments that, under *Seminole Tribe*, could not serve as a justification for abrogating the Eleventh Amendment's grant of immunity. For example, the Court reasoned that the "need for uniformity in the construction of patent law . . . is a factor which belongs to the Article I patent-power calculus,"[78] and thus is not a valid basis for vitiating state sovereign immunity.

Ultimately, the majority did not see sufficient evidence that states were regularly depriving intellectual property owners of property without due process of law, and was unable to find that the scope of the Patent Remedy Act was in proportion to the harm it sought to address. The Court suggested that Congress should have limited the scope of the states' liability under the Act.[79]

2. *The dissent*

The principal thrust of Justice Stevens's dissent was that the constitutionality of the Patent Remedy Act should not hinge on the frequency with which states infringe intellectual property.[80] Rather, he urged that the statutory preemption of patent infringement actions coupled with the "absence of effective state remedies" made the Patent Remedy Act appropriate legislation under the Fourteenth Amendment.[81]

Justice Stevens began by discussing the principle of national uniformity that pervades the patent system. He noted the "strong federal interest" in a uniform interpretation of the patent laws and argued that Congress's Article I power is directly relevant to the question of state immunity because it supports exclusive federal jurisdiction over patent law.[82] He concluded that the abrogation of state sovereign immunity in this field of the law, which would allow states to be sued in federal court, was a logical

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77. The Court did note that a legislative remedy exists in the State of Florida where aggrieved intellectual property owners can file a claims bill with the State. *Id.* at 644 n.9 (citing Fla. Stat. Ann. § 11.065 (West 1998)). *See also supra* note 15.

78. *Florida Prepaid*, 527 U.S. at 645.

79. *Id*. at 647. The Court contrasted state liability with the federal government's limited waiver with respect to infringement claims, which does not allow injunctive relief and treble damages, and awards attorney fees only in limited circumstances. *Id*. at 648 n.11. However, as Justice Stevens observed in his dissent, in private infringement actions, treble damages and attorney's fees are only available in limited circumstances. *Id.* at 663 n.15. (Stevens, J., dissenting).

80. *See id.* at 649 (Stevens, J., dissenting).

81. *Id.* at 649 (Stevens, J., dissenting).

82. *Id.* at 650 (Stevens, J., dissenting).

extension of this strong federal interest.[83] Justice Stevens also discounted the majority's concern with the intent of the infringer because "infringement actions based on mere negligence rarely arise."[84]

Turning to *City of Boerne v. Flores*,[85] Justice Stevens explained why the Patent Remedy Act was appropriate legislation to ensure due process under the Fourteenth Amendment. He first questioned the fairness of the majority faulting Congress for the lack of evidence of state infringement in violation of the Due Process Clause, given that the Supreme Court did not articulate the requirement for such evidence until almost five years after Congress passed the Patent Remedy Act.[86] As for the majority's focus on Congress's failure to examine the available state remedies in enacting the Act, Justice Stevens found sufficient evidence of inadequate state remedies for patent infringement claims.[87] He pointed out that many states have either waived their sovereign immunity to suit in their own courts only in limited circumstances, or not waived it at all.[88] Moreover, Congress reasonably presumed that there are few or no avenues to pursue remedies at the state level for patent infringement given federal preemption of patent law.[89]

Lastly, Justice Stevens discussed the "proportionality" aspect of the legislation as defined in *Boerne*. He noted that the Patent Remedy Act did not seek to alter any state law, "but merely effectuates settled federal policy to confine patent infringement litigation to federal judges."[90] The dissent noted that the abrogation power of the Act was limited to the narrow category of patent infringement cases, and that the Act would impair states' rights only to the extent that states infringe patents.[91]

The holding of *Florida Prepaid* leaves private parties with little ability to enforce their intellectual property rights against states and state entities

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83. *Id.* at 652 (Stevens, J., dissenting).

84. *Id.* at 654 n.5 (Stevens, J., dissenting). As Justice Stevens noted, infringers are generally put on notice of the existence of a patent and asked to cease and desist from infringing before they are served with a lawsuit. *Id.* (Stevens, J., dissenting). Moreover, he contended that the negligent infringer issue was not before the Court because the plaintiff's complaint alleged willful infringement. *See id.* at 653-54 (Stevens, J., dissenting).

85. 521 U.S. 507.

86. *Florida Prepaid*, 527 U.S. at 654 (Stevens, J., dissenting).

87. *Id.* at 655-56 (Stevens, J., dissenting).

88. *Id.* at 658-59 (Stevens, J., dissenting).

89. *Id.* at 658 (Stevens, J., dissenting).

90. *Id.* at 662 (Stevens, J., dissenting).

91. *See id.* (Stevens, J., dissenting).

that infringe those rights.[92] As illustrated by *State Contracting*,[93] states are free to take the fruits of intellectual property without compensating the owners of that property.

III. LEGISLATIVE PROPOSALS

A. Previous Legislative Proposals

Congress's 1990 and 1992 straightforward attempts to abrogate state sovereign immunity with respect to intellectual property claims were its first efforts to address how states should participate in the intellectual property system.[94] Following the invalidation of these laws by the *Florida Prepaid* decisions, members of Congress have made several legislative proposals that would once again subject states to federal intellectual property laws. Senator Leahy introduced the first such proposal, entitled the "Intellectual Property Protection Restoration Act of 1999" (1999 Draft IPPRA).[95]

The 1999 Draft IPPRA had three significant provisions. First, the 1999 Draft IPPRA set forth policy arguments in favor of subjecting states to the federal intellectual property laws.[96] The policy arguments emphasized that states are increasingly involved in securing intellectual property rights and lawsuits concerning those rights, but provided no factual findings or data to support their conclusions.[97]

Second, the 1999 Draft IPPRA contained a participation provision requiring states to waive their sovereign immunity in order to receive the various forms of protection available under the federal intellectual prop-

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92. The companion case to *Florida Prepaid*, *College Savings Bank v. Florida Prepaid Postsecondary Education Expense Board*, had an analogous impact on trademark rights. 527 U.S. 666 (1999). In *College Savings Bank* the plaintiff argued that the Florida Prepaid Board was subject to jurisdiction in federal court under both the abrogation provisions of the Trademark Remedy Clarification Act and under the constructive waiver doctrine. *Id.* at 671-72.The Court abstained from analyzing the Trademark Remedy Clarification Act because it concluded that the rights at issue were not property rights. *Id.* at 673-75. As to the constructive waiver argument, the Court expressly overturned this doctrine as a basis for overcoming sovereign immunity. *Id.* at 680-81.

93. *See supra* Part I.

94. *See generally* U.S.G.A.O. Report, *supra* note 16, at 5; Bohannan & Cotter, *supra* note 12, at 1454-55.

95. S. 1835, 106th Cong. (1999).

96. S. 1835 § 2.

97. S. 1835 § 2(a)(27)-(28).

erty laws.[98] For example, in order for a state to receive a copyright registration from the U.S. Copyright Office, a state would have to expressly waive its sovereign immunity to copyright infringement claims from private entities brought against it in federal court. The participation provision also contained penalties for states that apply for federal intellectual property protection and subsequently invoke the sovereign immunity defense to an intellectual property claim.[99]

Third, the 1999 Draft IPPRA made another attempt to abrogate state sovereign immunity. However, the 1999 Draft IPPRA narrowed the extent of abrogation by distinguishing between statutory and constitutional violations by the state.[100] For statutory violations, the 1999 Draft IPPRA reaffirmed the existence of prospective relief against state officers available under the *Ex Parte Young* doctrine.[101] For those cases of infringement that rise to the level of violations of the Fifth or Fourteenth Amendment, the 1999 Draft IPPRA proposed reinstituting abrogation of sovereign immunity by creating liability for states.[102]

Senator Leahy introduced a modified version of the 1999 Draft IPPRA in 2001 (2001 Draft IPPRA).[103] The most noteworthy change in the 2001 Draft IPPRA was the replacement of the participation provision with a remedies equalization provision.[104] The remedies equalization terms attempted to place states and private entities on the same footing by limiting relief available to a state that has not waived its sovereign immunity.[105] Under this provision, a state that relied on the protection of sovereign immunity could only recover the same relief a private entity could recover against such a state, namely an injunction.[106] Instead of requiring a waiver to participate in the intellectual property system, if a state chose to limit its

98. S. 1835 tit. I (requiring a state to opt-in and waive its sovereign immunity in order for it to acquire any federal intellectual property right).

99. S. 1835 § 113 (including penalties for abandonment of pending applications on behalf of the state for federal intellectual property protection, forfeiture of the opportunity to collect damages for infringement of intellectual property owned by the state, and a one-year bar on acquiring new intellectual property rights).

100. S. 1835 tit. II ("Restoration of Protection for Federal Intellectual Property Rights").

101. S. 1835 tit. II.

102. S. 1835 tit. II.

103. Intellectual Property Protection Restoration Act of 2001, S. 1611, 107th Cong. (2001).

104. S. 1611 §§ 3-4.

105. S 1611 §§ 3-4.

106. S. 1611 § 4.

liability, it would also assume a restriction on the potential relief it could seek in actions to protect its own intellectual property.

B. The Proposed Intellectual Property Protection Restoration Act of 2002

The proposed Intellectual Property Protection Restoration Act of 2002 (2002 Draft IPPRA)[107] combines provisions from both the 1999 Draft IPPRA and the 2001 Draft IPPRA. The 2002 Draft IPPRA also contains factual support not available at the time Congress drafted the earlier legislation.[108] In response to the emphasis the Court in *Florida Prepaid* placed on the lack of support for the abrogation legislation of the early 1990s, the Senate Judiciary Committee commissioned the General Accounting Office to gather data on state infringement of intellectual property. The General Accounting Office report, published in September 2001, provides an exhaustive catalog of data concerning intellectual property infringement by states and the availability of remedies at the state level for intellectual property infringement.[109]

The 2002 Draft IPPRA combines four approaches to expanding the available intellectual property remedies against states. First, the bill contains a limited abrogation of state sovereign immunity.[110] Second, the

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107. S. 2031, 107th Cong. (2002).

108. *See* U.S.G.A.O. Report, *supra* note 16.

109. *See generally id.*

110. Substitute 2002 Draft IPPRA, *supra* note 36, at § 6; *see also* S. 2031 § 5. The abrogation provision provides, in pertinent part:

> § 6(a) Due Process Violations - Any State or State instrumentality that violates any of the exclusive rights of a patent owner under title 35, United States Code, of a copyright owner, author, or owner of a mask work or original design under title 17, United States Code, of an owner or registrant of a mark used in commerce or registered in the Patent and Trademark Office under the Trademark Act of 1946, or of an owner of a protected plant variety under the Plant Variety Protection Act (7 U.S.C. 2321 et seq.), in a manner that deprives any person of property in violation of the fourteenth amendment of the United States Constitution, shall be liable to the party injured in a civil action in Federal court for compensation for the harm caused by such violation.
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> § 6(b) Takings Violations - (1) In General - Any State or State instrumentality that violates any of the exclusive rights of a patent owner under title 35, United States Code, of a copyright owner, author, or owner of a mask work or original design under title 17, United States Code, of an owner or registrant of a mark used in commerce or registered in the Patent and Trademark Office under the Trademark Act of 1946, or of an owner of a protected plant variety under the Plant Variety Protection Act (7 U.S.C. 2321 et seq.), in a manner that takes property in violation

2002 Draft IPPRA codifies the remedies that can be pursued against state officers and employees, including injunctive relief and monetary damages.[111] Third, the bill limits the availability of certain remedies to only those states that have waived their sovereign immunity with respect to intellectual property infringement actions.[112] Finally, the most recent proposed version of the 2002 Draft IPPRA contains a participation provision similar to the participation provision in the 1999 Draft IPPRA.[113]

IV. ANALYSIS OF THE 2002 DRAFT IPPRA

The obvious unfairness in a system where states are able to secure intellectual property rights and sue others for damages for infringing those rights, but are not subject to suits for damages themselves, is the motivating force behind recent attempts to correct the current gap in intellectual property rights.[114] The constitutional basis for the gap is the Eleventh

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> of the fifth and fourteenth amendments of the United States Constitution, shall be liable to the party injured in a civil action in Federal court for compensation for the harm caused by such violation.

Substitute 2002 Draft IPPRA, *supra* note 36, at § 6; *see also* S. 2031 § 5.

111. Substitute 2002 Draft IPPRA, *supra* note 36, at § 5 (providing for remedies against a state officer or employee including "monetary damages assessed against the officer or employee, declaratory and injunctive relief, costs, attorney fees, and destruction of infringing articles); *see also* S. 2031 § 4.

112. Substitute 2002 Draft IPPRA, *supra* note 36, at § 4 (amending 35 U.S.C. § 287 to state that no remedies under 35 U.S.C. §§ 283, 284 and 289 (2000) will be awarded to a state that has not waived its sovereign immunity); *see also infra* note 198. Section 4(a) provides, in pertinent part:

> No remedies under section 283, 284 or 289 shall be awarded in any civil action brought under this title for infringement of a patent issued on or after January 1, 2003, if a State or State instrumentality is or was at any time the legal or beneficial owner of such patent, except upon proof that — (A) on or before the date the infringement commenced or January 1, 2005, whichever is later, the State has waived its immunity, under the eleventh amendment of the United States Constitution and under any other doctrine of sovereign immunity, from suit in Federal court brought against the State or any of its instrumentalities, for any infringement of intellectual property protected under Federal law.

Substitute 2002 Draft IPPRA, *supra* note 36, at § 4(a).

113. Substitute 2002 Draft IPPRA, *supra* note 36, at § 3 (adding to 35 U.S.C. § 102 (2000), "that person is a State or any of its instrumentalities; and . . . that State has not waived its immunity, under the eleventh amendment of the United States Constitution . . . from suit in federal court."); *see also* Intellectual Property Protection Restoration Act of 1999, S. 1835, 106th Cong. (1999).

114. The Senate Report on the Patent Remedy Act provides a useful example. "A public school such as UCLA can sue a private school such as USC for patent infringement, yet USC cannot sue UCLA for the same act." S. REP. NO. 102-280, at 9 (1992).

Amendment, which affirms "that federal jurisdiction over suits against unconsenting States 'was not contemplated'" when the Constitution established the federal courts.[115] However, the Court also conceded that the Fourteenth Amendment "fundamentally altered the balance of state and federal power struck by the Constitution."[116] Given these competing principles, Congress faces a difficult task in crafting legislation that will satisfy the standards set forth by the Supreme Court and also achieve the goal of a national intellectual property system.

A. The Abrogation Provision

Section 6 of the 2002 Draft IPPRA contains a limited abrogation of state sovereign immunity. The proposed bill differs from the Copyright Remedy Clarification Act of 1990, Patent and Plant Variety Protection Remedy Clarification Act of 1992, and the Trademark Remedy Clarification Act of 1992 in that it distinguishes between statutory claims against a state employee and claims that rise to the level of constitutional violations.[117] The 2002 Draft IPPRA abrogates state immunity only in the case of a due process or a takings violation.[118] For example, although not explicitly stated in the bill, a constitutional violation would ostensibly exist where a state has no system, or an inadequate system, to hear private litigants' infringement allegations against the state.[119]

Although the 2002 Draft IPPRA's abrogation provision is more narrow than the legislation of the early 1990s, the Supreme Court has set a relatively high bar for legislation that attempts to abrogate immunity with respect to intellectual property claims. In particular, the Court in *Florida Prepaid* focused on the need for the legislative record to justify abrogating state immunity under the Eleventh Amendment. The GAO report commissioned by Congress provides some of the factual background required by the Court.[120] In preparing the report, the GAO assessed the extent to which

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115. Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank, 527 U.S. 627, 634-35 (1999) (quoting *Hans v. Louisiana*, 134 U.S. 1 (1890)).

116. *Id*. at 637 (quoting *Seminole Tribe v. Florida*, 517 U.S. 44, 59 (1996)).

117. *Compare* Substitute 2002 Draft IPPRA, *supra* note 36, § 5 *with* § 6. In response to the Supreme Court's distinction in *Florida Prepaid* between unintentional and intentional infringement, the proposed legislation differentiates between statutory claims for infringement against state employees and constitutional claims against the state. Section 5 of the 2002 Draft IPPRA provides for injunctive relief and damages against the employee as an individual where the claims of infringement are statutory. In contrast, where the state's infringement rises to the level of a constitutional violation, Section 6 overrides the Eleventh Amendment and authorizes an action against the state in federal court.

118. *See supra* note 110.

119. *See Florida Prepaid*, 527 U.S. at 643.

120. U.S.G.A.O. Report, *supra* note 16.

states are involved in the acquisition of and litigation concerning intellectual property rights and whether states consistently encroach on private owners' rights.[121] To that end, the report attempts to catalog all of the intellectual property lawsuits involving states and state entities since 1985.[122] The GAO also sought the opinions of the intellectual property community as to whether state immunity is an issue that needs to be addressed through legislation.[123]

The GAO found relatively few intellectual property lawsuits involving states.[124] Although the precise number of intellectual property lawsuits against states is difficult to determine, the report indicated that of all intellectual property lawsuits brought in federal court since 1985, fewer than 0.1 % involved a state or state entity as the plaintiff or defendant.[125] Significantly, 37 of the 100 lawsuits identified in the report concerned state institutions of higher education, while the remaining 63 named other state entities.[126] The report also emphasized the difficulty in collecting evidence of every intellectual property dispute that includes a state.[127] For example, surveys collected from state attorneys general identified at least 78 instances of infringement accusations against a state that were handled administratively without a lawsuit being filed.[128]

If the abrogation provisions of the proposed legislation are subjected to a constitutional challenge, the relatively small number of suits identified in the GAO report may serve as a stumbling block in view of the majority opinion in *Florida Prepaid*. The Court's opinion rested heavily on the argument that abrogation is only appropriate where the states regularly violate the federal constitution, requiring federal remedial action.[129] Although

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121. *See id.*

122. *Id.* at 2.

123. *Id.* at 4.

124. *Id.* at 7. However, the legislative history of the 1990 Copyright Remedy Act cites numerous instances of states infringing copyrights. *Florida Prepaid*, 527 U.S. at 658 n.9 (Stevens, J., dissenting).

125. U.S.G.A.O. Report, *supra* note 16, at 9-12. Of the 100 lawsuits the GAO reviewed, 58 named a state as a defendant and 42 named a state as a plaintiff. *Id*. The suits reviewed are less than 0.1% of the over 104,000 intellectual property lawsuits filed in federal district court over that same time period. *Id.* Although the GAO was not able to collect data on the total number of intellectual property suits filed in state courts, 17 of the 100 suits naming a state as a party were brought in a state court. *Id.* at 66-67.

126. *Id.*

127. *Id.* at 8-9.

128. *Id.* at 12.

129. The Court noted that Congress did not identify a pattern of state infringement, "[u]nlike the undisputed record of racial discrimination confronting Congress in the voting rights cases." *Florida Prepaid*, 527 U.S. at 640 (citing *City of Boerne v. Flores*, 521

there is not a specific threshold that justifies action under Section 5 of the Fourteenth Amendment, the Court in *Florida Prepaid* said "[t]here must be a congruence and proportionality between the injury to be prevented or remedied and the means adopted to that end."[130]

For example, a recent decision from the Second Circuit considered the constitutionality of an abrogation of sovereign immunity pursuant to the 4-R Act, a law concerning state taxation of railways.[131] In upholding the abrogation as a valid exercise of Congressional power under the Fourteenth Amendment, the court found that Congress identified a history and pattern of discriminatory taxation against railroads by the states in that the non-voting, often nonresident railroads were "easy prey" for state tax assessors.[132] The Second Circuit pointed to the "fifteen years of deliberations and investigations [wherein] Congress concluded that railroads are overtaxed by at least $50 million each year."[133] Those opposed to federal abrogation of sovereign immunity for intellectual property claims would likely argue that the extent of state infringement does not rise to the same level of unconstitutional conduct as found in the voting rights cases cited by the Supreme Court or the evidence supporting the 4-R Act.

On the other hand, the small number of lawsuits may be attributable to a general belief that states were not subject to suit for infringement during much of the 15-year period surveyed in view of *Atascadero*, *Florida Prepaid*, and the federal courts' exclusive jurisdiction under 28 U.S.C. § 1338(a) (2000). Furthermore, the United States Patent and Trademark Office opined that the data reported by the U.S.G.A.O. was inconclusive as to whether the number of lawsuits constituted a pattern of infringement.[134] Among other comments, it remarked "[g]iven that state entities constitute only a tiny fraction of the total number of parties using intellectual property, fifty-eight lawsuits implicating state entities as defendants seems like a substantial number."[135]

Aside from the quantitative data, additional evidence in the report addresses other questions raised by the Court and supports a limited abroga-

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U.S. 507 (1997)). In *City of Boerne*, the Court reviewed a number of cases upholding various portions of the Voting Rights Act of 1965 where there was extensive evidence in the legislative history of literacy tests being applied unconstitutionally to prevent people from voting. *City of Boerne*, 521 U.S. at 525-27.

130. *Florida Prepaid*, 527 U.S. at 639 (quoting *City of Boerne*, 521 U.S. at 519-20).

131. CSX Transp., Inc. v. N.Y. State Office of Real Prop. Svcs., 306 F.3d 87 (2d Cir. 2002).

132. *Id.* at 93 (quoting from the legislative history).

133. *See id.* (internal quotations omitted).

134. U.S.G.A.O. Report, *supra* note 16, at 69.

135. *Id.*

tion of state immunity. The majority in *Florida Prepaid* found that Congress did not adequately examine the existence of remedies for intellectual property infringement at the state level.[136] To correct this deficiency, the GAO polled state representatives, intellectual property practitioners and legal scholars. Most authorities agreed that remedies for intellectual property claims are largely an untested avenue in the state courts.[137] In light of the general federal preemption in the litigation of patent and copyright claims, most of the people the GAO consulted did not view an action in state court as a viable option.[138]

Some respondents to the GAO's poll suggested that a cause of action for a taking of property without compensation might be possible in state court, but acknowledged that the idea of "taking" intellectual property rights is untested.[139] Other respondents proposed state actions based on contract or tort law.[140] Both options pose additional problems. For instance, bringing a suit for infringement based on breach of contract requires that an agreement, express or implied, existed between the state and the owner of the intellectual property.[141] Many cases of infringement involve parties that have not entered into an express agreement and do not have a relationship that might support an argument that an implied contract exists. Damages in a contract suit would also be limited to those provided for by the agreement.[142] Both a contract and tort action attempting to recover for intellectual property infringement would have to overcome the federal exclusive jurisdiction of 28 U.S.C. § 1338. In other words, the intellectual property owner would have to convince a state court that its claim was not merely an infringement claim dressed in state law

136. Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank, 527 U.S. 627, 643 (1999).

137. U.S.G.A.O. Report, *supra* note 16, at 17-19.

138. *Id.*

139. *See id.* at 19. "Takings" case law is generally grouped into either possessory takings or regulatory takings, and primarily concerns governmental action affecting real property or tangible property. *See* Paul J. Heald and Michael L. Wells, *Remedies for the Misappropriation of Intellectual Property by State and Municipal Governments Before and After Seminole Tribe: The Eleventh Amendment and Other Immunity Doctrines*, 55 WASH. & LEE L. REV. 849, 865-67 (1998). However, in considering whether government regulations affect a taking of property, courts have held that the interest in an intangible trade secret is a protected property right under the Fifth Amendment. *See* Ruckelshaus v. Monsanto, 467 U.S. 986, 1003-04 (1984); *see also supra* note 12.

140. U.S.G.A.O. Report, *supra* note 16, at 19.

141. *Id.*

142. *See id.*

clothes.[143] Finally, many states enjoy some form of governmental immunity in their own courts that would serve as an obstacle to pursuing a cause of action in state court.[144]

Some state officials polled by the GAO argued that, because states are governmental entities, they can be trusted not to infringe intellectual property rights.[145] A similar argument suggests that state entities, such as research universities and hospitals, will police themselves because they are heavily involved in the development, acquisition, and use of intellectual property, based on their experience in acquiring and respecting intellectual property rights.[146] However, proficiency in acquiring intellectual property assets does not necessarily equate with noninfringement of others' intellectual property rights. As the *Florida Prepaid* decision acknowledges, intellectual property infringement can often occur innocently or negligently.[147]

Admittedly, unlike private entities, states are subject to social and legal obligations that prevent them from pursuing overt policies of infringing intellectual property.[148] However, the "self-policing" position is troubling considering the growing role of universities in the development and use of

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143. *See id.* at 18-19. A recent decision suggests another creative approach to bringing an infringement action in federal court where a private entity sponsors research at a state university. In *Syrrx, Inc. v. Oculus Pharmaceuticals, Inc.*, No. 02-321-JJF, 2002 WL 1840917 (D. Del. Aug. 9, 2002), an exclusive licensee brought suit against Oculus for inducing the University of Alabama at Birmingham to infringe its licensed patent. The Court denied the defendant's motion to dismiss finding that, although the state entity itself cannot be sued for direct infringement, a court can still find that the University infringed the patent in order to support a claim for inducing infringement. However, the utility of such vicarious lawsuits obviously rests on the existence of a private party that is contributing to or inducing infringement by a state entity.

144. *See* U.S.G.A.O. Report, *supra* note 16, at 23. Some have proposed that 28 U.S.C. § 1338 be amended to allow for concurrent jurisdiction in cases where states are accused of infringing intellectual property. *See* Chavez v. Arte Publico Press, 204 F.3d 601, 608 n.10 (5th Cir. 2000). However, the general co-existence of sovereign immunity at the state level undermines the merit of this suggestion.

145. U.S.G.A.O. Report, *supra* note 16, at 25; *see generally* Peter S. Menell, *Economic Implications of State Sovereign Immunity from Infringement of Federal Intellectual Property Rights*, 33 LOY. L.A. L. REV. 1399 (2000) (discussing the legal, social, political, and market constraints that prevent widespread infringement by states of federal intellectual property rights).

146. U.S.G.A.O. Report, *supra* note 16, at 25.

147. *See* Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank, 527 U.S. 627, 645 (1999); *see also id.* at 658 n.9 (Stevens, J., dissenting) (noting numerous instances of copyright infringement by states and state entities).

148. *See* Menell, *supra* note 145 at 1428-32.

technology.[149] Research universities, many of which are state entities,[150] have in the last twenty years significantly increased their acquisition and development of intellectual property assets.[151] For example, the number of intellectual property licenses granted by universities in the early 1990s as compared with the early 1980s has increased 5,000%.[152] Over the last ten years, state universities have also filed a larger number of patent applications and generated significantly more revenue from licenses, reflecting a concerted effort by universities to become significant players in the intellectual property field.[153] This growing dependence on intellectual property-based revenue is a reaction to decreased state and federal funding for universities.[154] In view of the inherent lag time in developing technology, securing patent protection, and bringing products to market, the litigation resulting from the recent emphasis on securing intellectual property assets is sure to grow in the coming years.[155] Although state governments and entities do not compete in the marketplace in the same way that private corporations do,[156] the argument that they can be trusted not to infringe the intellectual property of others appears to be largely self-serving.

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149. *See* Margaret Cronin Fisk, *Ivory Towers Fire Back Over Patents*, NAT'L L.J., August 26, 2002, at A1.

150. State affiliated universities, such as the University of California, Michigan State University, and Florida State University, are typically among the top schools when comparing royalties earned from intellectual property licenses. *See* Kenneth S. Dueker, *Biobusiness on Campus: Commercialization of University-Developed Biomedical Technologies*, 52 FOOD & DRUG L. J. 453, 480 tbl.7 (1997).

151. *See* Steve L. Bertha, *Intellectual Property Activities in U.S. Research Universities*, 36 IDEA 513, 515 (1996) (referring to the passage of the Bayh-Dole Act of 1980 that allows universities to own and manage inventions obtained in the course of research funded by government sponsors).

152. Dueker, *supra* note 150, at 465. Specifically, "[f]rom 1974 through 1984, just over 1000 licenses were granted by universities; from 1989 through 1990, 10,510 licenses were granted." *Id.* (citations omitted).

153. *Id.* at 479, 489, 496, 507; *see also* Letter from the National Association of State Universities and Land-Grant Colleges to Senator Leahy (April 17, 2002), *available at* http://www.nasulgc.org/washington/watch/letters2002/s2031 (acknowledging that "public research universities are some of the greatest beneficiaries of intellectual property laws"). Although the majority of revenues are generated from licenses for patented inventions and copyrights on printed materials and software, royalties can also be extracted from valuable trademarks. A good example of a valuable trademark is the University of Florida's development of "Gatorade." *See* Bertha, *supra* note 151, at 517.

154. *See* Menell, *supra* note 145, at 1433-35 (noting that state universities are increasingly drawn into the commercial arena and that they have been "involved in numerous and substantial intellectual property disputes").

155. *See* Dueker, *supra* note 150, at 490; Fisk, *supra* note 149.

156. Private entities pursue intellectual property rights for a number of reasons, including as defensive leverage to avoid being sued and as an offensive weapon to block

Despite the GAO report's factual support for reform, Section 6 of the 2002 Draft IPPRA may not have gone far enough in reigning in the abrogation provision. The proposed legislation provides states with the same protections currently afforded to the federal government[157] in that it explicitly precludes the treble or enhanced damages provided by 35 U.S.C. § 284.[158] Section 6 is also narrower than the abrogation legislation of the early 1990s in that it is limited to constitutional violations.[159]

However, the proposed legislation does not clearly state which cases of infringement will meet the constitutional violation threshold. In view of the rigorous standard for review set forth in *Florida Prepaid*,[160] this section of the 2002 Draft IPPRA would have a better chance of surviving judicial scrutiny if it explicitly defined such cases of infringement. For example, the majority in *Florida Prepaid* also proposed limiting abrogation to situations where: 1) states intentionally infringe; or, 2) where a state provides no forum for a remedy.[161] In the first case, the Court particularly emphasized that negligent or innocent infringement does not constitute a due process violation.[162] As to the second situation, if a state provided a sufficient avenue for an intellectual property owner to pursue a remedy, an infringement by the state would not implicate due process concerns.[163] Applying this notion to the 2002 Draft IPPRA, if a state voluntarily established an administrative procedure to address intellectual property infringement claims, that state should be exempted from the abrogation provision. Inserting these limitations into the abrogation provision would more clearly define its scope and keep with the Court's requirement of proportionality.

The abrogation provision also does not enumerate the forums where a private party may sue a state. The Supreme Court recently held that state sovereign immunity also insulates states from having to appear before quasi-judicial bodies, such as the Federal Maritime Commission (FMC).[164]

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competitors out of a particular market segment. In contrast, state entities generally do not have the same agenda to control markets and primarily pursue intellectual property to generate licensing revenues.

157. *See supra* note 41.

158. Substitute 2002 Draft IPPRA, *supra* note 36, at § 6(c); *see also* S. 2031, 107th Cong. § 5(c).

159. Substitute 2002 Draft IPPRA, *supra* note 36, at § 6; *see also* S. 2031 § 5.

160. *See supra* Part II.B.1.

161. Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank, 527 U.S. 627, 647 (1999).

162. *Id.* at 645.

163. *Id.* at 643.

164. Fed. Mar. Comm'n v. S.C. State Ports Auth., 122 S. Ct. 1864, 1874 (2002).

The case involved a private party that filed an action with the FMC against the South Carolina State Ports Authority for alleged violations of the Shipping Act of 1984, seeking damages and injunctive relief.[165] The Court concluded that, given the similarities between an adversarial proceeding before the FMC and an action in an Article III court, South Carolina's sovereign immunity bars such an action.[166] In so holding, the majority pointed out that it would be inconsistent to prohibit Congress from using its Article I power to abrogate state sovereign immunity in Article III courts, but at the same time allow Congress to create Article I administrative tribunals where sovereign immunity does not apply.[167]

Two such quasi-judicial bodies frequently hear intellectual property suits. The U.S. International Trade Commission (U.S.I.T.C.) has recently become a popular forum for resolving intellectual property disputes because of the expedited nature of its proceedings.[168] Adversarial proceedings over intellectual property rights can also take place before the Patent and Trademark Office in the form of an interference proceeding or under the recently established inter partes reexamination procedure.[169] A logical extension of the holding in *Federal Maritime Commission* may prevent a party from pursuing an action against a state before the Patent and Trademark Office or the U.S.I.T.C. Although the Patent and Trademark Office and the U.S.I.T.C. do not have the power to award money damages,[170] and will therefore not always be the preferred forum for intellectual property suits, the proposed legislation should seize the opportunity to address the power of quasi-judicial tribunals as they still could play an important role

165. *Id.* at 1868.

166. *Id.* at 1873-74.

167. *Id.* at 1875.

168. *See* Bryan A. Schwartz, *Where the Patent Trials Are: How the U.S. International Trade Commission Hit the Big Time as a Patent Litigation Forum*, A.B.A. INTELL. PROP. L. NEWSL., Winter 2002, at 1.

169. An interference is a proceeding before the Patent Office to determine who is the first party to invent when more than one applicant files an application for substantially the same invention. *See* DONALD S. CHISUM, CHISUM ON PATENTS § 10.09 (2002). Inter partes reexamination is a process whereby a third party can ask the Patent Office to reexamine an issued patent in view of prior art that arguably raises a substantial new question of patentability. *See id.* § 11.07[4][g].

170. The Court's opinion in *Federal Maritime Commission* explicitly rejects the notion that state sovereign immunity is premised on the goal of protecting states from money damages. Rather, "the doctrine's central purpose is to 'accord the States the respect owed them as' joint sovereigns." Fed. Mar. Comm'n v. S.C. State Ports Auth., 122 S. Ct. 1864, 1877 (quoting *P.R. Aqueduct & Sewer Auth. v. Metcalf & Eddy, Inc.*, 506 U.S. 139, 146 (1993)).

in resolving intellectual property disputes that concern states and state entities.

B. Actions Against State Officers

As a fallback for those claims that do not rise to the level of a constitutional violation, Section 5 of the 2002 Draft IPPRA provides for an explicit cause of action against an "officer or employee of a state or state instrumentality" for statutory violations of intellectual property rights.[171] This section of the proposed legislation codifies the doctrine set forth in *Ex Parte Young* while also providing for money damages against state employees in their individual capacity.[172] *Ex Parte Young* created an exception to the immunity retained by the states under the Eleventh Amendment, allowing a private party to sue an officer or employee of the state challenging the legality of the state official's actions in executing her duties.[173] The Supreme Court subsequently refined the *Ex Parte Young* doctrine by explicitly limiting the recovery available against state officers and employees sued in their official capacity to prospective (i.e. injunctive) relief.[174]

In *Edelman v. Jordan*, the plaintiffs sought, among other remedies, an order that a state official release withheld welfare benefits.[175] In articulating the distinction between prospective and retroactive relief, the Court in *Edelman* noted that regardless of how the defendants are named in the suit, the primary issue in determining whether an action is barred by the Eleventh Amendment is whether the relief sought would "impose a liability which must be paid from public funds in the state treasury."[176] Significantly, the Eleventh Amendment and the foregoing case law do not prohibit actions for damages against state employees in their *personal* capacity.[177] However, as the Fourth Circuit later enunciated, in determining whether an action for damages is barred by the Eleventh Amendment, a court must consider whether the relief sought implicates the employee's personal liability or her official duties.[178]

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171. Substitute 2002 Draft IPPRA, *supra* note 36, at § 5; *see also* S. 2031, 107th Cong. § 4 (2002).

172. 209 U.S. 123 (1908).

173. *Id.* at 155-56.

174. Edelman v. Jordan, 415 U.S. 651, 663 (1974).

175. *See id.* at 656.

176. *See id.* at 663.

177. *See infra* note 185 and accompanying text.

178. Richard Anderson Photography v. Brown, 852 F.2d 114, 122 (4th Cir. 1988) (quoting *Larson v. Domestic & Foreign Commerce Corp.*, 337 U.S. 682 (1948) (Frankfurter, J., dissenting)).

Injunctive relief against state officers or employees is generally considered one of the few remaining options available to intellectual property owners with claims against a state in the wake of *Florida Prepaid*.[179] A recent decision from the Southern District of New York relied on *Ex Parte Young* to allow a copyright action seeking injunctive relief to proceed against two university officials.[180] In denying a motion to dismiss as to the university officials, the Court found plaintiff's claims concerning the officials' involvement in the alleged infringement to be "limited," but sufficient to sustain the suit.[181] Nonetheless, the Supreme Court has continually narrowed the contours of the *Ex Parte Young* doctrine. In *Idaho v. Coeur d'Alene Tribe of Idaho*, the Court cautioned that Eleventh Amendment immunity is a limitation on federal court jurisdiction and to allow every action for prospective relief against a state officer to proceed would undermine the holding of *Seminole Tribe*.[182] Furthermore, from a practical standpoint, the costs of litigation generally do not justify pursuit of an equitable remedy without the potential for collecting damages.[183]

Section 5 of the 2002 Draft IPPRA addresses the cost issue by allowing a private intellectual property owner to recover money damages, costs, and attorney's fees in a suit against a state officer or employee.[184] Section 5 essentially codifies the principle, made clear by the Fourth Circuit in *Richard Anderson Photography v. Brown*, that a state employee can be sued for damages in her individual capacity irrespective of the Eleventh Amendment.[185] In *Richard Anderson Photography*, a public relations director was sued for infringement based on alleged unauthorized use of copyrighted photographs.[186] The Fourth Circuit concluded that, although a claim for damages against the public relations director in her official capacity was barred by the Eleventh Amendment, the plaintiff could pursue

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179. *See* U.S.G.A.O. Report, *supra* note 16, at 16.

180. Salerno v. City Univ. of N.Y., 191 F. Supp. 2d 352, 357 (S.D.N.Y. 2001).

181. *Id.*

182. 521 U.S. 261, 269 (1997) (finding that an action to quiet title to land concerns the unique sovereignty interests of the State of Idaho and does not fall within the *Ex Parte Young* doctrine); *see also* Earles v. State Bd. of Certified Pub. Accountants, 139 F.3d 1033, 1036 (5th Cir. 1998) (noting that the Eleventh Amendment prohibits an action where the state, although not the nominal party, is the true party in interest).

183. *See* U.S.G.A.O. Report, *supra* note 16, at 16.

184. Substitute 2002 Draft IPPRA, *supra* note 36, at § 5; *see also* S. 2031, 107th Cong. § 4 (2002).

185. 852 F.2d 114, 122 (4th Cir. 1988); *see also* Kersavage v. Univ. of Tenn., 731 F. Supp. 1327, 1330 (E.D. Tenn. 1989); Lane v. First Nat'l Bank, 687 F. Supp. 11, 15 (D. Mass. 1988), *aff'd*, 871 F.2d 166 (1st Cir. 1989).

186. *Richard Anderson Photography*, 852 F.2d at 122.

a claim against the university employee in her individual capacity.[187] The court in *Lane v. First National Bank* reached a similar conclusion where the plaintiff alleged certain state employees infringed her copyrighted databases.[188]

However, collecting money damages against an individual employee of the state may prove difficult in practice. First, the individual may be protected nevertheless by substantive immunity. The Supreme Court has held that "government officials performing discretionary functions, generally are shielded from liability for civil damages insofar as their conduct does not violate clearly established statutory or constitutional rights of which a reasonable person would have known."[189] Second, an individual government employee may not have the means to pay the often significant award in an infringement action.[190] It is the individual's employer, the state, that has the deep pockets to pay a damages award. Although the provisions of Section 5 are consistent with Eleventh Amendment jurisprudence, they do not by themselves completely close the gap in an intellectual property owner's rights created by state sovereign immunity.

C. The Equal Remedies Provision

The 2002 Draft IPPRA also conditions the availability of certain remedies to a state on the state's voluntary waiver of sovereign immunity.[191] In other words, if a state does not voluntarily submit to jurisdiction in federal court for all cases involving infringement of intellectual property under federal law, then the state, as a potential plaintiff, will not enjoy the full extent of the remedies provided for under those same laws. This section of the 2002 Draft IPPRA thus levels the playing field between private parties and states without abrogating state immunity altogether. In view of the severability clause in Section 7(c) of the 2002 Draft IPPRA, even if the other more aggressive provisions are overturned by the courts,

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187. *Id.* at 116.

188. 687 F. Supp. at 11.

189. Harlow v. Fitzgerald, 457 U.S. 800, 818 (1982). *But see Richard Anderson Photography*, 852 F.2d at 122-23 (remanding qualified immunity issue and noting that the Supremacy Clause precludes application of a state immunity law); *Lane*, 687 F. Supp. at 15-17 (denying the individual defendants' motion for summary judgment based on qualified immunity).

190. However, in certain situations a state employee may be indemnified by the state employer for such liability.

191. *See supra* note 112.

the equal remedies provision will likely protect some private litigants from liability to states for damages.[192]

Although states and state entities are increasingly active in the acquisition and enforcement of intellectual property, it is unlikely they would voluntarily waive the blanket protection of sovereign immunity for the opportunity to pursue damages for infringement of intellectual property.[193] For example, many state universities are empowered by their respective state legislatures to enforce intellectual property rights.[194] However, the universities primarily derive revenues from their intellectual property through licensing agreements, and not from judgments of infringement obtained in court.[195]

Universities with sophisticated intellectual property licensing programs typically earn revenues in the millions or tens of millions of dollars each year.[196] In contrast, the ten largest patent damages awards between 1982 and 2000 all exceeded $100,000,000.[197] Consequently, the exposure to the potentially substantial money judgments that often result from intellectual property litigation would in most cases far outweigh the potential benefits that a state or state entity could accrue from being able to sue for money damages. States, because of their financial resources, are attractive defendants in lawsuits. Furthermore, states and state entities engage in an expansive range of activities, increasing their potential liability. Assuming a state chooses not to waive its immunity, under Section 4 of the 2002 Draft IPPRA the state will still retain the same potential remedies a private litigant would have against the state, namely injunctive relief and attorney's fees.[198] Thus, in light of the potential for significant liability, states

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192. *See* S. 2031, 107th Cong. § 7(c) (2002) (regarding severability of the provisions).

193. *See* U.S.G.A.O. Report, *supra* note 16, at 2.

194. *See, e.g.*, FLA. STAT. ANN. § 240.229 (West 1998) ("[E]ach university is authorized, in its own name, to: (1) Perform all things necessary to secure letters of patent, copyrights, and trademarks on any work products and to enforce its rights therein. . . (3) Take any action necessary, including legal action, to protect the same against improper or unlawful use or infringement.").

195. *See generally* Dueker, *supra* note 150.

196. *See id.* at 489, 496.

197. *See* Kathleen M. Kedrowski & Jennifer L. Knabb, *An In-Depth Look at Historical Patent and Trademark Damages Trends*, A.B.A. INTELL. PROP. L. NEWSL., Spring 2002, at 9.

198. For example, as to the patent laws, the equal remedies provision prohibits remedies under 35 U.S.C. § 284 (2000) (damages) and 35 U.S.C. § 289 (2000) (statutory damages for design patent), but does not bar relief under 35 U.S.C. § 283 (2000) (providing courts with the power to grant injunctions "to prevent the violation of any right secured by the patent") or 35 U.S.C. § 285 (2000) (giving the power to "award reasonable attor-

will not likely waive the immunity provided by the Eleventh Amendment.[199]

Although Section 4 of the proposed legislation is less likely than some of the other provisions to receive a direct constitutional challenge, in its current form it is also likely to be largely ineffectual for the reasons discussed above. States that decline to waive their immunity will still be able to pursue patents, federal copyright registrations, and federal trademark registrations. However, without the ability to enforce intellectual property rights through the threat of litigation, states will have less incentive to invest the resources to develop an intellectual property portfolio. In other words, undermining the ability to enforce intellectual property rights dilutes their worth because intellectual property derives value from its exclusive nature. The net effect of the equal remedies provision as currently drafted may be to dampen the incentive for states, and particularly state universities, to pursue and protect intellectual property.

With modification, the equal remedies provision could be more effective at encouraging states to respond to the intellectual property claims of private parties. One approach would be to allow states to set up an administrative procedure for parties to file claims of intellectual property infringement against the state as an alternative to waiving their immunity in federal court. Such administrative procedures already exist to some extent in Florida and California.[200]

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ney fees to the prevailing party"). However, the substitute version of the 2002 Draft IPPRA, *see infra* note 205, includes the respective injunctive relief provisions of each of the patent, copyright, and trademark statutes as a prohibited remedy. If this substitute version of the 2002 Draft IPPRA were adopted, states and private entities would not have the same potential remedies in that private litigants could still pursue injunctive relief, but states could not. This more stringent version of the equal remedies provision is thus less likely to withstand the Supreme Court's requirement of proportionality.

199. In the limited situation where a state or state entity is the owner of the intellectual property in dispute, some courts have found a constructive waiver of sovereign immunity. *See* T. Michael McGuire v. Regents of the Univ. of Mich., No. 2: 99CV1231, 2000 WL 1459435, at *4 (S.D. Ohio Sept. 21, 2000); New Star Lasers, Inc. v. Regents of the Univ. of Cal., 63 F. Supp.2d 1240, 1244 (E.D.Cal. 1999) (holding that university regents are not immune from suit in a declaratory judgment action seeking invalidity of the university's patent, notwithstanding the Supreme Court decisions in *Florida Prepaid* and *College Savings Bank*).

200. *See* Chew v. California, 893 F.2d 331, 332 (Fed. Cir. 1990) (referring to the plaintiff's action in filing a claim with the State of California Board of Control before bringing suit in federal court); Jacobs Wind Elec. Co. v. Dep't of Transp., 626 So. 2d 1333, 1338 (Fla. 1993) (Harding, J., dissenting) (citing FLA. STAT. ANN. § 11.065 (West 1998), which ostensibly permits a citizen to file a claim for compensation with the state

Even assuming that state courts could hear intellectual property claims without conflicting with exclusive federal jurisdiction over patent law, a state administrative procedure for hearing intellectual property claims would likely be preferable to having state courts hear intellectual property cases for several reasons. First, a general administrative procedure may not implicate the exclusivity provisions of 28 U.S.C. § 1338.[201] Second, an administrative procedure can be simplified, making it less likely to raise the uniformity issues that prompted the creation of the Federal Circuit. Creating an administrative procedure to hear claims would in this respect be better than having state courts become involved in interpreting patent and copyright law and creating potentially conflicting precedent.[202] Third, such an alternative is in accord with the Supreme Court's opinion in *Florida Prepaid*. The majority's focus on the existence of state remedies[203] and the need for Congress to proceed judiciously in abrogating the Eleventh Amendment[204] calls out for creative state solutions to the problem. Finally, there is a much greater probability that states would adopt an administrative claim procedure of their own design, as opposed to a wholesale waiver of their sovereign immunity. Although requiring states to establish administrative procedures may not effectively redress all intellectual property claims, it is likely to have a more constructive impact than the current version of Section 4.

D. The Participation Provision

At the time of this writing, an additional provision was set forth in an amended version of the proposed legislation, but the bill had not been formally introduced in Congress.[205] The participation provision contained in Section 3 of the 2002 Draft IPPRA absolutely conditions a state's ownership of patents, trademarks, or copyrights on that state's waiver of its sovereign immunity.[206] In other words, if the state does not formally agree

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legislature). The California state code permits a citizen to file a claim for damages with the state legislature. *See* CAL. GOV'T CODE ANN. §§ 905.2(c), 905.4 (West 1995).

201. Section 1338 states, in pertinent part, "[s]uch jurisdiction shall be exclusive of the *courts* of the states in patent, plant variety protection and copyright cases." 28 U.S.C. § 1338(a) (2000) (emphasis added).

202. A private party wanting to challenge the adequacy of such an administrative proceeding could potentially bring a due process claim in federal court as acknowledged in *Florida Prepaid*. Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank, 527 U.S. 627, 643 (1999).

203. *See id.*

204. *See id*. at 646-47.

205. *Draft Leahy/Hatch Amendment Stiffens IP Protection/Immunity Waiver Trade-Off*, 64 BUREAU OF NAT'L AFFAIRS PAT., TRADEMARK & COPYRIGHT J. 32 (2002).

206. Substitute 2002 Draft IPPRA, *supra* note 36, at § 3.

to open itself to suit in federal court for intellectual property claims, the state cannot apply for trademark registrations, copyright registrations, and patents with the respective federal agencies that issue them. This provision overlaps the equal remedies provision by excluding states from obtaining intellectual property altogether, and the 2002 Draft IPPRA does not indicate which section takes precedence. However, Section 3 logically applies to all future applications for federal intellectual property protection, while the equal remedies section logically applies to all existing intellectual property rights.[207]

Excluding states from obtaining certain intellectual property altogether is a drastic approach to leveling the playing field between states and private parties. The participation provision also raises a constitutional issue. On the one hand, as Justice Scalia noted in *College Savings Bank*, Congress can force the states to waive their sovereign immunity in order to receive a "gift or gratuity" from the federal government.[208] When Congress disburses funds under its Spending Clause power, such a disbursement is a gift rather than an obligation.[209] The Constitution, which gives Congress the power to create intellectual property rights, does not explicitly require that the states be entitled to receive those rights.[210] On the other hand, the participation provision of Section 3 may go too far in that federal intellectual property protection may not be a "gift or gratuity," but instead, "lawful activity."[211] Put another way, a state may argue that coercing it to surrender the constitutionally protected right of immunity from suit in federal court in order to participate in the federal intellectual property scheme is itself unconstitutional.[212] Whether participation in the federal system is a gratuity or a right is not clear under the current law.[213] Nonetheless, forcing the states to extract themselves from a system that is

207. Substitute 2002 Draft IPPRA, *supra* note 36, at §§ 3-4. The remedies equalization provision explicitly applies to all suits brought after January 1, 2003 regardless of when the underlying right was secured, whereas the participation provision applies to all new applications for patents, trademarks, or copyrights after January 1, 2003.

208. Coll. Sav. Bank v. Fla. Prepaid Postsecondary Educ. Expense Bd., 527 U.S. 666, 686-87 (1999).

209. *Id.*

210. U.S. CONST. art. I, § 8, cl. 8.

211. *See* Menell, *supra* note 145, at 1441 (discussing Justice Scalia's analysis of financial inducements and coercive conditions); *see also* Gilbert L. Carey, *The Resurgence of States' Rights Creates New Risk to Intellectual Property*, 11 ALB. L.J. SCI. & TECH. 123, 150-51 (2000).

212. *See* Daniel J. Meltzer, *The Seminole Decision and State Sovereign Immunity*, 1996 SUP. CT. REV. 1, 51.

213. *See id.* at 51-54 (providing an alternate, less coercive solution to the immunity issue based on conditioning federal tuition grants on a waiver of sovereign immunity).

significantly linked to their own fiscal policies, particularly in the context of state universities, appears to be a straightforward example of coercive activity.

The participation provision presents some of the same practical concerns as the equalization of remedies provision. As discussed above, it is unlikely that states will willingly forfeit the protections of sovereign immunity to participate in the intellectual property system. The potential liability risks for states probably far outweigh any economic benefits that could be recovered from owning intellectual property. Admittedly, the participation provision requires a more involved analysis than the equal remedies provision discussed above, because foregoing participation would eliminate all potential revenue from intellectual property licensing. However, as the data from patent damages cases indicates, damage awards have the potential to far exceed the licensing revenues that can be collected by a university.[214] Furthermore, the various areas in which states and state entities operate expose a state to a far greater range of intellectual property infringement claims than a typical private entity, such as a company in the software field.[215] Consequently, the result of Section 3 will be to simply force the states out of the intellectual property arena. Although the implications of such a situation are not entirely clear, it is a result that is contrary to the incentive-oriented goals of the intellectual property laws. For example, precluding research universities from being able to collect licensing fees may cause a significant drain on the capital necessary to continue sophisticated research.[216] Since Section 3 does not further the goals of the patent system, it should be eliminated from the final legislation.

Finally, Congress may want to consider the international implications of state sovereign immunity to intellectual property infringement claims. As a signatory to several international agreements establishing certain minimum standards for respecting intellectual property rights, the federal government must enforce these basic protections in the United States.[217] The gap in intellectual property rights created by the *Florida Prepaid* decisions likely contravenes at least certain provisions of these international

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214. *See supra* Part IV.C.

215. Examples of potential state infringing activity provided by Professors Heald and Wells include unauthorized use of a patented process for making a drug at a research university, unauthorized copying of a text, and misattribution of a product used by the state. *See* Heald and Wells, *supra* note 139, at 850.

216. *See* Menell, *supra* note 145, at 1434 (noting the decline in state and federal funding to universities and the resulting dependence on licensing proceeds).

217. *See id.* at 1448-49.

agreements.[218] Accordingly, Congress could look to other sources of its power in Article I of the Constitution, notwithstanding the limitations set by the Court in *Seminole Tribe*,[219] to support abrogation of state sovereign immunity as it relates to intellectual property rights.[220] Specifically, the power to implement foreign treaties with enacting legislation, provided by the Necessary and Proper Clause,[221] may serve as an alternate basis for justifying the abrogation provision in Section 6 of the 2002 Draft IPPRA. The same argument also could be made to justify the participation provisions of Section 3. However, as already discussed, the approach proposed in the participation provision would likely have detrimental effects that would outweigh the goal of protecting private entities' intellectual property against state infringement.

Given the history of the statutes and case law addressing intellectual property claims against the states, implementing the foregoing suggestions would produce a more moderate piece of legislation with a greater likelihood of surviving judicial review. Furthermore, these suggested revisions are intended to further the policies underlying intellectual property rights.

V. CONCLUSION

The imbalance of intellectual property rights between the states and private entities is ripe for correction. Although the evidence of state infringement of intellectual property is limited, as the GAO's report explained, these types of claims are not easily monitored and tabulated.[222] In light of the increasing activity of states (and particularly state-affiliated universities) in the intellectual property field, the 2002 Draft IPPRA is a significant piece of legislation worthy of careful consideration.

Some intellectual property scholars and practitioners are of the view that any gap in ownership rights is the fault of the federal preemption statutes.[223] However, removing the federal courts' exclusive jurisdiction would not bridge this gap because many states are immune from suit in their own courts. Furthermore, opening the state courts as entirely new venues to hear patent and copyright claims undermines Article I's implicit goal of national uniformity in intellectual property law. If state courts could hear intellectual property claims, their decisions would not be re-

218. *See id.* at 1449-55.
219. *See supra* note 61 and accompanying text.
220. *See* Menell, *supra* note 145, at 1460-61.
221. U.S. CONST. art. I, § 8, cl. 18.
222. *See* U.S.G.A.O. Report, *supra* note 16, at 7-8.
223. *See id.* at 24.

viewable by the Federal Circuit.[224] National uniformity was the motivation behind the creation of the Federal Circuit, and any proposed legislation should avoid compromising that goal.[225]

Assuming that the proposed legislation is codified, one or more of its provisions will likely face a constitutional challenge in the judicial system in the near future. Although the drafters of the proposed legislation have attempted to narrow the abrogation provision, Section 6 should be further revised to improve its chances of being sustained on judicial review. The participation provision, Section 3, is a drastic remedy that is unnecessary in view of the equal remedies section. Furthermore, the growing importance of state universities in developing intellectual assets suggests that Section 3 may do more harm than good. Finally, amending the equal remedies provision in Section 4 to encourage the creation of state administrative processes for protecting private rights will further the policies underlying our intellectual property laws.

224. *See* Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank, , 527 U.S. 627, 659 (1999) (Stevens, J., dissenting).

225. *See id.* at 651 (Stevens, J., dissenting).

BIOINFORMATICS AND INTELLECTUAL PROPERTY PROTECTION

By M. Scott McBride†

ABSTRACT

This article describes the nature of bioinformatics and how the various components of bioinformatics relate to intellectual property law. The article begins by "decomposing" bioinformatics into three categories: (A) biological sequences such as DNA, RNA, and protein sequences; (B) databases in which these sequences are organized; and (C) software and hardware designed to access, organize, and analyze information contained within these sequences and databases. Next, the article analyzes how each of these components relates to patent law, copyright law, and trade secret law. In particular, the article analyzes whether the various components qualify as protectable subject matter under these areas of law. Where protection may be available, the article discusses whether such protection is practical. The article concludes with a policy discussion of whether intellectual property protection should be available for bioinformatics, where bioinformatic inventions may promote advances in human health care.

I. INTRODUCTION

Advances in biotechnological techniques, such as DNA, RNA, and protein sequencing,[1] and more widespread application of these techniques,[2] have led to a huge accumulation of information in the past two decades. The DNA of the human genome has now been sequenced,[3] and

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1. 1 GENOME ANALYSIS: A LABORATORY MANUAL 1-36 (Bruce Birren et al. eds., 1997) (describing numerous techniques for isolating and sequencing DNA and RNA) [hereinafter GENOME ANALYSIS].

2. *See* CYNTHIA GIBAS & PER JAMBECK, DEVELOPING BIOINFORMATICS COMPUTER SKILLS ix-x (O'Reilly & Assoc. 2001) (describing the increase in accessibility to computers during the past two decades and how this increase in accessibility has given rise to bioinformatics).

3. *See* Leslie Roberts, *A History of the Human Genome Project*, SCIENCE, Feb. 16, 2001, at 1195 (describing the history of the Human Genome Project and containing a map of the human genome).

the entire human genome will likely be assembled and determined in the near future.[4] Much of this information is in "raw form" and must be analyzed, organized, and stored.[5] Bioinformatics is the "[r]esearch, development, or application of computational tools and approaches for expanding the use of biological, medical, behavioral or health data."[6] It is an amalgamation of biology and information technology.

Bioinformatics is estimated to generate more than a billion dollars of revenue per year worldwide.[7] Several publicized deals demonstrate that companies value bioinformatics very highly,[8] perhaps because of the promise it holds for human medicine. Moreover, "genomics information [is nearly] a commodity these days."[9]

Because companies are willing to invest large sums to reap the benefits bioinformatics holds, it is important to understand the nature of bioinformatics,[10] whether bioinformatics may be subject to intellectual property protection, and what the scope of that protection may be when available. In cases where bioinformatic components are protected by multiple areas of intellectual property law, it is important to determine which form of

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4. *See* Elizabeth Pennisi, *The Human Genome*, SCIENCE, Feb. 16, 2001, at 1177-80. (noting that drafts of the human genome "have yet to be finished, with all the i's dotted and the t's crossed.").

5. *See id.*

6. National Institutes of Health, Office of Extramural Research, Bioinformatics at the NIH, *available at* http://grants1.nih.gov/grants/bistic/bistic.cfm (visited May 5, 2002).

7. *See* John Thackray, *BIOINFORMATICS Grows LEGS*, ELEC. BUS., July 2001 (citing a report by Strategic Direction International ("SDI") stating "Bioinformatics generated worldwide revenue [in 2000] of more than $700 million . . . and total bioinformatics volume could exceed $2 billion [in 2001]").

8. *See* GARY ZWEIGER, TRANSDUCING THE GENOME 161 (2001) (describing the growth in biotech companies attempting to capitalize on bioinformatics); *BIO Session: What Does It Mean to Be a Genomics Company in a 'Post-Genomics' Era?*, BioSpace.com, *at* http://www.biospace.com/articles/bio_genomics.cfm (visited Oct. 10, 2002) (noting that in 1993, SmithKline Beecham entered into a $125 million deal for access to Human Genome Sciences' biological information, and in 1999, Bayer AG entered into a $465 million agreement for identification and validation of drug targets with Millennium Pharmaceuticals); *Exelixis in Deal for Genomica*, THE N.Y. TIMES, Nov. 20, 2001, at C8 (noting a $110 million deal); Press Release: Compaq Announces $100 Million Investment Program for Life Sciences Start-Up Companies: Targeted for Genomics, Bioinformatics, and Related Areas, Sept. 26, 2000, *available at* http://www.compaq.com/newsroom/pr/2000/pr2000092604.html.

9. David Shook, *Celera: A Biotech That Needs a Boost*, BUS. WK. ONLINE, Mar. 1, 2002, *at* http://www.businessweek.com/bwdaily/dnflash/mar2002/nf2002031_8351.html.

10. *See* Sana Siwolop, *INVESTING: A Hunt for the Gems in Genomics*, THE N.Y. TIMES, Oct. 29, 2000, sec.3 C8 (describing how many investors lack the basic knowledge of what genomics companies do).

protection is most practical. These issues are critical in performing a cost-benefit analysis of an investment in bioinformatics; if protection is available and practical, then high investment costs may be justified.[11] However, the resolution of these issues is unclear, as exemplified by the recent dispute over the patentability of human genes,[12] and the recent dispute between Celera Genomics, Corp. and the International Human Genome Sequencing Consortium ("IHGSC") over Celera's attempt to commercialize a database of the human genome.[13] This article explores some of these issues by providing a survey of the intellectual property protection currently available for bioinformatic components, and the practicality of the available protection. First, Part II defines the term "bioinformatics." Part III separates bioinformatics into three components: (A) the information contained within biological sequences, (B) biological databases comprised of this information, and (C) software and hardware designed to access, organize, and analyze this information. Next, Parts IV, V, and VI discuss whether these components are proper subject matter for protection under patent law, copyright law, and trade secret law, respectively.[14] Part VII

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11. Intellectual property protection generally includes a right to exclude others from "practicing" the protected subject matter. *See, e.g.*, 35 U.S.C. § 271 (stating patent protection's basic right to exclude). As such, the owner of a protected "product" may extract a higher price for the "product" to recoup any investment costs, because the owner is the only source.

12. For arguments against gene patents, see generally Public Comments of the United States Patent and Trademark Office "Revised Utility Examination Guidelines; Request for Comments," 64 Fed. Reg. 71,440 (Dec. 21, 1999), corrected 65 Fed. Reg. 3425, (Jan. 21, 2000), *available at* http://www.uspto.gov/web/offices/com/sol/comments/utilguide/index.html. Based on these comments, opposition to the patentability of human genes arises in part because of the mistaken impression that a DNA *sequence* is patentable in lieu of a DNA *composition*. *See id*. (arguing against patents for genomic *sequences*). These opponents may not realize that the sequence itself is probably unprotectable "information," whereas only the isolated "composition" would be protectable. *See infra* Part III.A.

13. *See* Jasper A. Bovenberg, *Should Genomics Companies Set Up Database in Europe? The E.U. Database Protection Directive Revisited*, E.I.P.R. 23(8) 361[2001] (discussing Celera's claims that its database is protected by copyright law); Justin Gillis, *Celera to Share Human Genetic Map: Scientists Will Be Able to Download Some Information From Web*, WASH. POST, Feb. 8, 2001, at E18 (noting the IHGSC's concern over Celera's *limited* agreement to allow academic scientists access to its database); *Row Over 'Book of Life,'* BBC NEWS, Feb. 12, 2001, *available at* http://news.bbc.co.uk/1/hi/sci/tech/1164014.stm. (noting the IHGSC's accusation that Celera is "holding back science by imposing commercial restrictions on its data").

14. Traditionally, intellectual property includes patents, trademarks, copyrights, and trade secrets. *See generally* MARK A. LEMLEY et al., SOFTWARE AND INTERNET LAW 50 (Richard Epstein et al. eds, 2000) [hereinafter LEMLEY]. This article excludes trademark protection because a trademark is generally a "source indicator," and, as such, trademark

concludes with a discussion of public policy issues in regard to intellectual property protection for bioinformatics.

II. BIOINFORMATIC COMPONENTS

Before one can understand intellectual property protection for bioinformatics, it is necessary to understand the nature of the various components that comprise the field of bioinformatics. Bioinformatics involves the acquisition, organization, storage, analysis, and visualization of information contained within biological molecules.[15] For the purposes of this article, bioinformatics is analyzed according to the following categories: (A) biological sequences such as DNA, RNA, and protein sequences, (B) databases in which these sequences are organized, and (C) software and hardware designed to create, access, organize, and analyze information contained within these sequences and databases.

A. DNA, RNA, and Protein Sequences

Scientists classify biological molecules into four general classes that include nucleic acids (which comprise DNA and RNA), proteins, lipids, and carbohydrates.[16] Bioinformatics is currently focused on the biology of DNA, RNA, and protein.

DNA is the material whereby genetic traits are transmitted from one generation to the next. Genes are comprised of DNA.[17] Before DNA is "expressed," *i.e.*, effects a genetic trait, DNA serves as a "template" to create an RNA molecule.[18] The information within this RNA molecule is then interpreted by cellular machinery to create a protein.[19] As such, RNA is an intermediary molecule within the process of genetic expression.[20] The protein created from the RNA molecule is typically the final effecter of the genetic trait.[21] Based on the information within the DNA molecule, a protein folds into a three-dimensional structure, which ultimately deter-

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protection might not raise any unique issues for bioinformatics. For a discussion of the goals of trademark law; see generally JANE C. GINSBURG et al., TRADEMARK AND UNFAIR COMPETITION LAW: CASES AND MATERIALS 44-47 (2d ed. 1996).

15. NIH, *supra* note 6.

16. *See* BENJAMIN LEWIN, GENES VI (6th ed. 1997) (noting that the study of lipids and carbohydrates are largely reserved to biochemists) [hereinafter LEWIN].

17. *Id.* at 71-79. However, Lewin indicates that some viruses use RNA as their genetic material. *Id.*

18. *Id.* at 153-55.

19. *Id.* at 179-81.

20. *Id.* at 153-55.

21. LEWIN at 61-63.

mines its function.[22] For example, most enzymes are composed of protein, and many diseases, *e.g.*, lactose intolerance, are the result of defective enzymes created from a mutated DNA. In conclusion, the central dogma of molecular biology is described by the expression:

DNA → RNA → Protein[23]

Each of these three molecules are described using a fairly simple code: DNA by A,C,G,T; RNA by A,C,G,U; and protein by twenty different amino acids.[24]

DNA, or deoxyribonucleic acid, is a large molecule comprised of four different repeating units called nucleotides.[25] DNA nucleotides contain one of four nitrogenous bases (adenine ("A"), guanine ("G"), cytosine ("C"), or thymine ("T")),[26] and the sequence of a particular DNA is typically described by using the single-letter designation of the nucleotides within the DNA sequence, *e.g.*, ATTGGCATGGA.[27]

RNA, like DNA, is comprised of a chain of nucleotide molecules.[28] However, RNA differs from DNA because it contains RNA nucleotides,[29] rather than DNA nucleotides. RNA nucleotides, like DNA nucleotides, may contain adenine, guanine, or cytosine, but unlike DNA nucleotides, RNA nucleotides use uracil ("U") instead of thymine.[30] In a simplistic way, an RNA molecule is a copy of the DNA where "T" is replaced with "U." Therefore, a DNA molecule with the sequence "ATTGGCATGGA," would have a corresponding RNA molecule with the sequence "AUUGG-

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22. *Id.* at 13-19.
23. *Id.* at 154.
24. *Id.* at 76-79 (describing the DNA and RNA codes); *id*. at 10-11 (describing the amino acid code).
25. LEWIN at 76-77.
26. *Id.* at 76-77.
27. *See id.* at 81.
28. *Id.* at 76-77.
29. *Id.*
30. LEWIN at 76-79. In addition to using uracil instead of thymine, the nucleotides of an RNA molecule use ribose instead of deoxyribose as a sugar moiety. *Id.* at 76-77. This difference, while conceptually simple, actually has drastic implication for the stability of RNA as compared to DNA. While DNA is relatively stable and resistant to enzymes that degrade nucleic acid called nucleases, RNA is inherently unstable and sensitive to nucleases. *See id.* at 173-77. The cell can utilize RNA's instability as a mechanism for regulating the expression of a corresponding gene. *Id.* For example, after an RNA has been synthesized and a gene has been expressed, the cell can rapidly and easily degrade the RNA to prevent further expression until the cell synthesizes new RNA. *Id.*

One additional difference between RNA and DNA is that RNA typically exists as a single-stranded molecule while DNA is typically double-stranded. *See id.* at 81.

CAUGGA." This RNA molecule is used as a template to synthesize the encoded protein.

Proteins are comprised of twenty different amino acids described by the single letter designations A, C, D, E, F, G, H, I, K, L, M, N, P, Q, R, S, T, V, W, Y,[31] and a protein molecule contains a sequence of any combination of these twenty amino acids, *e.g.*, P-A-T-E-N-T-L-A-W-I-S-G-R-E-A-T. Each of these twenty amino acids is specified by three nucleotides of RNA, *e.g.*, AUG corresponds to methionine or "M".[32] Such triplets comprise codons. Because there are sixty-four different combinations of nucleotide triplets, *i.e.*, $4^3 = 64$, and there are only twenty amino acids, there are more codons than necessary to code for the twenty amino acids.[33] As such, more than one codon can code for a particular amino acid, thereby leading to redundancy in the genetic code.[34] Because of this redundancy, it is not always possible to determine the correct codon sequence for a given amino acid, while it is always possible to determine the correct amino acid for a given codon sequence.[35]

Gene expression, or the route from gene to protein, is regulated within cells. Thus, two genetically identical cells, such as a skin cell and a nerve cell, may express a different complement of proteins[36] and hence exhibit different traits. One aspect of bioinformatics is the study of gene expression through functional genomics (*e.g.*, studying the expression of genes at the mRNA level), and functional proteomics (*e.g.*, studying the expression of genes at the protein level).[37]

In summary, DNA, RNA, and protein are large molecules comprised of repeating units of DNA nucleotides, RNA nucleotides, and amino acids, respectively. DNA, RNA, and protein can be described by the sequence of these repeating units, and the sequence of these repeating units ultimately determines the function of the DNA, RNA, or protein. Therefore, the sequence of the DNA, RNA, or protein contains functional information.

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31. LEWIN at 8. The twenty amino acids are alanine, cysteine, aspartic acid, glutamic acid, phenylalanine, glycine, histidine, isoleucine, lysine, leucine, methionine, asparagine, proline, glutamine, arginine, serine, threonine, valine, tryptophan, and tyrosine, respectively. *Id.* These twenty amino acids can also be designated by three-letter designations (Ala = "A", Cys = "C", Asp = "D", Glu = "D", Phe = "F", Gly = "G", His = "H", Ile = "I", Lys = "K", Leu = "L", Met = "M", Asn = "N", Pro = "P", Gln = "Q", Arg = "R", Ser = "S", Thr = "T", Val = "V", Trp = "W", and Tyr = "Y"). *Id.*

32. *Id.* at 213-15.

33. *Id.*

34. *Id.*

35. LEWIN at 8.

36. *See id.* at 811-13.

37. *See* GIBAS & JAMBECK, *supra* note 2, at 310-21.

B. Biological Databases

As more DNA, RNA, and protein sequences are reported, scientists are developing biological databases to catalog and store the sequence information.[38] These databases are valuable if the stored information can be readily searched, accessed, and analyzed. For instance, scientists can use these databases to compare and assign biological functions to particular or characteristic sequences (*i.e.*, "motifs").[39] Then, when a scientist obtains a sequence from an unknown DNA, RNA, or protein molecule, the scientist can use these databases to identify the unknown molecule and determine its function.[40] Scientists are encouraged to contribute to these databases.[41] For instance, most scientific journals expect the scientist to submit the sequence of a novel biological molecule to a public database prior to publication.[42] Failure to submit a sequence may result in the scientist being denied the opportunity to publish the article.[43]

Although several databases are available to the general public,[44] private companies are not required to make their databases freely available. For example, one company working on sequencing the human genome, Celera, generally charges for access to its database,[45] although it provides

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38. For example, the National Center for Biotechnology Information ("NCBI") offers several databases that are available to the general public. *See* NCBI, Submit to GenBank, *available at* http://www.ncbi.nlm.nih.gov/Genbank/index.html (visited May 5, 2002).

39. *See* NCBI, BLAST: Basic Overview, *available at* http://www.ncbi.nlm.nih.gov/BLAST/tutorial/Altschul_1.html (visited May 5, 2002).

40. Search programs, such as BLAST®, can be used to search databases for similar proteins. *See id.*

41. *See* NCBI, Submit to GenBank, *available at* http://www.ncbi.nlm.nih.gov/Genbank/index.html (visited May 5, 2002). ("The most important source of new data for GenBank® is direct submissions from scientists."). There is a "20-year old convention within genomics research of placing data in GenBank[®] or similar large publicly run databases as a condition of academic publication." Pete Moore, *Publication with a Pinch of Privatisation*, THE SCIENTIST, Apr. 4, 2002, *available at* http://www.biomedcentral.com/news/20020404/04.

42. *See* Moore, *supra* note 41.

43. *Id.* However, SCIENCE recently broke with tradition and published two articles even though "the genomic data underpinning the publications" are kept in private databases. *Id.* SCIENCE's break with tradition caused "20 eminent scientist to write a letter of protest . . . saying that the action poses 'a serious threat to genomics research.'" *Id.* (reprinting the letter of protest in its entirety).

44. The NCBI offers several databases besides GenBank®, including "RefSeq," "PDB," and "Entrez Genomes," for nucleotide sequences, and "SwissProt," "PIR," "PRF," and "PDB" for amino acid sequences. *See* NCBI, DATABASES, *available at* http://www.ncbi.nlm.nih.gov/Databases/index.html (visited May 5, 2002).

45. Bovenberg, *supra* note 13.

free access to "qualified academic users."[46] Celera claims that its database is subject to patent and copyright protection,[47] an issue disputed by Celera's noncommercial competitor, the IHGSC.[48] Celera's case exemplifies the necessity of analyzing whether databases such as Celera's should be subject to IP protection.[49]

C. Bioinformatic Software and Hardware

To utilize information contained in these databases, software developers have developed bioinformatic programs to organize, access, analyze, and view sequence information.[50] One such program, BLAST® ("Basic Local Alignment Search Tool"),[51] compares sequences for similarity by first aligning the two sequences at areas of local identity or similarity and then calculating a "similarity score."[52] Such algorithms can be designed to incorporate scientific principles based on the molecular biology of DNA, RNA, and protein. For example, an algorithm may be created to compare two nucleotides or amino acids that are not identical but function similarly based on their molecular biology.[53] Such programs are useful in predicting

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46. *Id.*

47. *See id. See also* Celera Free Public Access Click-On Agreement, Heading 4.a., *at* http://www.celera.com/genomics/academic/pubsite/terms.cfm ("The Celera Data, both the *primary sequence assembly* and the representation thereof, is a copyrighted work . . . ") (emphasis added).

48. Bovenberg, *supra* note 13. The IHGSC further argues that Celera is not entitled to intellectual property protection for its database of the human genome because its database contains sequences that are within the public domain. Philip Cohen, *Rivals Dismiss Celera's Human Genome Draft*, NEW SCIENTIST, Mar. 5, 2002, *available at* http://www.newscientist.com/news/news.jsp?id=ns99991999 (visited May 5, 2002).

49. Incyte Genomics also offers subscriptions to its databases. *See* http://www.incyte.com. Other gene database companies include Human Genome Sciences and Millennium Pharmaceuticals. *See* Matthew Herper, *Stock Focus: Genomics Companies*, FORBES.COM, Apr. 4, 2001, *at* http://www.forbes.com/2001/04/11/0411sf.html.

50. *See, e.g.*, NCBI, Tools for Data Mining, *available at* http://www.ncbi.nlm.gov/Tools/index.html (visited May 5, 2002) (listing several bioinformatics programs including BLAST®, MapViewer, LocusLink, UniGene, ORF Finder, Electronic PCR, VAST Search, and VecScreen).

51. *See* NCBI, BLAST: Basic Overview, *available at* http://www.ncbi.nlm.nih.gov/BLAST/tutorial/Altschul_1.html (visited May 5, 2002) (describing the algorithm used by BLAST® to compare biological sequences).

52. *Id.*

53. For nucleotide sequences, because of redundancy in the genetic code, two genes may use different nucleotides and still encode the same amino acid. *See supra* notes 32-35 and accompanying text. For proteins, certain amino acids may be interchangeable. *See id.* (describing how certain amino acids may be grouped as "hydrophobic" or "hydrophilic," or alternatively described as "acidic," "basic," or "neutral").

the function of an unknown gene or protein, or to draw evolutionary relationships.[54]

Engineers have also developed computer hardware and machines that facilitate the acquisition and storage of biological information. For example, machines called "thermocyclers" amplify small amounts of DNA or RNA to provide a scientist with a workable amount for sequencing.[55] Other machines rapidly determine the sequence of DNA, RNA, or protein molecules.[56] One of the most promising recent inventions is the "gene chip." A gene chip contains many different DNA sequences organized in a grid or microarray on the chip.[57] By exposing the chip to a test sample of DNA, a scientist determines whether the test sample corresponds to any of the sequences on the chip through a process called "hybridization."[58] The gene chip is advantageous because it is a "high throughput device," meaning that a scientist can obtain a large amount of information from a single input or experiment, and furthermore, the gene chip is suitable for automation.[59]

The next three sections analyze whether these defined components of bioinformatics, *i.e.*, (A) DNA, RNA, and protein sequences, (B) biological databases, and (C) bioinformatic software and hardware, are proper subject matter for patent, copyright, or trade secret protection.

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54. *See, e.g.*, L. Feng et al., *Aminotransferase Activity and Bioinformatic Analysis of 1-Aminocyclopropane-1-Carboxylate Synthase*, BIOCHEMISTRY, Dec. 12, 2000, at 15242-29 (describing the use of BLAST® to draw an evolutionary connection between the aminocyclopropane carboxylate synthases and the aminotransferases).

55. Brinkmann Company sells popular thermocyclers, described on its website: http://www.brinkmann.com/product.asp?ref=86&tb=Description (visited May 5, 2002).

56. These machines are aptly named "sequencers." Applied Biosystems sells rapid DNA sequencers, described on its website: http://www.appliedbiosystems.com/products/productdetail.cfm?prod_id=41 (visited May 5, 2002).

57. GIBAS & JAMBECK, *supra* note 2, at 311-17. For a description of the technology underlying "gene chips," see also http://www.gene-chips.com (visited May 5, 2002) [hereinafter Gene Chips].

58. *See* Gene Chips, *supra* note 57. *See also* GENOME ANALYSIS, *supra* note 1 (describing numerous techniques for DNA analysis including "hybridization"). "Hybridization" refers to the process of identifying a particular DNA or RNA sequence by using a probe that is complementary to the identified sequence. For example, DNA and RNA form double-stranded molecules like a "zipper" by binding to a complementary molecule. Complementarity relies on the fact that A binds to T (or U in RNA's case) and G binds to C. To detect the DNA target sequence AGCTTCGA, one would use the probe TCGAAGCT labeled with radioactivity or photo-emitting moieties. Gene chips are useful because a scientist can adhere many nucleotide sequences to a single gene chip, and use the chip to obtain a large amount of information from a single "hybridization." *See* Gene Chips, *supra* note 57.

59. *See* Gene Chips *supra* note 57.

III. PATENT PROTECTION: ELIGIBLE SUBJECT MATTER MUST BE A PROCESS, MACHINE, APPARATUS, OR COMPOSITION OF MATTER

One of the most critical questions regarding whether bioinformatic components are patentable is whether they qualify as statutory subject matter under § 101 of the Patent Act.[60] Under § 101, "Whoever invents or discovers any new and useful process, machine, manufacture [apparatus], or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor."[61] Thus, to determine whether bioinformatic components qualify as statutory subject matter, one must determine whether bioinformatic components are a "new and useful process, machine, manufacture [apparatus], or composition of matter, or any new and useful improvement thereof."[62]

A. Patent Protection for DNA, RNA, and Protein Sequences

Section 101 permits the patentability of "composition[s] of matter."[63] Courts have held this as including "all compositions of two or more substances and . . . all composite articles, whether they be the results of chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids."[64] The USPTO has specifically interpreted this to include DNA, RNA, and protein *compositions*[65] because they are composed of two or more substances—DNA and RNA are composed of nucleotides while proteins are made up of amino acids. Indeed, many DNA, RNA, and protein molecules have been patented as *compositions*.[66]

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60. 35 U.S.C. § 101 (1998). To be patentable, subject matter must also possess "utility" under § 101, and it is well-known that the subject matter of an invention must also meet the statutory requirements under 35 U.S.C. §§ 102 (novelty) and 103 (nonobviousness). However, a thorough discussion of the "novelty" or "nonobviousness" of bioinformatic components is beyond the scope of this article. For such a discussion, see Charles Vorndran & Robert L. Florence, *Bioinformatics: Patenting the Bridge Between Information Technology and the Life Sciences*, 42 J.L. & TECH. 93 (2002).

61. 35 U.S.C. § 101. For a discussion of the scope of patentable subject matter see CHISUM ON PATENTS §§ 1.01-1.06[5] (2002).

62. 35 U.S.C. § 101.

63. *Id.*

64. Diamond v. Chakrabarty, 447 U.S. 303, 308 (1980) (citing Shell Dev. Co. v. Watson, 149 F. Supp. 279, 280 (D.D.C. 1957) (citing WALKER ON PATENTS § 14, at 55 (1st ed. 1937)).

65. *See* 66 Fed. Reg. 1092-97 (Jan. 5, 2001) (noting the USPTO response to comments regarding the patentability of genes).

66. *See, e.g.*, U.S. Patent No. 6,348,348 (issued Feb. 19, 2002) (claiming the nucleotide and deduced amino acid sequences of the Human Hairless gene); U.S. Patent No. 6,284,492 (issued Sept. 4, 2001) (claiming viral nucleic acid).

However, it was not always clear that biological molecules were patentable subject matter. Only after the Supreme Court's decision in *Diamond v. Chakrabarty*[67] did patents on biological molecules become widespread. Writing for the majority, Chief Justice Burger concluded that § 101 permitted the patenting of genetically modified bacteria,[68] stating, "Congress intended statutory subject matter to 'include anything under the sun that is made by man.'"[69] Since then, the USPTO has permitted the patenting of biological molecules under the premise that a biological molecule is a "composition made by man," where the biological molecule has been isolated and purified from its natural setting.[70]

While biological molecules are themselves patentable as *compositions*, the information within the composition, *i.e.*, the abstract biological sequence itself, arguably is not patentable subject matter.[71] Based on the Supreme Court's holding in *Diamond v. Diehr*,[72] to qualify as patentable subject matter the biological sequence would have to be categorized as a process, machine, apparatus, or composition, and do more than describe a "natural phenomenon."[73] The *Diehr* Court also excluded "laws of nature . . .and abstract ideas" from patent protection.[74] "An idea of itself is not patentable,"[75] and neither is "[a] principle, in the abstract[,] a fundamental truth[,] an original cause[, or] a motive.'[76] As "Einstein could not patent his celebrated law that '$E = mc^2$' [and] Newton [could not] have patented the law of gravity,"[77] it is unlikely that one could patent a biological sequence since it may be characterized as a natural phenomenon. Therefore, patent protection for DNA, RNA, or protein extends only to the physi-

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67. 447 U.S. 303.

68. *Id.* at 308-09.

69. *Id.* at 309 (citing S. REP. NO. 82-1979, at 5 (1952); H.R. REP. NO. 82-1923, at 6 (1952).

70. *See* 66 Fed. Reg. 1092-99 (Jan. 5, 2001).

71. For a discussion of the distinction between DNA as a molecule versus DNA as information, *see* Rebecca S. Eisenberg, *Re-examining the Role of Patents in Appropriating the Value of DNA Sequences*, 49 EMORY L.J. 783, 786-89 (2000).

72. 450 U.S. 175, 191-93 (1981).

73. *Id*. In *Diehr*, the Court held that a process for curing rubber was patentable, even though the process relied on an unpatentable mathematical formula to calculate the amount of time that the rubber needed to "cure." *Id.*

74. *Id.* at 185 (citing Parker *v.* Flook, 437 U.S. 584 (1978); Gottschalk v. Benson, 409 U.S. 63, 67 (1972); Funk Bros. Seed Co. *v.* Kalo Inoculant Co., 333 U.S. 127, 130 (1948)).

75. *Id*. (citing Rubber-Tip Pencil Co. v. Howard, 20 Wall. 498, 507 (1874)).

76. *Id*. (citing LeRoy v. Tatham, 14 How. 156, 175 (1853)).

77. *Id.* (citing Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (quoting *Funk Seed Bros. Co.*, 333 U.S. 127 (1948)).

cal/biological composition, and not to the abstract biological sequence information that describes the composition. Thus, a patentee could only prevent another from using the composition itself and not the information within the molecule.[78]

B. Patent Protection for Biological Databases

For the same reason that patent protection is unavailable to biological sequences, patent protection may also be unavailable for biological databases. Biological databases are compilations of biological sequences. If biological sequences are unpatentable information, then a biological database is a compilation of unpatentable information.[79] Thus, for a database to be patentable, the process of compiling and organizing the biological sequences into a database must convert the unpatentable information into statutory subject matter for a patent, *i.e.*, a "tangible product."[80] Whether a database is a "tangible product" might be debatable,[81] but the USPTO has said that if the database is merely a "data structure" or "nonfunctional descriptive material," it is not patentable.[82]

Even if the database itself does not constitute patentable subject matter, the *manner of creating the database* may constitute a patentable process. For instance, in *State Street Bank and Trust Co. v. Signature Financial Group, Inc.*,[83] the Federal Circuit held that a data processing system for a financial fund was patentable subject matter where the system produced a "useful, concrete, and tangible result"[84] even though the data processing system produced only information. Of course, to reconcile the Federal Circuit's holding and semantics in *State Street Bank* with prior

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78. Eisenberg, *supra* note 71, at 788 ("Patent claims on DNA sequences as 'compositions of matter' give patent owners exclusionary rights over tangible DNA molecules and constructs, but do not prevent anyone from perceiving, using, and analyzing information about what the DNA sequence is.").

79. *See id.* at 787. ("The traditional statutory categories of patent-eligible subject matter . . . seem to be limited to *tangible products* and processes, as distinguished from information as such.") (emphasis added).

80. *See id.*

81. *See id.* ("Although many cases have used the word 'tangible' in defining the boundaries of patentable subject matter, neither the language of the statute nor judicial decisions elaborating its meaning have *explicitly* excluded 'information' from patent protection." However, "such a limitation is *implicit* in prior judicial decisions.") (emphasis added).

82. *See* U.S. Department of Commerce, Manual of Patent Examining Procedure 2106-11 to -35 (8th ed. 2001) (citing *In re* Warmerdam, 33 F.3d 1354, 1360-61 (Fed. Cir. 1994)).

83. 149 F.3d 1368 (Fed. Cir. 1998).

84. *Id.* at 1375 (citing In re Alappat, 33 F.3d 1526, 1544 (Fed. Cir. 1994)).

courts' holdings,[85] we may have to assume that a "tangible result" is not necessarily to be equated with a "tangible product."[86] Nonetheless, under *State Street Bank*, even if information *per se* is not patentable as a "tangible product," a process of producing information may be patentable if it produces a "tangible result."[87] Applying this principle to bioinformatic databases, we can conclude that if the *process* of creating a bioinformatic database produces a "useful, concrete, and tangible result," *i.e.*, a database that has numerous applications, then the process of creating the database may be patentable.

However, such a process patent would be limited in at least two ways. First, the process must satisfy the other requirements of the Patent Act. In particular, the process must be novel under § 102,[88] and nonobvious under § 103.[89] In conforming to §§ 102 and 103, the scope of the patent's claim undoubtedly would be narrowed. Because scientists have been producing and cataloguing biological information for many years, a patentee would have to draft process claims narrowly to avoid the prior art; and even if the patentee could draft process claims narrowly so as to be novel, the patent claims may yet be obvious in light of the prior art.

Second, patent protection would extend only to the process for creating the database and not to the database itself. This would limit the value of the patent because a competitor wanting to create an identical database could avoid infringing the patent simply by creating the database by a non-infringing process,[90] *i.e.*, creating the database by performing different steps than those recited within the claimed method.[91] Even if the competi-

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85. *See* Eisenberg, *supra* note 71, at 787 (noting that prior courts have implicitly held that only "tangible products" are patentable and information is not a "tangible product").

86. *See id.*

87. *See* State St. Bank & Trust Co. v. Signature Fin. Group, Inc., 149 F.3d 1368, 1375 (Fed. Cir. 1998).

88. 35 U.S.C. § 102 (1998).

89. *Id.* § 103.

90. In contrast, machine claims, apparatus claims, and composition claims implicitly include method of making claims, because under 35 U.S.C. § 271, an infringer is one who "without authority makes, uses . . . any patented invention." *Id.* § 271(a).

91. Because the patent claims define the invention, an infringer must perform the equivalent of each step of the claimed process to infringe the process under the "all elements rule." ATD Corp. v. Lydall Inc., 159 F.3d 534, 552 (Fed. Cir. 1998) (Clevenger, J., concurring in part and dissenting in part) ("A claim of infringement by equivalents cannot succeed unless each limitation of a claim is met by an equivalent.") (citing Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 41 (1997) (adopting sub silentio the "all elements" rule of Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931 (Fed. Cir. 1987) (en banc)).

tor infringes the patented process, it may be more difficult to prove infringement of a process claim than a machine, apparatus, or composition claim, because the plaintiff would have to prove that the database was *created* by the patented process, not just used or sold. If the database itself is more valuable than the patented process, the patent would offer only token protection. Therefore, while patent protection for creating databases may be available under a *State Street Bank* theory, the protection may be narrow, easily evaded, and of questionable value.

C. Patent Protection for Bioinformatic Software and Hardware

In contrast to biological sequences and databases, computer software does constitute patentable subject matter if the software produces a "useful, concrete, and tangible result."[92] The Supreme Court and Federal Circuit have indicated that so long as a software program is more than a mere algorithm, the program may be eligible for patent protection.[93] Bioinformatic software should be no exception.[94] The results produced by bioinformatic software have a biological application and are therefore most definitely "useful, concrete, and tangible." Because bioinformatic software can be used to make medical diagnoses, design drugs, or draw evolutionary conclusions, it would be difficult to hold bioinformatic software as unpatentable under a *State Street Bank* regime.

Likewise, patent protection is available for bioinformatic hardware, where the hardware qualifies as patentable subject matter under § 101 as a "machine" or an "apparatus."[95] Bioinformatic hardware may be used to acquire bioinformatic information (*e.g.*, as a sequencer or a gene chip), and/or store, access, or organize bioinformatic information (*e.g.*, as a computer system). However, because a patent would only protect the patentee from an infringer who uses a machine or apparatus that contains *all the elements* of the claimed invention,[96] the patentee could not protect a biological sequence or a database *that is only a component* of a protected machine or apparatus.

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92. *State St. Bank*, 149 F.3d at 1375 (citing In re Alappat, 33 F.3d 1526, 1544 (Fed. Cir. 1994)).

93. *See* Diamond v. Diehr, 450 U.S. 175, 185 (1981); *In re Alappat*, 33 F.3d at 1544; *State St. Bank*, 149 F.3d at 1373.

94. However, see Part VI for a discussion of the "Open Informatics" petition, which would require that all publicly-funded, bioinformatic software be made freely available to the public.

95. 35 U.S.C. § 101 (1998) ("Whoever invents . . . any new and useful . . . machine, manufacture [apparatus] . . . may obtain a patent therefor . . . .").

96. *See supra* note 91.

IV. COPYRIGHT PROTECTION: ELIGIBLE SUBJECT MATTER MUST BE AN ORIGINAL EXPRESSION

The Copyright Act defines the requirements for copyrightable subject matter.[97] Under § 102, "[c]opyright protection subsists . . . [i]n original works of authorship fixed in any tangible medium of expression."[98] Copyright protection is available for "works of authorships," such as "literary works," but copyright protection does not extend to "any idea, procedure, process, system, method of operation, concept, principle, or discovery. . ."[99] This latter limitation severely restricts the scope of copyright protection available for bioinformatic components.

A. Copyright Protection for DNA, RNA, and Protein Sequences

Arguably, the originator(s) of the DNA code nomenclature (who used A, G, C, and T to describe a DNA's sequence), the RNA code nomenclature (who used A, G, C, and U to describe an RNA's sequence), and the protein code nomenclature (who used A, C, D, E, F, G, H, I, K, L, M, N, P, Q, R, S, T, V, W, Y to describe a protein's sequence) may have had a legitimate claim to copyright protection for their original expression.[100] However, as the law now stands "the Copyright Office has unofficially stated that it will not grant copyright registration to gene sequences or DNA molecules because they are not copyrightable subject matter."[101] Furthermore, a contemporary scientist discovering a biological molecule probably would not be entitled to copyright protection for the sequence of the newly discovered molecule or information contained therein for several reasons.[102]

First, the scientist is not the original author of the biological code nomenclatures. Although the scientist is the first to report the sequence of the

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97. 17 U.S.C. §§ 101-1332 (1998).

98. *Id.* § 102(a).

99. *Id.* § 102(a)(1), (b).

100. Using any one of these codes to describe the respective biological molecule might be considered an "original work of authorship" under § 102. *See id.* § 102. However, these codes have been in use at least since the 1930s, and any "work of authorship" that was published before 1923 and was never registered has fallen into the public domain. *See id.* § 301 (describing the duration of copyrights that had not fallen into the public domain prior to January 1, 1978, the effective date of the act. Prior to the Copyright Act of 1976, the term of a copyright was 56 years, and copyrights initiated before 1923 would have expired before the January 1, 1978 effective date of the 1976 revisions.).

101. *See* James G. Silva, *Copyright Protection of Biotechnology Works: Into the Dustbin of History?*, B.C. INTELL. PROP. & TECH. F. (2000) (citing MICHAEL A. EPSTEIN, MODERN INTELLECTUAL PROPERTY, Ch. 11, II, C 458-59 (2d ed. 1992)).

102. *See id.*

novel molecule and the reported sequence may therefore comprise "original expression" under copyright law, the originality of his expression is minimal because the biological codes have been used for decades to report sequences.[103] Second, the sequence or information that the scientist seeks to protect is a "discovery" or "idea,"[104] neither of which is entitled to copyright protection. Third, because of the limited ways to express a DNA, RNA, or protein sequence, these biological codes have become standard techniques for describing molecules and are therefore not "creative expression." Under the doctrine of scenes á faire, "when similar features . . . are 'as a practical matter indispensable, or at least standard in the treatment of a given [idea], they are treated like ideas and are therefore not protected by copyright.'"[105] Where there is simply no other way to describe a natural phenomenon, there is no room for "creative expression."

Even if the scientist were to obtain copyright protection for the sequence of a discovered biological molecule, an accused infringer might assert the defense of "fair use" under § 107.[106] In determining "fair use," courts use four balancing factors including (1) "the purpose and character of the use," *e.g.*, commercial versus not-for-profit, (2) "the nature of the copyrighted work," *e.g.*, fiction versus nonfiction compilation, (3) "amount and substantiality of the portion used," *e.g.*, an entire work versus a small portion of a large work, and (4) "effect of the use upon the potential market."[107] For example, "fair use" would arguably exist where the accused infringer shows that he used the sequence of a single gene from a large copyrighted compilation (assuming that the compilation is copyrightable[108]) where his purpose was "criticism, comment, news reporting, teaching, scholarship, or research"[109] in a not-for-profit, academic setting. In this regard, many critics of IP protection for bioinformatics have been

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103. The chemical composition of DNA was found in 1909, and DNA was made artificially in 1956. Damian Carrington, *The History of Genetics*, BBC NEWS, May 30, 2000, *available at* http://news.bbc.co.uk/hi/english/in_depth/sci_tech/2000/hman_genome/newsid_749000/749026.stm (visited May 5, 2002).

104. *See* 17 U.S.C. § 102(b).

105. Apple Computer, Inc. v. Microsoft Corp., 35 F.3d 1435, 1444 (9th Cir. 1994) (citing Frybarger v. IBM Corp., 812 F.2d 525, 530 (9th Cir. 1987) (quoting Atari, Inc. v. N. Am. Philips Consumer Elec. Corp., 672 F.2d 607, 616 (7th Cir. 1982), *cert. denied*, 459 U.S. 880 (1982)).

106. 17 U.S.C. § 107 (1998).

107. *Id. See also* Campbell v. Acuff-Rose Music, Inc., 510 U.S. 569, 577 (1994) (discussing the four "fair use" factors). "All [four factors] are to be explored, and the results weighed together . . ." *Id.* at 578.

108. *See infra* Part IV.B.

109. 17 U.S.C. § 107.

academic researchers,[110] for whom the "fair use" is more likely to apply.[111] In summary, copyright protection for biological sequences is probably unavailable,[112] and were it to become available, it might be evaded by some of its strongest critics under the "fair use" exception.

B. Copyright Protection for Biological Databases

The Copyright Act of 1976 specifically describes compilations as copyrightable subject matter; therefore if a database is described as a compilation, it may qualify for copyright protection. The Supreme Court explored the boundaries of copyright protection for compilations in *Feist Publications, Inc. v. Rural Telephone Service Co.*[113] In *Feist* the work at issue was a telephone book, for which the creator sought copyright protection.[114] Justice O'Connor, writing for the majority, described the issue in the case: "[F]acts are not copyrightable [but] compilations of facts generally are."[115] However, the compilation must be sufficiently original, *e.g.*, in *selection* or *arrangement* of the compiled facts.[116] Where a compilation is copyrighted, copyright protection does not extend to every element of the work.[117] "Originality is the *sine qua non* of copyright [and] copyright protection may extend only to those components of a work that are original to the author."[118]

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110. *See generally* Public Comments on the United States Patent and Trademark Office "Revised Interim Utility Examination Guidelines," 64 Fed. Reg. 71440 (Dec. 21, 1999). Many of those responding to the USPTO's request for comments regarding its new "utility" guidelines for patentability were academic researchers who echoed Dr. Steven E. Sherer's comments: "I believe that at least [the] human genomic sequence goes to the core of what it means to be human and no individual or corporation should control or have ownership of something so basic."

111. *See* 17 U.S.C. § 107.

112. The DNA Copyright Institute ("DNACI") Inc. might disagree. *See* http://www.dnacopyright.com (visited May 5, 2002). For a fee, the DNACI will collect a sample of your DNA, determine your unique "DNA profile," and report your profile to you so that you can establish copyright protection. *Id.* However, nowhere on the DNACI website does the DNACI persuasively establish that copyright protection is available for one's "DNA profile" under the Copyright Act. *Id.* Furthermore, one can argue that we are not the "authors" of our DNA profiles. Our parents or maybe even a "higher authority" may be the true authors.

113. 499 U.S. 340 (1991).

114. *Id.* at 342-43.

115. *Id.* at 344.

116. *Id.* at 346, 348.

117. *Id.* at 348.

118. *Id. See also* N.Y. Times Co. v. Tansini, 533 U.S. 483, 494 (2001) (discussing the elements of an electronic database compilation which are subject to copyright). Copyright in a compilation "is limited to the compiler's original 'selection, coordination, and

Applying *Feist*'s principles, biological databases are copyrightable, provided they contain the requisite originality. For example, a scientist might obtain copyright protection if he chooses an original set of genes or proteins for a database or arranges the database in an original way. However, the copyright protection would not extend to all the genes or proteins in the database. Rather, copyright protection would extend only to his original selection or arrangement. Thus, a competitor who creates his own database using individual elements of the scientist's copyrighted database would not infringe the scientist's copyright so long as the competitor does not use the same selection or arrangement as the scientist's copyrighted database. Therefore, copyright protection for databases is limited.

Certain databases might have qualified for *sui generis* protection[119] under bills that were debated in the U.S. House of Representatives in 1998 and 1999.[120] These bills contemplated *sui generis* protection for databases and borrowed elements from the Patent Act, *e.g.*, a short defined term,[121] and elements from the Copyright Act, *e.g.*, a research exception comparable to "fair use."[122] To date, this legislation has not been enacted. However, because some members of the European Union have enacted *sui*

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arrangement.'" *Id.* (quoting *Feist*, 499 U.S. at 358). *See also* Torah Soft Ltd. v. Drosnin, 136 F. Supp. 2d 276, 286 (S.D.N.Y. 2001) (analyzing which elements of a compilation of the Hebrew Bible are subject to copyright). "A work comprised of material which in itself is not protected may become protectable as a compilation if the copyright holder has utilized sufficient creativity in selecting and arranging the material." *Id.* (quoting *Feist*, 499 U.S. at 358). The *Torah Soft* court found that the Hebrew Bible compilation was not protectable because the compilation possessed only *de minimis* creativity and incorporated only functional changes that were merely *scenes à faire*. *Id.* at 287-88.

119. "Sui generis protection" refers to protection "of its own kind or class." BLACK'S LAW DICTIONARY 1434 (2d ed. 1990).

120. These bills include H.R. 2652, 105th Cong. (1998), which later became H.R. 2281, 105th Cong. (1998) as part of the Digital Millennium Copyright Act ("DMCA"), and H.R. 354, 106th Cong. (1999). *See* J.H. Reichmann and Paul F. Uhlir, *Database Protection at the Crossroads: Recent Developments and Their Impact on Science and Technology*, 14 BERKELEY TECH. L.J. 793, 802 (1999). H.R. 2281 was dropped prior to enactment of the DMCA and was reintroduced as H.R. 354, 106th Cong. (1999). *See id.*

121. Under H.R. 2652 and H.R. 354, the term for protection would have been 15 years. H.R. 2652 § 1207(C); H.R. 354 § 1408(c). Although some have argued that the owner could extend the term indefinitely by "invest[ing] in maintenance or updates of a dynamic database." *Id.* at 809-10.

122. "[N]o person shall be restricted from making available or extracting information for nonprofit educational, scientific, or research purposes in a manner that does not materially harm the primary market for the product or service referred to . . . ." H.R. 354 § 1403(b). Similar language is included in H.R. 2652 § 1202(D) and H.R. 2281 § 1303(D). H.R. 354 also lists five factors similar to the four factors in 17 U.S.C. § 107. *See* H.R. 354 § 1403(a)(1)-(5).

generis protection for databases under an E.C. Directive,[123] Congress may feel pressure to harmonize U.S. law and enact some form of database protection in the future.[124]

C. Copyright Protection for Bioinformatic Software and Hardware

Courts have construed the term "literary works"[125] liberally to encompass computer software.[126] Thus, copyright protection is available for computer software and by extension to bioinformatic software where either the object code[127] or the source code[128] represents an original form of expression.[129] However, copyright protection for computer software is not as robust as patent protection. For instance, copyright protection extends only to the "original expression" contained within the software, and not to the functional elements or methods.[130] Typically, "original expression" is found in the literal code of the software,[131] and to avoid infringement, a competitor need only use different object or source code to achieve the same result. Therefore, copyright might not protect functional elements of the software, such as a hierarchal structure of the bioinformatic pro-

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123. *See* Xuqiong (Joanna) Wu, *Foreign and International Law: E.C. Database Directive*, 17 BERKELEY TECH. L.J. 571 (2002).

124. *Id.* at 572 ("The database industry has been lobbying Congress to strengthen database protection in the United States.").

125. 17 U.S.C. § 102.

126. *See* Torah Soft, Ltd. v. Drosnin, 136 F. Supp. 2d 276, 284 (S.D.N.Y. 2001) ("It is well-established that computer programs are protected by copyright law as *literary works*.") (emphasis added) (citing Computer Assoc. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 702 (2d Cir. 1992); Whelan Assoc., Inc. v. Jaslow Dental Lab., Inc., 797 F.2d 1222, 1233 (3d Cir. 1986) (citing Stern Elecs., Inc. v. Kaufman, 669 F.2d 852, 855 n.3 (2d Cir. 1982) (extending copyright protection to source code); Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 1246-47 (3d Cir. 1983) (extending copyright protection to source and object code), *cert. dismissed*, 464 U.S. 1033 (1984); Williams Elecs., Inc. v. Artic Int'l, Inc. 685 F.2d 870, 876-77 (3d Cir. 1982) (extending copyright protection to object code)).

127. Computers respond to instructions embodied in "object code," which is a binary language consisting of "0's" and "1's." LEMLEY, *supra* note 14, at 85. However, because it is difficult for a programmer to write a program in object code, programmers rely on intermediate languages called "source code," which is more akin to a written language with word instructions. *Id.* The computer "compiles" the source code into object code to obtain its binary instructions. *Id.*

128. *See id.*

129. See cases cited *supra* note 126.

130. Lotus Dev. Corp. v. Borland Int'l, 49 F.3d 807, 815 (1st Cir. 1995) (holding that Lotus' computer menu command hierarchy consisted of a "method of operation," and as such, it was not subject to copyright protection).

131. *See* cases cited *supra* note 126.

gram.[132] For programs like BLAST®, which searches a database of biological molecules to find those similar to a particular molecule,[133] copyright protection might not extend to the functional elements, such as BLAST's search and comparison method.

Copyright protection may be available for a bioinformatic machine or apparatus,[134] but the protection would extend only to the aesthetic, nonfunctional elements. For example, in *Carol Barnhart Inc. v. Economy Cover Corp.*,[135] the court held that certain elements of mannequin display forms could be copyrightable, but because the forms were functional, the functional and nonfunctional elements first needed to be "conceptually separable."[136] After conceptual separation, only the nonfunctional elements could be copyrightable.[137] For bioinformatic machines or apparatuses, most of their commercial value lies within their functional elements and not their aesthetic qualities. Thus, copyright protection may be inapplicable to bioinformatic machines or apparatuses.

One particular bioinformatic apparatus, the "gene chip," may qualify for *sui generis* protection under the Semiconductor Chip Protection Act ("SCPA").[138] The SCPA borrows concepts from the Patent Act[139] and the Copyright Act[140] and protects a semiconductor chip where it contains an original "mask work."[141] "Mask work" refers to the layers of a chip that are built up by deposition and etching to create the functional chip,[142] so in

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132. *See Lotus*, 49 F.3d 807, 815 (arranging the code in a particular manner, *i.e.*, hierarchical structure, might be described as a patentable "method.").

133. *See supra* note 51 (describing BLAST®, its principles, and its algorithm).

134. *See* Mazer v. Stein, 347 U.S. 201, 214-15 (1954) (holding that a sculptural lamp base could be copyrighted).

135. 773 F.2d 411, 415 (2d. Cir. 1985). Copyrightable elements might reside in the aesthetic features but not in the functional features of the mannequins.

136. *See id.* at 414.

137. *See id.* at 418. Even after determining that the elements are copyrightable subject matter, the elements would also have to be an original form of expression. 17 U.S.C. § 102.

138. 17 U.S.C. §§ 901-914 (2002).

139. Like patent protection, protection under the SCPA is for a short, finite term, *i.e.*, 10 years. 17 U.S.C. § 904(b).

140. *Compare* 17 U.S.C. § 102(b), *with* 17 U.S.C. § 902(c) (similarly limiting the scope of protection). *See also* text accompanying *infra* note 152.

141. 17 U.S.C. § 902(b) ("Protection under this chapter shall not be available for a mask work that . . . is not original.").

142. 17 U.S.C. § 901(a)(2) defines a "mask work" as

"a series of related images, however fixed or encoded—(A) having or representing the predetermined, three-dimensional pattern of metallic, insulating, or semiconductor material present or removed from the layers of a

some ways a "mask work" may be considered a "creative work." While the traditional idea of a gene chip is a microarray of DNA molecules imbedded or immobilized on a solid substrate, and not necessarily a semiconductor chip, recently developed gene chips do incorporate DNA onto a semiconducting chip.[143] If such a gene chip contains an original "mask work," the chip may be eligible for protection under the SCPA.[144] However, like copyright, the protection afforded to any mask work does not "extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which in which it is described, explained, illustrated, or embodied in such work."[145] This provision significantly limits the scope of protection under the SCPA and may preclude practical applicability of the SCPA to gene chips, where the value of such a chip likely resides in its "method of operation" and not its "mask work"—if it contains a "mask work" at all.[146] Therefore the SCPA may not afford significant protection to gene chips.

V. TRADE SECRET PROTECTION: ELIGIBLE SUBJECT MATTER MUST BE SOMETHING OF VALUE KEPT CONFIDENTIAL

Where federal patent or copyright protection is unavailable, state trade secret law may provide protection for bioinformatic components. Trade secret protection derives from the common law of tort,[147] but most states have enacted the Uniform Trade Secrets Act ("UTSA") in some form.[148] The UTSA defines a "trade secret" as:

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semiconductor chip product; and (B) in which series the relation of the images to one another is that each image has the pattern of the surface of one form of the semiconductor chip product"
Id.

143. *See, e.g.*, J.P. Cloarec et al., *Immobilization of Homooligonucleotide Probe Layers onto Si/SiO(2) Substrates: Characterization by Electrochemical Impedance Measurements and Radiolabelling*, 17(5) BIOSENSORS & BIOELECTRONICS 405-12 (May 2002); http://linkage.rockefeller.edu/wli/microarray/ (discussing microarray); Gene Chip, *supra* note 57.

144. 17 U.S.C. § 902.

145. *See supra* note 140.

146. *See* Gene Chip, *supra* note 57, Cloarac, *supra* note 143.

147. LEMLEY, *supra* note 14, at 50.

148. A recent survey notes that 44 of the 50 states had enacted some form of trade secrets law. *See* Andrew Beckerman-Rodau, *Trade Secrets—The New Risks to Trade Secrets Posed by Computerization*, 28 RUTGERS COMPUTER & TECH. L.J. 227, 230-33; Uniform Law Commissioners, Uniform Trade Secrets Act ("UTSA"), *at* http://www.nccusl.org/nccusl/uniformact_why/uniformacts-why-utsa.asp (visited Nov. 3,

> information, including . . . a compilation, program, device, method . . . that:
>
> (i) derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use, and
>
> (ii) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy.[149]

As such, if a bioinformatic component, such as a sequence, database, software or hardware can derive "independent economic value . . . from not being generally known," it can qualify for trade secret protection.[150] Trade secret protection offers a distinct advantage over patent or copyright protection because the protection is for a potentially infinite term. However, trade secret protection exists only as long as the subject matter remains "secret."[151] A confidentiality agreement can be used to prevent the contracting party from disclosing the trade secret, but if breached, it cannot be used to "regain" a trade secret that is released into the public domain; *i.e.*, a plaintiff could recover damages for breach of contract,[152] but the trade secret, once exposed to the public, is lost forever.[153] Similarly, trade secret protection does not prevent independent creation[154] or (perhaps more importantly) "reverse engineering,"[155] and like confidentiality agreements, contracts that prohibit licensees from reverse engineering may be futile because of the inability to "regain secrecy" in the event of breach.

2002). Even where a state has not enacted statutory protection, common law protection may be available.

149. The National Conference of Commissioners on Uniform State Laws approved its final draft of the Uniform Trade Secrets Act in 1985, *available at* http://www.law.upenn.edu/bll/ulc/fnact99/1980s/utsa85.html.

150. *Id.*

151. *See* UTSA *supra* note 149; MILGRIM ON TRADE SECRETS § 1.01. (To remain a trade secret, the subject matter must not become "generally known.").

152. "A suit to redress theft of trade secret is grounded in tort damages for breach of a contract . . . ." Kewanee Oil, Co. v. Bicron Corp., 416 U.S. 470, 498 (1974) (Douglas, J., dissenting).

153. Bonito Boats v. Thunder Craft Boats, 489 U.S. 141, 155 (1989) ("[T]he policy that matter once in the public domain must remain in the public domain is not incompatible with the existence of trade secret protection.") (citing *Kewanee Oil*, 416 U.S. at 484).

154. *See Kewanee Oil*, 416 U.S. at 490; *Bonito Boats*, 489 U.S. at 160 (citing *Kewanee Oil*, 416 U.S. at 476).

155. *See Kewanee Oil*, 416 U.S. at 490. For example, if a scientist commercializes a product containing an embodiment of the trade secret, the scientist cannot prevent one from purchasing the product, discovering the trade secret therein by reverse engineering, and subsequently releasing the trade secret into the public domain.

Therefore, the feasibility of trade secret protection for bioinformatic components may depend on the ease with which they can be reverse engineered.

A. Trade Secret Protection for DNA, RNA, and Protein Sequences

Trade secret protection may be the only viable form of IP protection available for biological sequences.[156] However, trade secret protection may also be impractical. First, it is relatively easy to determine the sequence of a biological composition, so others could independently obtain the sequence information if the biological composition is made readily available. Likewise, trade secret protection of a discovered function encoded in the biological sequence information might be equally futile if the owner intends to market and capitalize on that very function he is trying to protect. For example, assume that a biotechnology company discovers that a particular biological sequence is predictive for a particular disease, and the company develops a corresponding diagnostic test. To establish the validity of its testing services, the company would probably have to submit its test to some form of "peer review." However, by doing so, it might lose its trade secret protection because validation usually entails general dissemination and widespread acceptance,[157] and as such, the company might have to reveal the basis of its test. While the company might find a small group of experts willing to validate its test under a confidentiality agreement, it may be difficult to market a test for which the validity is not *generally and widely accepted*. Therefore, trade secret protection may be impractical to protect biological sequences or their encoded functions if the scientist seeks commercialization thereof.

B. Trade Secret Protection for Biological Databases

Trade secret protection is also available for databases if the database can be shown to derive "independent economic value . . . from not being generally known."[158] If the owner of a database wishes to commercialize it by selling access or even the database itself, the creator runs the risk that the information within the database will be disclosed and released to the public domain. To avoid such a risk, the owner might engineer or acquire security devices that allow access to the database without revealing the

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156. *See supra* Parts III.A and IV.A (discussing unlikely protection of biological sequences under patent and copyright law, respectively).

157. Some "disclosure" is permitted under trade secret law, but the subject matter of the trade secret must not become "generally known." *See* MILGRIM ON TRADE SECRETS § 1.01.

158. *See* LEMLEY, *supra* note 14, at 52.

entire contents.[159] Nevertheless, these devices can be circumvented and the database content released into the public domain, thereby forever destroying the trade secret status of the information. Notwithstanding such risks, some databases owners have attempted to "exploit [their] databases commercially by controlling access to them, in effect using contracts and trade secrecy to protect their intellectual property."[160] Even where database owners have controlled access and secrecy through contracts, *third party release* of independently acquired information into the public domain has hampered efforts to commercialize these databases.[161] For instance, as part of its policy, the Wellcome Trust, called the "world's largest medical charity,"[162] releases the DNA sequence information that it gathers from the human genome into the public domain.[163] Likewise, pharmaceutical giant Merck sponsored human DNA sequencing research by Washington University for "instantaneous dedication [of the results] to the public domain."[164] This policy increases the amount of information that is *freely available* and, therefore, may diminish the value of fee-based databases.[165] Merck nonetheless believes that release of such information into the public domain will benefit its own development efforts in the long run.[166] Data released by the Wellcome Trust or companies like Merck may be incorporated into the free databases offered by the NIH.[167] Therefore, if the owner of a database wishes to maintain the database as a trade secret, the owner must protect against not only unlicensed access, but also erosion of the database's value through third party disclosures and the growth in the number of free databases.

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159. For example, companies that offer on line databases typically require that subscribers use passwords, and subscribers may have limited access based on the subscription agreement.

160. Rebecca S. Eisenberg, *Intellectual Property at the Public-Private Divide: The Case of Large-Scale cDNA Sequencing*, 3 U. CHI. L. SCH. ROUNDTABLE 557, 563 (1996).

161. *Id.* at 570 (describing Merck's collaboration with Washington University to release data to the public domain). Some observers suggest cynically that Merck's goal is "to undermine the value of investments already made in existing sequence databases by its commercial competitors." *Id. See* Alexander K. Haas, *The Wellcome Trust's Disclosures of Gene Sequence Data into the Public Domain & the Potential for Proprietary Rights in the Human Genome*, 16 BERKELEY TECH. L.J. 145, 152 (2001) (describing the Wellcome Trust's release of biological information into the public domain).

162. Haas, *supra* note 161, at 151.

163. *Id.* at 152.

164. Eisenberg, *supra* note 160, at 559.

165. *Id.* at 564.

166. *Id.* at 570. Because Merck does not have the resources to investigate every biological sequence that it discovers, it has chosen to release the sequence into the public domain, hoping to "capture an adequate share of [the] resulting products." *Id.*

167. *See supra* note 44 (listing some of the databases offered by the NIH).

C. Trade Secret Protection for Bioinformatic Software and Hardware

Trade secret protection is available for computer software, and bioinformatic software is no exception.[168] Many software developers maintain the source code of their programs as a trade secret, releasing only the object code for sale or license.[169] However, the software developer still runs the risk of disclosure by reverse engineering if the object code is decompiled into source code.[170] Again, the use of security devices or contracts to prevent reverse engineering is insufficient if the devices are circumvented or the contracts breached. Despite these risks, developers have utilized trade secret protection effectively, where decompiling is difficult and produces errors.[171]

Trade secret protection is also available for a bioinformatics machine or apparatus. However, if the owner intends to sell the machine or apparatus, the risk of disclosure is very high because machines and apparatuses, once freely distributed and in "plain view," can be reverse engineered by disassembling them and determining how they function.[172]

VI. ARGUMENTS AGAINST IP PROTECTION FOR BIOINFORMATIC COMPONENTS

Even where IP protection is available and practical for bioinformatic components, some argue that bioinformatic components should be excluded from IP protection for policy reasons. For instance, some argue against IP protection for bioinformatics because they believe that the human genome belongs to everyone and should not be kept as a property

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168. *But see infra* Part VI for a discussion of the "Open Informatics" petition which argues for free licenses for bioinformatic software.

169. LEMLEY, *supra* note 14, at 61-62 ("[S]oftware developers generally distribute their programs only in object code form and keep the source code . . . as [a] trade secret[], licensing [it] only rarely and only under agreements of confidentiality."). For an example of a Microsoft licensing agreement see *Microsoft Corp. v. Commissioner*, 115 T.C. 228, 235-38 (2000). *See also* http://www.compaq.com/Cas-Catalog/das055hm.html (exemplifying a Compaq license agreement for its "trade secret diagnostic software." "Source code . . . is not sold, licensed, nor otherwise distributed without prior approval . . . .Object code, in binary form, . . . is available for sale or license.").

170. "Decompiling" involves "translat[ing] the 1s and 0s into some form of assembly language and then into readable source code." LEMLEY, *supra* note 14, at 85.

171. *Id.* (citing Andrew Johnson-Laird, *Reverse Engineering of Software: Separating Legal Mythology from Actual Technology*, 5 SOFTWARE L.J. 331, 342-43 (1992)).

172. Patent protection is probably more suitable for bioinformatics machines and apparatuses. *See supra* Part III.C.

right.[173] As previously noted, many of these arguments incorrectly equate the human genome *sequence* with the human genome *composition*. Others argue against IP protection for bioinformatics because it relates to human medicine. For example, some commentators argue against patenting medical procedures,[174] *i.e.*, patents on medical procedures hinder medical research where the patentee excludes others from practicing the patented procedure. By analogy, some may argue that patents on bioinformatic components hinder medical research where bioinformatic components released into the public domain would advance human medicine more rapidly. However, these arguments do not address the need to create incentives for biological sequence research and development.[175] The USPTO[176] and many patent scholars[177] argue that *patents spur invention* and that it is wrong "to single out any area of subject matter and deny rewards for creativity in that area."[178] Furthermore, patent protection encourages the *full disclosure* of bioinformatics components,[179] which *promotes* progress in medical research.

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173. *See supra* note 12.

174. *See, e.g.*, Linda Rabin Judge, *Comment: Issues Surrounding the Patenting of Medical Procedures*, 13 COMPUTER & HIGH TECH. L.J. 181, 194 (1997). *Compare* Wendy W. Yang, *Note: Patent Policy and Medical Procedure Patents: The Case for Statutory Exclusion from Patentability*, 1 B.U. J. SCI. & TECH. L. 5 (1995), *with* Joel Garris, *Note and Comment: The Case for Patenting Medical Procedures*, 22 AM. J.L. & MED. 85 (1996). These articles were written in response to H.R. 1127, 104th Cong. (1995) and S. REP. NO. 1334 104th Cong. (1995).

175. *See* DONALD S. CHISUM ET AL., PRINCIPLES OF PATENT LAW 62-67 (1998) (describing four policy goals of our patent system including (1) to create an "incentive to invent," (2) to create an "incentive for full disclosure," (3) to create an "incentive to commercialize," and (4) to create an "incentive to design around"). *See also* 66 Fed. Reg. 1092, 1094 (Jan. 5, 2001) (stating that "[t]he incentive to make discoveries and inventions is generally *spurred* . . . by patents.") (emphasis added).

176. *See* 66 Fed. Reg. 1092, 1092-97 (Jan. 5, 2001) (USTPO, addressing arguments raised by opponents of DNA patents).

177. For example, testifying against the banning of patent protection for medical procedures, Donald R. Dunner, former Chairman of the Intellectual Property Law Section of the American Bar Association, stated that the goal of the patent system is to provide incentives for innovation for "any and all subject matter." Linda Rabin Judge, *supra* note 174.

178. *Id.* (quoting Donald R. Dunner, former Chairman of the Intellectual Property Law Section of the American Bar Association).

179. In order to obtain a patent, the applicant must fulfill a disclosure requirement. *See* 35 U.S.C. § 112 (discussing the disclosure requirements for obtaining a patent). *See also* M. Scott McBride, *Note: Patentability of Human Genes: Our Patent System Can Address the Issues Without Modification*, 85 MARQ. L. REV. 511, 527-28 (2001) (describing how our patent system encourages full disclosure of DNA sequences in regard to patent applications for genes). Even though the patentee has the right to exclude others from

Copyright protection would hinder medical research only to a limited degree because it would not extend to a component's *function*.[180] However, because copyright protection is available for the literal code of bioinformatic software, opponents of copyright protection for publicly-funded bioinformatic software have recently argued for "open source licenses" as further discussed below.[181]

With regard to trade secret protection, any arguments against protection for bioinformatic components are essentially arguments for forced disclosure, which for privately-funded entities would be unworkable and unconstitutional.[182] For publicly-funded entities, disclosure is encouraged, and the Bayh-Dole Act[183] and current NIH guidelines preclude an NIH-funded scientist from keeping bioinformatics information as a trade secret as further discussed below.[184]

Others argue against IP protection of bioinformatics components because their discovery is publicly funded and thus belong to the public.[185] For patents, this persuasive argument has been largely muted by enactment of the Bayh-Dole Act.[186] The Bayh-Dole Act amended the Patent

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practicing his claimed invention, see 35 U.S.C § 271, the "right to exclude" is for a limited period of time. *See* 35 U.S.C. § 154 (describing the finite length of a patent term). In exchange, society receives full disclosure of the claimed invention. *See* 35 U.S.C. § 112. *See also* Rebecca S. Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 YALE L.J. 177, 181-84, 197-205, 207-17 (1987) (discussing disclosure in regard to biotechnology).

180. *See supra* notes 134-137 and accompanying text. The *functional elements*, not the aesthetic or literal elements, typically drive medical advances. For example, most would agree that the functional elements of an magnetic resonance imaging machine ("MRI") are more important than its aesthetic qualities.

181. *See* Jason E. Stewart & Harry Mangalam, *The Open Informatics Petition*, O'REILLY NETWORK (Jan. 14, 2002), *available at* http://www.oreillynet.com/pub/a/network/2002/01/11/openinfo.html (visited Nov. 3, 2002).

182. For example, the inventor, creator, or discoverer could simply keep his invention, creation, or discovery secret, and any attempt to force disclosure would violate the U.S. Constitution, *e.g.*, the First Amendment's right to free speech. U.S. CONST. amend. I ("Congress shall make no law . . . abridging the freedom of speech . . . ."). *See* Bartnicki v. Vopper, 532 U.S. 514, 533 n.20 (2000) (citations omitted). A forced disclosure might also violate the Fifth Amendment's prohibition against "takings." U.S. CONST. amend. V ("[N]or shall private property be taken for public use, without just compensation."). Where a trade secret is "property," forced disclosure might constitute a "taking." *Id.*

183. 35 U.S.C. §§ 200-212 (1998).

184. *See infra* notes 210-220 and accompanying text.

185. For example, grants from the National Institutes of Health ("NIH") or the National Science Foundation ("NSF") often fund research that may lead to the development of bioinformatics components.

186. 35 U.S.C. §§ 200-212 (1998).

Act to indicate that inventors[187] are entitled to their inventions, even if the invention was funded by public sources from a federal agency.[188] However, the Bayh-Dole Act also provides that the federal government has "march-in" rights in limited circumstances,[189] although the government rarely exercises these rights.[190] In order to secure rights in their inventions, the inventors must "disclose each subject invention to the [funding] Federal agency within a reasonable time,"[191] although the inventors may ultimately choose not to pursue patent protection. This "disclosure requirement" supplements the disclosure requirements of 35 U.S.C. § 112, which an applicant must satisfy before receiving a patent. Therefore, in enacting the Bayh-Dole Act, Congress effectively addressed the argument against patent protection for publicly-funded research by permitting protection in exchange for further disclosure.[192]

However, the Bayh-Dole Act applies to "inventions," and therefore does not apply to copyright law,[193] which (as noted) is applicable to some bioinformatic components such as literal elements of software.[194] Recently, software developers circulated a petition that required the free licensing of bioinformatic software developed with public funds.[195] These developers and others signing the petition "believe that publicly funded

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187. "Inventors" includes "small business firm[s] [and] nonprofit organizations." 35 U.S.C. § 202(a) (2002). However, the GAO asserts that "inventors" was extended to include large businesses under Exec. Order No. 12,591, 52 Fed. Reg. 13414 (Apr. 10, 1987). *See* Peter S. Arno & Michael H. Davis, *Why Don't We Enforce Existing Drug Price Controls? The Unrecognized and Unenforced Reasonable Pricing Requirements Imposed upon Patents Deriving in Whole or in Part from Federally Funded Research*, 75 TUL. L. REV. 631, 642 n. 60 (2001).

188. 35 U.S.C. § 201(b) (1998) (defining "funding agreement" as an agreement between any Federal Agency and any contractor).

189. 35 U.S.C. § 203

190. "'The Government does not use its march-in rights one in a million times . . . .I think that is a paper tiger. I think we can forget [march-in rights] as a realistic protection for the public.'" Arno & Davis, *supra* note 187, at 658 (quoting Representative Jack Brooks, "perhaps the harshest critic of the proposed legislation," during congressional hearings). "Brooks's statement proved to be prophetic—the NIH has never exercised its march-in rights." *Id*.

191. 35 U.S.C. § 202(c)(1) (1998).

192. *Id.*

193. 35 U.S.C. § 201(d) ("The term 'invention' means any invention or discovery which is or may be patentable [under the Patent Act]").

194. *See supra* Part III.C.

195. *See The Open Source Definition*, *at* http://www.opensource.org/docs/defintion.html (visited May 5, 2002). The circulation of this petition was initiated by developers Jason Stewart, Harry Mangalam, and Jiaye Zhou. *Id*.

research should be made available to all."[196] The "Open Informatics" petition, as it is called, "would require that publicly funded researchers publish any source code under an open source or free software license."[197] The purported advantages to such a policy include:

- Promoting cooperation between academic and commercial organizations;
- Promoting standardization;
- Promoting peer-review of software to allow "bugs . . . to be found and corrected"; and
- Promoting a mechanism for more rapid improvement and development of code.[198]

Andrew Dalke, co-founder of the Biopython Project, "an international association of developers of *freely available* . . . tools for computational molecular biology,"[199] opposes the "Open Informatics" petition.[200] First, Dalke states that an "open source" policy would not promote cooperation between academic and commercial organizations.[201] Indeed, an academic scientist under an "open source" obligation may not be able to work with commercial organizations that require license agreements that are apposite to the "open source" policy.[202] Further, the petition may be "dead on arri-

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196. David Malakoff, *Petition Seeks Public Sharing of Code*, 294 SCIENCE 27 (Oct. 5, 2001).

197. Andrew Dalke, *Why I'm not Supporting the Open Informatics Petition*, O'REILLY NETWORK, Jan. 14, 2002, *at* http://www.oreillynet.com/pub/a/network/2002/01/12/dalke.html (visited Oct. 13, 2002).

198. Jason E. Stewart & Harry Mangalam, *The Open Informatics Petition*, O'REILLY NETWORK, Jan. 14, 2002, *at* http://www.oreillynet.com/pub/a/network/2002/01/11/openinfo.html (visited Oct. 13, 2002).

199. http://www.biopython.org (visited Oct. 13, 2002).

200. Dalke, *supra* note 197.

201. *Id.*

202. *Id. See also* Bernadette Toner, *Legal Pitfalls of Free Bioinformatics Software May Loom Large*, GENOME WEB NEWS, Aug. 17, 2001, *at* http://www.genomeweb.com/articles/view-articles.asp?Article=200181784719 (discussing the case of Steve Brenner, assistant professor of computational genomics research at the University of California, Berkeley). Because Dr. Brenner's work on open source was incompatible with the university's default software license, Dr. Brenner had to request a formal variance to continue his work.

val"[203] because funded entities have proprietary rights to their inventions under the Bayh-Dole Act and cannot be made to "release software under [free] licenses that contradict federal law.[204] Second, while supporters argue that the petition will promote standardization, Dalke disagrees that standardization is desirable in all instances.[205] For example, in some instances, verifying one scientist's results by using different bioinformatic software might bolster the scientist's results. Third, Dalke disagrees with equating "open source" to "peer review."[206] Although a policy of "open source" might facilitate detection and correction of "bugs," it does not necessarily follow that the author of the code should be denied IP protection. For instance, Dalke argues that we allow copyright protection and peer review of scientific papers, and by analogy that he should not be "allowed to take a peer-reviewed [scientific] paper, modify a paragraph, and republish it."[207] This would violate the author's copyright,[208] and yet this is exactly what the proponents of "open source" would permit in regard to bioinformatics software. Finally, Dalke disagrees that "open source" would promote improvement and development, and he cites article I, section 8, clause 8 of the U.S. Constitution for the argument that IP protection "promote[s] the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."[209] Proponents of "open source" should note that while "open source" may promote improvement and development through widespread analysis and constructive criticism, "open source" would remove the incentive to create where the author of the code could not obtain a proprietary right in his work.

Even in the absence of an "open source" requirement, publicly-funded entities are encouraged to disclose their work not only under Bayh-Dole[210] but also under NIH policy. It is the NIH's stated goal to "promote free dissemination of research tools without legal agreements whenever possi-

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203. Justin Hibbard, *The Open-Source Debate Enters the Genomics Arena*, REDHERRING, Feb. 25, 2002, *available at* http://www.redherring.com/insider/2002/0225/1805.html.

204. *Id.*

205. Dalke, *supra* note 195.

206. *Id.*

207. *Id.*

208. *Id.*

209. U.S. CONST. art. I, § 8, cl. 8.

210. In fact, if the publicly-funded entity seeks patent protection, the entity must disclose its finding to the Federal agency which funded its work within a reasonable amount of time. 35 U.S.C. § 202(c)(1).

ble."[211] A "research tool . . . includes[s] DNA sequences [and] databases,"[212] and scientists are expected to make "intellectual property, such as computer programs," accessible as well.[213] Further, the NIH is developing a new policy on data sharing and has requested comments on its Draft Statement of Sharing Research Data.[214] Under the proposed policy, researchers who "submit . . . an NIH [grant] application will be required to include a plan for data sharing or to state why data sharing is not possible."[215] The recipient of a grant will be subject to NIH policy as a condition of the grant.[216] Therefore, under current and proposed guidelines a scientist would violate NIH policy by attempting to keep as a trade secret any sequence or database developed with an NIH grant.[217] However, while the current NIH guidelines may prohibit a researcher from maintaining "research tools" as a trade secret, the guidelines do not prevent the researcher from obtaining patent protection[218] or copyright protection[219]

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211. http://www.nih.gov/news/researchtools/index.html. *See also* 64 Fed. Reg. 72,090 (Dec. 23, 1999) (Department of Health and Human Services, Principles and Guidelines for Recipients of NIH Research Grants and Contracts on Obtaining and Disseminating Biomedical Research Resources: Final Notice), *available at* http://ott.od.nih.gov/NewPages/Rtguide_final.html (visited May 5, 2002) (responding to comments submitted in regard to the NIH's then proposed policy on Sharing Biomedical Research Resources)[hereinafter NIH Dissemination Policy].

212. NIH Dissemination Policy, *supra* note 211, at 72092 n.1.

213. NIH Grants Policy Statement (Mar. 2001) at 121. http://grants.nih.gov/grants/policy/nihgps_2001/nihgps_2001.pdf [hereinafter NIHGPS].

214. National Institutes of Health, Office of Extramural Research, NIH Draft Statement of Sharing Research Data, *available at* http://grants1.nih.gov/grants/policy/data_sharing/index.html (visited May 5, 2002)[hereinafter NIH Draft Statement].

215. *Id.* Unfortunately, because researchers are often judged by their publication record—*i.e.*, "publish or perish"—some are loathe to share their research data for fear that a competitor may "scoop" them. The NIH Draft Statement does not describe acceptable circumstances where data sharing might not be possible, but presumable, the risk of "being scooped" will not be a permissible circumstance.

216. National of Institutes of Health, Office of Extramural Research, Award Conditions and Information for NIH Grants, *at* http://grants1.nih.gov/grants/policy/awardconditions.html (visited May 5, 2002).

217. NIHGPS, *supra* note 213, at 121, "Investigators are expected to submit unique biological information to the appropriate data banks." Further, the NIHGS has enforcement provisions, and noncompliance with the terms and conditions of an award may result in "[s]uspension, [t]ermination, or [w]ithoholding of [s]upport." *Id.* at 144-45.

218. *See* Principles and Guidelines for Recipients of NIH Research Grants and Contracts on Obtaining and Disseminating Biomedical Research Resources: Final Notice, 64 Fed. Reg. 72090 (Dec. 23, 1999), *available at* hhtp://ott.od.nih.gov/NewPages/RTguide_final.html "[W]here patent protection is necessary for development of a research tool as a potential product for sale and distribution to the research community, Recipients are not discouraged from seeking such protection, but should license the intel-

where available. While the NIH promotes accessibility, the NIH leaves it up to "*recipients* to determine the appropriate means of effecting prompt and effective access to research tools,"[220] and as such, the NIH is not necessarily advocating "free licenses" as proposed by the "Open Informatics" petition.

In summary, it appears that our laws seek to strike a balance, *i.e.*, promote full disclosure and cooperation to encourage development, but permit IP protection to create incentives for development as well. It remains to be seen whether opponents of IP protection for bioinformatics will tip the scale in their direction, *i.e.*, to require full disclosure with no proprietary rights.

VII. CONCLUSION

Bioinformatics comprises a wide array of components, and it follows that a wide array of protection might be available, depending on the particular nature of the bioinformatic component and its intended use. Because of the tremendous growth and investment in the field of bioinformatics, it is important to consider whether IP protection is available to offset the cost of development.

With regard to biological sequences, trade secret protection may be the only practical protection. This holds best where the owner effectively maintains confidentiality agreements or does not intend to commercialize the corresponding biological composition, because sequences can be easily determined or "reverse engineered" where compositions are available.

Likewise, trade secret protection may provide the best protection for biological databases, but only if adequate security measures can reliably limit access and the owner effectively maintains confidentiality agreements. Copyright protection for databases is minimal and is unlikely to extend to the information contained within the database.

With regard to bioinformatic software, the inventor can obtain patent protection on the method within the program, provided the method produces tangible results; and the author can obtain copyright protection, but only for the literal elements of the bioinformatic software code. Although

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lectual property in a manner that maximizes the potential for broad distribution of the research tool.").

219. NIHGPS, *supra* note 213, at 119 ("Except as otherwise provided in the terms and conditions of the award, the grantee is free to copyright without NIH approval when publications, data, or other copyrightable works are developed under, or in the course of, work under an NIH grant.").

220. *Id.* at 121.

trade secret protection is available for bioinformatic software, again, like many bioinformatic components, the owner runs the risk that the code will be reverse engineered and the trade secret will be lost to the public domain.

AGAINST "AGAINST CYBERANARCHY"

By David G. Post†

I. INTRODUCTION

It makes me indignant when I hear a work
Blamed not because it's crude or graceless but
Only because it's new . . .
Had the Greeks hated the new the way we do,
Whatever would have been able to grow to be old?[1]

Professor Jack Goldsmith's *Against Cyberanarchy*[2] has become one of the most influential articles in the cyberspace law canon. The position he sets forth—what I call "Unexceptionalism"—rests on two main premises. The first is that activity in cyberspace is "functionally identical to transnational activity mediated by other means"[3] (e.g., "mail or telephone or smoke signal"[4]). The second is that, as a consequence of this functional identity, the "settled principles" and "traditional legal tools"[5] of the international lawyer are fully capable of handling all jurisdictional and choice-of-law problems in cyberspace. Thus, the "choice-of-law problems implicated by cyberspace are not significantly different from those [of] non-cyberspace conflicts,"[6] and we therefore need make no special provision for these problems when they arise in *cyberspace*.

I beg, in what follows, to differ. I remain an unrepentant Exceptionalist. Communication in cyberspace is not "functionally identical" to communication in realspace—at least, not in ways relevant to the application of the choice-of-law and jurisdictional principles under discussion. Furthermore, the jurisdictional and choice-of-law dilemmas posed by cyberspace activity cannot be adequately resolved by applying the "settled principles" and "traditional legal tools" developed for analogous problems in realspace. Unexceptionalism in cyberspace

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1. HORACE, THE EPISTLES OF HORACE 117 (David Ferry trans., Farrar, Straus and Giroux 2001) (n.p., 14 b.c.).
2. Jack L. Goldsmith, *Against Cyberanarchy*, 65 U. CHI. L. REV. 1199 (1998) [hereinafter *Against Cyberanarchy*].
3. *Id*. at 1240.
4. *Id*.
5. *Id*. at 1200.
6. *Id*. at 1233-34.

Border-crossing transactions have always presented the international legal system with difficult and challenging jurisdictional questions: Whose law applies to such transactions? Which sovereign(s) have jurisdiction to prescribe law for transactions that originate in one country and terminate elsewhere? When and to what extent is extraterritorial regulation permissible?

In *Against Cyberanarchy*, Jack Goldsmith asked us to consider

> the predicament of one of the scores of companies that offer, sell, and deliver products on the World Wide Web. Assume that the web page of a fictional Seattle-based company, Digitalbook.com, offers digital books for sale and delivery over the Web. One book it offers for sale is *Lady Chatterley's Lover*. This offer extends to, and can be accepted by, computer users in every country with access to the Web. Assume that in Singapore the sale and distribution of pornography is criminal, and that Singapore deems *Lady Chatterley's Lover* to be pornographic.
>
> Assume further that Digitalbook.com's terms of sale contain a term that violates English consumer protection laws, and that the publication of Digitalbook.com's *Lady Chatterley's Lover* in England would infringe upon the rights of the novel's English copyright owner. Digitalbook.com sells and sends copies of *Lady Chatterley's Lover* to two people whose addresses (say, anonymous@aol.com and anonymous@msn.com) do not reveal their physical location but who, unbeknownst to Digitalbook.com, live and receive the book in Singapore and London, respectively.[7]

This scenario, Goldsmith acknowledged, raises some difficult problems: Does English law, Singaporean law, or both, apply to Digitalbook.com's conduct? Would application of either of these bodies of law constitute "impermissible extraterritorial regulation of a U.S. corporation"?[8] If Digitalbook.com "cannot limit its cyberspace information flows by geography,"[9] would application of English or Singaporean law cause Digitalbooks.com to remove *Lady Chatterley's Lover*[10] from circulation (or, at the very least, to "raise its price"[11]), thereby "adversely affect[ing] the purchasing opportunities of parties in other countries"?[12] And if so, are these "negative spillover effects" of national regulation "illegitimate [and] unfair"[13]—especially given that "Digitalbook.com had no way of

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7. *Id*. at 1204-05.
8. *Id*. at 1205.
9. *Id*.
10. *See id*.
11. *Id*.
12. *Id*. at 1205.
13. *Id*.

knowing that it sold and delivered a book to consumers in these countries"?[14]

Goldsmith's position—what I term "Unexceptionalism"—is straightforward. However difficult and complicated Digitalbooks.com's problems may be, they are no *more* difficult or complicated because the underlying transactions take place "in cyberspace." As Goldsmith puts it,

> [t]ransactions in cyberspace involve real people in one territorial jurisdiction either (i) transacting with real people in other territorial jurisdictions or (ii) engaging in activity in one jurisdiction that causes real-world effects in another territorial jurisdiction. *To this extent, activity in cyberspace is functionally identical to transnational activity mediated by other means, such as mail or telephone or smoke signal*.[15]

To the Unexceptionalist, whether a transaction occurs in cyberspace or realspace does not matter. The questions of jurisdiction and choice of law posed by Digitalbooks.com's conduct are not "unique to cyberspace"[16] because "identical problems arise all the time in real space."[17] After all, people have been communicating and transacting with other people in other territorial jurisdictions for a long time, well before the Internet raised its head. Thus, the questions created by Digitalbook's conduct may be complex and challenging, but they are "no more complex or challenging than similar issues presented by increasingly prevalent real-space events such as airplane crashes, mass torts, multistate insurance coverage, or multinational commercial transactions, all of which form the bread and butter of modern conflict of laws."[18]

Over the past century or so, a number of important principles of law and analytical tools have evolved to resolve the jurisdictional problems posed by border-crossing transactions. These traditional principles and tools, though developed to deal with realspace phenomena, do not spontaneously disintegrate or misfire when we apply them to phenomena on the global electronic network. Cyberspace transactions "are not significantly less resistant to the tools of conflict of laws, than other transnational transactions,"[19] and

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14. *Id*.

15. *Id*. at 1239-40 (emphasis added); *see also* Jack L. Goldsmith, *The Internet and the Abiding Significance of Territorial Sovereignty*, 5 IND. J. GLOBAL LEGAL STUD. 475, 479 (1998) [hereinafter *The Abiding Significance*] ("Internet activities are functionally identical to these non-Internet activities. People in one jurisdiction do something—upload pornography, facilitate gambling, offer a fraudulent security, send spam, etc.—that is costly to stop at another jurisdiction's border and that produces effects within that jurisdiction deemed illegal there."); Allan R. Stein, *The Unexceptional Problem of Jurisdiction in Cyberspace*, 32 INT'L LAW 1167, 1180 (1998) ("The Internet is a medium. It connects people in different places. The injuries inflicted over the Internet are inflicted by people on people. In this sense, the Internet is no different from the myriad of ways that people from one place injure people in other places . . . .").

16. *Against Cyberanarchy*, *supra* note 2, at 1234.

17. *Id*.; *see also* Stein, *supra* note 15, at 1191 ("Jurisdiction in cyberspace is not unproblematic. My point is that it is not *uniquely* problematic.") (emphasis added).

18. *Against Cyberanarchy*, *supra* note 2, at 1234.

19. *Id*. at 1201.

it would therefore be a mistake to "underestimate the potential of [these] traditional legal tools and technology to resolve the multijurisdictional regulatory problems implicated by cyberspace."[20]

Those who think otherwise—Goldsmith calls them "regulation skeptics,"[21] though I prefer the less loaded and more symmetrical term "Exceptionalists"—believe that cyberspace *is* somehow different, that it matters, for purposes of understanding these jurisdictional questions, that Digitalbooks.com is operating on the World Wide Web and not in a brick-and-mortar realspace storefront. Exceptionalists, in Goldsmith's view, are skeptical of the "potential of traditional legal tools and technology to resolve the multijurisdictional regulatory problems implicated by cyberspace."[22] They believe that "the application of geographically based conceptions of legal regulation and choice of law to a-geographical cyberspace activity either makes no sense or leads to hopeless confusion,"[23] and that because "cyberspace transactions occur 'simultaneously and equally' in all national jurisdictions, regulation of the flow of this information by any particular national jurisdiction illegitimately produces significant negative spillover effects in other jurisdictions."[24]

The problem with Exceptionalism, Goldsmith tells us, is that it is "in the grip of a nineteenth century territorialist conception of how 'real space' is regulated and how 'realspace' conflicts of law are resolved."[25] This outdated and discredited territorialist conception—"Hermetic Territorialism,"[26] he calls it—involves a belief that there must be "a *unique* governing law for all transnational activities,"[27] a "*single* legitimate governing law for transborder activity based on discrete territorial contacts."[28] Hermetic territorialism directs us to identify one body of law applicable to Digitalbooks.com's behavior, and to define the "discrete territorial contact" which is a necessary prerequisite to the application of local law to its conduct.

Hermetic territorialism, though it held sway for several hundred years, was repudiated as part of a "revolution[ ] [in] conflict of laws in the second half of [the 20th] century."[29] Many factors—including "[c]hanges in transportation, communication, and in the scope of corporate activity [leading] to an unprecedented increase in multijurisdictional activity"[30]—led directly to an "expansion of the permissible bases for territorial jurisdiction."[31] The result is that in "modern times[,] a transaction can legitimately be regulated

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20. *Id*. at 1200-01.
21. *Id*. at 1199.
22. *Id*. at 1200-01.
23. *Id*. at 1200.
24. *Id*.
25. *Id*. at 1205.
26. *Id*. at 1206.
27. *Id*. at 1208 (emphasis added).
28. *Id*. at 1206 (emphasis added).
29. *Id*. at 1208.
30. *Id*. at 1206 (noting that these "significant changes in the world" led to an "unprecedented increase in multijurisdictional activity" and "put pressure on the rigid territorialist conception").
31. *Id*. at 1207; *see also* Stein, *supra* note 15, at 1169 ("As people and transactions became more mobile, jurisdictional rules based solely on the current location of the defendant were strained. Courts increasingly had a need to assert authority over persons not currently within their borders, and improvements in communications and transportation

[not only] . . . by the jurisdiction where the transaction occurs"[32] and "the jurisdictions where the parties burdened by the regulation are from,"[33] but also by "the jurisdictions *where significant effects of the transaction are felt.*"[34]

Under "current conceptions of territorial sovereignty," a sovereign "is allowed to regulate extraterritorial acts that cause harmful local effects unless and until it has consented to a higher law (for example, international law or constitutional law) that specifies otherwise."[35] If that means, as it often does, that "more than one jurisdiction can legitimately apply its law to the same transnational activity,"[36] so be it; under the modern view, there is no need to find the single discrete territorial event on which to base the application of any single body of law.

As a result of this change in viewpoint and the repudiation of Hermetic Territorialism, extraterritorial regulation is "commonplace in the modern world."[37] Both customary international law and the U.S. Constitution "permit a nation to apply its law to extraterritorial behavior with substantial local effects."[38] It is, for instance "relatively uncontroversial"[39] that a newspaper publisher "is liable for harms caused wherever the newspaper is published or distributed."[40] There is "nothing extraordinary or illegitimate" about this "unilateral regulation of transnational activity that affects activity and regulation in other countries."[41] Therefore, neither Singapore's nor England's regulation of Digitalbook.com is "less legitimate than the United States' regulation of the competitiveness of the English reinsurance market, which has worldwide effects on the availability and price of reinsur-

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rendered travel to a distant judicial forum less onerous than it once had been.").

32. *Against Cyberanarchy*, *supra* note 2, at 1208.

33. *Id*.

34. *Id*. (emphasis added).

35. *Id*. at 1240. *See id*. at 1239 ("[A] nation's right to control events within its territory and to protect its citizens permits it to regulate the local effects of extraterritorial acts."); *Id*. at 1208 (noting that it "seems clear that customary international law . . . permits a nation to apply its law to extraterritorial behavior with substantial local effects"). *See also* RESTATEMENT (THIRD) OF FOREIGN RELATIONS § 402(1)(c) (1987) (concluding that unless "unreasonable," a state has jurisdiction to prescribe law with respect to "conduct outside its territory that has or is intended to have substantial effect within its territory"); Goldsmith, *supra* note 15, at 479 ("The effects criterion tells us that it is legitimate for a nation to apply its regulation to an extraterritorial act with harmful local effects."); Neil Weinstock Netanel, *Cyberspace Self-Governance: A Skeptical View from Liberal Democratic Theory*, 88 CALIF. L. REV. 395, 491 (2000) (criticizing as "fundamentally incorrect as a matter of positive international law" the notion that a sovereign "cannot properly legislate or otherwise prescribe law" that applies to extraterritorial conduct); *id*. at 490 n.395 (noting a sovereign "has a *right* to prohibit . . . speech if [speakers] can be said to have communicated their speech within [the sovereign's] territory or, . . . if [the] speech is deemed to occur entirely [elsewhere] but nevertheless has substantial effect within [the sovereign's territory]") (emphasis added) (citing 1 SIR ROBERT JENNINGS & SIR ARTHUR WATTS, OPPENHEIM'S INTERNATIONAL LAW 460, 472-76 (9th ed. 1992)).

36. *Against Cyberanarchy*, *supra* note 2, at 1208.

37. *Id*. at 1239.

38. *Id*. at 1208.

39. *Id*. at 1230.

40. *Id*.

41. *Id*. at 1240.

ance."[42]

The bottom line? "It is settled with respect to realspace activity"[43]—elsewhere Goldsmith refers to this as one of two "uncontested assumptions"[44]—"that a nation's right to control events within its territory and to protect its citizens permits it to regulate the local effects of extraterritorial acts."[45] Thus,

> prevailing concepts of territorial sovereignty permit a nation to regulate the local effects of extraterritorial conduct even if this regulation produces spillover effects in other jurisdictions[, and that] . . . such spillover effects are a commonplace consequence of the unilateral application of any particular law to transnational activity in our increasingly interconnected world.[46]

And if all that is "settled with respect to realspace activity," why would we think that cyberspace is any different?

III. SETTLED PRINCIPLES

The core of the Unexceptionalists' argument thus contains a simple, but very powerful, syllogism:

> Transnational activities of an ordinary, brick-and-mortar bookstore—"Analogbooks, Inc."—are subject to "settled principles" of "customary international law."
>
> These settled principles hold that if Analogbooks' realspace activities produce "substantial local effects" in Singapore, or in England, those activities can "legitimately be regulated" by those governments.
>
> Digitalbooks' activities are "functionally identical" to Analogbooks' activities.

Therefore, if Digitalbooks' cyberspace activities produce "substantial local effects" in Singapore, or in England, those activities can "legitimately be regulated" by those governments. The logic is unassailable: If X is true in environment 1, and if environment 2 is "functionally identical" to environment 1, then X is true in environment 2. The argument, however, is not quite as persuasive as it might appear at first glance.

Take, for instance, the Unexceptionalists' reliance upon settled principles of customary international law. Even accepting Professor Goldsmith's assertion that these princi-

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42. *Id*.
43. *Id*. at 1239.
44. *Id*. at 1212.
45. *Id*. at 1239.
46. *Id*. at 1212.

ples "are settled"—in particular, the "uncontested assumptions"[47] that, at least in modern times, transactions "can legitimately be regulated by . . . the jurisdictions where significant effects of the transaction are felt,"[48] and that "a nation's right to control events within its territory and to protect its citizens permits it to regulate the local effects of extraterritorial acts"[49]—it is clear that this "modern view" of international jurisdiction is itself the product of profound changes in the world over the past century or so (as Goldsmith himself points out[50]).

These now-settled principles were, in other words, once themselves in conflict with then-settled principles. It was once "settled" law that a state *cannot* regulate extraterritorial acts, the "substantial local effects" of those acts notwithstanding, and that therefore Analogbooks' activities could not "legitimately be regulated" in either Singapore or England. The Unexceptionalists of one hundred, or even fifty, years ago might have made an argument very much like Goldsmith's, arguing that rail transport, the telephone, or radio broadcasting, would (and should) have no effect on our analysis of jurisdictional problems. We can imagine the following colloquy:

> Scene: A New York street corner, circa 1900. Two law professors, Professor E and Professor U, meet.
>
> Professor E: "Have you noticed? This telegraph thing changes everything! I can step inside a Western Union office in New York and execute a contract in San Francisco *instantaneously*! Incredible, eh?"
>
> Professor U: "Well, I suppose it is. But what of it?"
>
> E: "What of it? Surely you jest. The world as we know it will never be the same. We're going to need new principles of law to deal with this phenomenon. Our jurisdictional principles—especially the one that requires *physical presence* for the exercise of 'jurisdiction to prescribe'—must yield to this new context, no?"
>
> U: "Not at all. Transactions completed by telegraph are functionally identical to those completed by mail or by smoke signal; they all involve real people in one territorial jurisdiction either (i) transacting with real people in other territorial jurisdictions or (ii) engaging in activity in one jurisdiction that causes real-world effects in another territorial jurisdiction. It is settled law that the people of California *cannot* reach people and transactions occurring outside of its borders. Why would we need to adjust those principles now?"

Life, Kierkegaard said, must be lived forwards, but it can only be understood back-

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47. *Id*.
48. *Id*. at 1208.
49. *Id*. at 1239.
50. *See supra* notes 29-31.

wards.[51] Looking backwards, of course, we know that events proved *those* Unexceptionalists wrong. Though it was surely difficult to see at the time, the world was changing profoundly, and settled understandings were becoming unsettled because of that change. How would Professors U and E have known that this unsettling was occurring before their very eyes? How would *we* know if the world was again changing, unsettling *our* settled understandings? In retrospect, it may be easy to identify such seismic shifts in the legal landscape, phase transitions between different ordered states of an entire domain of legal thought and practice. But in prospect, that may not be so easy.

The world, sometimes, does that—changes profoundly. When it does, settled understandings sometimes change with it. Unless we think that for some reason this cannot happen again, questions about the legitimate scope of a nation's jurisdictional reach cannot rest on the notion that those questions are somehow already, and forever, "settled."

IV. FUNCTIONAL IDENTITY

That the world *can* change so as to unsettle settled principles does not, of course, mean that it has done so in ways that are relevant to the questions at hand. The Unexceptionalists say that it has not; activity in cyberspace is "*functionally identical to transnational activity mediated by other means, such as mail or telephone or smoke signal.*"[52]

What could that possibly mean? It does not take a great deal of insight or deep thinking to come up with ways in which activity in cyberspace is functionally not identical to activity in realspace. For example, in cyberspace, I can communicate an offer to sell some product or service

- instantaneously (or nearly so);
- at zero marginal cost (or nearly so);
- to several million people;
- with near-zero probability of error in the reproduction or distribution of that offer;
- which can be stored, retrieved, and translated into another language by each of the recipients (instantaneously, and at zero marginal cost); and
- to recipients who have the capability to respond to my offer (instantaneously, and at zero marginal cost).

I surely cannot engage in a transaction having *all* of those features using mail, telephones, or smoke signals.

The Unexceptionalists are intelligent and sophisticated thinkers; how could they possibly think that activity in communication in cyberspace is "functionally identical"—not, mind you, merely functionally similar, or even roughly equivalent, but *identical*—to realspace communication?

Asking whether realspace and cyberspace transactions are identical to or different

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51. *See* 1 SOREN KIERKEGAARD'S JOURNALS AND PAPERS 450 (Howard V. Hong & Edna Hong eds., 1967).

52. *Against Cyberanarchy*, *supra* note 2, at 1240 (emphasis added).

from one another is like asking whether life on land is identical to or different from life in the ocean. The answer is that it is, and it must be, simultaneously, both; it depends entirely on the questions you are asking.[53] The second law of thermodynamics, gravity, and the principle of natural selection work identically in the two environments; the mechanics of sound propagation, buoyancy, and chemical diffusion do not. For the purpose of answering some questions (e.g., about the mechanics of genetic recombination in mammals, energy transmission within food webs, or the relative advantages of sexual and asexual reproduction) we ignore the differences between the two environments and lump terrestrial and oceanic organisms together. For the purpose of answering other questions (e.g., about social communication within animal populations, the mechanics of oxygen transport, or the design of the mammalian forelimb) we must distinguish between terrestrial and oceanic organisms, because for these purposes the two environments are very different indeed.

It is true that events and transactions in realspace and cyberspace are identical in many ways, and can be treated identically for many purposes. Transactions between human beings are still transactions between human beings, whether they take place via e-mail, postcards, telegraph, or smoke signal. Whatever it is that motivates human beings to engage in one transaction or another—love, hate, greed, curiosity, fear, etc.—remains the same, on or off the Internet. A dollar is still a dollar, whether it is earned by a seller of goods from a showroom transaction or a transaction at www.i'vegotstuffforsale.com.

Digitalbooks.com and Analogbooks will thus have many identical characteristics. Digitalbooks.com, like Analogbooks, provides: a forum where buyers and sellers can exchange consideration for goods; a system for making sure that those goods get shipped from seller to buyer after a transaction is consummated; rules for identifying the winners and losers of individual auctions; and means for obtaining payment for its services, accounting for those payments, and transferring money to its suppliers.

Therefore, questions about how Digitalbooks.com and Analogbooks spend the money they earn—for example, questions about the investment strategies of book dealers, and the laws regulating those investment strategies—can surely lump cyberspace and realspace earnings together.

However, it is also true that events and transactions in realspace and cyberspace are

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53. Confronted with the assertion "that in all the vast countries of America, there is but one language," Thomas Jefferson pondered the question: "what constitutes identity, or difference, in two things, in the common acceptation of sameness?" This, he wrote, is a question of definition, in which every one is free to use his own . . . All languages may be called the same, as being all made up of the same primitive sounds, expressed by the letters of the different alphabets. But, in this sense, all things on earth are the same, as consisting of matter. . . . [and] it may be learnedly proved, that our trees and plants of every kind are descended from those of Europe, because, like them, they have no locomotion, they draw nourishment from the earth, they clothe themselves with leaves in spring of which they divest themselves in autumn for the sleep of winter, etc. Our animals too must be descended from those of Europe, because our wolves eat lambs, our deer are gregarious, our ants hoard, etc.
Letter from Thomas Jefferson, Third President, United States of America, to John Adams, Second President, United States of America. THE ADAMS-JEFFERSON LETTERS: THE COMPLETE CORRESPONDENCE BETWEEN THOMAS JEFFERSON AND ABIGAIL AND JOHN ADAMS (Lester Cappon ed., Univ. North Carolina Press 1959) (May 27, 1813).

not identical in many other ways. For example, transactions in cyberspace can take place at much greater physical remove; they are consummated by means of the movement of bits rather than atoms; they are digitally encoded; they are unaffected by the participants' sense of smell; they are embedded in and mediated by computer software; they travel at the speed of light, etc.

> Transactions in cyberspace involve real people in one territorial jurisdiction either (i) transacting with real people in other territorial jurisdictions or (ii) engaging in activity in one jurisdiction that causes real-world effects in another territorial jurisdiction. *To this extent, activity in cyberspace is functionally identical to transnational activity mediated by other means, such as mail or telephone or smoke signal*.[54]

Now I get it: *to that extent, but only to that extent*, cyberspace and realspace transactions are identical. To the extent that our question requires us to ask whether "real people in one territorial jurisdiction [are] transacting with [other] real people in other territorial jurisdictions,"[55] cyberspace and realspace transactions are, for that purpose, identical. To the extent that our question requires us to ask something else—whether, say, they involve bits and software, or instantaneous communication with enormous numbers of people across the global network, etc.—they are not.

The question we need to be addressing, then, is this one: are Digitalbooks.com's and Analogbooks' transactions identical—or, at least, sufficiently similar—to one another *with respect to the relevant principles of international choice of law and prescriptive jurisdiction*? If so, it is reasonable to ignore the many differences between them; if not, it is not.

V. SCALE

To the Unexceptionalist, Digitalbooks.com's and Analogbooks' transactions *are* identical with respect to the relevant principles of international choice of law. The issues raised by application of these principles and prescriptive jurisdiction to Digitalbooks.com's cyberspace transactions, they say,

> . . . are no more complex than the same issues in real space. They also are no more complex or challenging than similar issues presented by increasingly prevalent real-space events such as airplane crashes, mass torts, multistate insurance coverage, or multinational commercial transactions, all of which form the bread and butter of modern conflict of laws. Indeed, they are no more complex than a simple products liability suit arising from a two-car accident among residents of the same state, which can implicate the laws of several states, including the place of the accident, the states where the car and tire manufacturers are head-

54. *Against Cyberanarchy*, *supra* note 2, at 1239-40 (emphasis added).
55. *Id*. at 1239.

> quartered, the states where the car and tires were manufactured, and the state where the car was purchased.[56]

This may well be true. Digitalbooks.com's sale of an individual book to a customer in Singapore, in isolation, is no more "complex or challenging" as a matter of international law than Analogbooks' sale of the same book to the same customer.

To stop the analysis there, however, is to miss the forest for the trees. Scale matters; the biologists and the engineers know this. A rose is a rose is a rose; three roses, or three hundred roses—a garden—is a different, a more "complex and challenging," phenomenon. Network protocols that can manage one thousand transactions may not be able to handle one million, or one billion. The tree is one thing; the forest, though it is nothing more than a large number of trees, is another, more "complex and challenging," phenomenon. The movement of a single clump of dirt down a slope is one thing; an avalanche, though it is nothing more than the movement of lots of individual pieces of dirt down a slope, is another, more "complex and challenging," event.[57] The motion of a single pendulum—which has been understood with great precision since Galileo's day—is one thing; connect a number of pendulums together and you have a much more "complex and challenging" phenomenon.[58]

You get the idea: the anthill is more "complex and challenging" than the ant. Ignoring the anthill when making rules for the ant—ignoring the ways in which the individual ant's behavior is embedded within a complex system of large numbers of other individuals—would be odd indeed.[59]

Therefore, although Digitalbooks.com and Analogbooks each may be doing the "same" things, the *systems* within which they operate are not necessarily the same as a consequence of that identity. *Scale matters*. Differences in degree sometimes become differences in kind; quantitative changes can become qualitative changes.[60] Rules and

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56. *Id*. at 1234 (emphasis added).

57. For an extensive discussion of the complex ways in which avalanches propagate through sandpiles, see PER BAK, HOW NATURE WORKS chs. 3-4 (1996); STUART KAUFFMAN, AT HOME IN THE UNIVERSE 235-43 (1995).

58. The chaotic dynamics of coupled pendulums are discussed in BAK, *supra* note 57, at 39-48; JAMES GLEICK, CHAOS: MAKING A NEW SCIENCE 39-44 (Viking, 1987); David Tritton, *Chaos in the Swing of a Pendulum*, *in* EXPLORING CHAOS: A GUIDE TO THE NEW SCIENCE OF DISORDER 22-33 (N. Hall ed., 1991). A more technical treatment can be found in D. D'Humieres et al., *Chaotic States and Routes to Chaos in the Forced Pendulum*, 26 PHYS. REV. A 3483 (1982).

59. *See* Stein, *supra* note 15, at 1191 ("The Internet geometrically multiplies the number of transactions that implicate more than one state. *But it is a problem of quantity, not quality*.") (emphasis added); *Against Cyberanarchy*, *supra* note 2, at 1237-38 (discussing the "dramatic increase in the number and speed of transactions" in cyberspace in the context of "a nation's incentives to regulate" and the efficacy of regulation).

60. The repudiation of "Hermetic Territorialism" was a kind of "phase transition" in the law—one orderly arrangement of the interlocking parts of a complex system gives way, rather suddenly, to an entirely different arrangement. Think of the transformation of liquid water into solid ice. As the temperature falls, the individual components of the system—the hydrogen and oxygen atoms and the bonds between them—slowly change, releasing small quanta of energy, while retaining the orderly arrangement that defines the

principles that may be quite reasonable at one scale may become incoherent and unreasonable at another.

Consider the following example of the ways in which the scale of activities in cyberspace can unsettle settled legal principles. In 1995, Dennis Erlich, a former-minister-turned-critic of the Church of Scientology, took the texts of a number of works authored by Scientology founder L. Ron Hubbard and, using the services of Netcom On-line Communication Services, Inc., distributed them to the Usenet newsgroup alt.religion.scientology. Netcom, for its part, reproduced each of those documents dozens, perhaps hundreds or thousands, of times in the course of transmitting Erlich's messages (and the files he included in those messages) to other Usenet sites. Hubbard's works were protected by U.S. copyright law, and the owner of the copyright in Hubbard's works—Religious Technology Center—appeared in Judge Ronald Whyte's courtroom in the Northern District of California to enjoin Netcom's violation of its statutory rights.[61]

Judge Whyte, I think it fair to say, found this case somewhat unsettling. On the one hand, one would be hard-pressed to find a case in the federal reporters where the law, and the application of the law to particular facts, was more straightforward than this one. There was a nice, "settled" principle of law to work with: it is an infringement of copyright to "reproduce" a copyrighted work of authorship "in copies" without the copyright holder's authorization.[62] It was hard to deny that Netcom had done just that.

It was true, of course, that Netcom did not *know* that it was making copies of the copyrighted works,[63] that the "copies" it made were merely transient arrangements of bits on its disk drives,[64] that it had not taken any "affirmative action . . . other than by installing and maintaining a system whereby software automatically forwards messages received from subscribers onto the Usenet, and temporarily stores copies on its system" to carry out its copying activities,[65] and that it was only doing exactly what thousands of other Usenet servers around the globe were doing with the documents that Erlich had posted.[66]

All true, and all, under the settled law of 1995, irrelevant. The Copyright Act is a "strict liability statute";[67] because infringement "does not require intent or any particular state of mind,"[68] whether Netcom knew of the infringing nature of the messages it was

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"liquid" state. But at the freezing point, the system abandons gradualism, changing abruptly into a different kind of orderly arrangement of its atoms, an entirely different configuration. We do not know, I would submit, very much at all about phase transitions in the law—how small changes in the many interlocking doctrines, judicial decisions, statutory provisions that underlie any particular legal domain can lead to a systemic reconfiguration of those interlocking parts.

61. Religious Tech. Ctr. v. Netcom On-line Servs., Inc., 907 F. Supp. 1361 (N.D. Cal. 1995).

62. 17 U.S.C. § 106 (2002).

63. *Religious Tech. Ctr.*, 907 F. Supp. at 1374 (noting "no question of fact as to whether Netcom knew or should have known of Erlich's infringing activities" prior to receipt of notification from plaintiffs).

64. *Id*. at 1368.

65. *Id*.

66. *Id*. at 1373.

67. *Id*. at 1370. *See also id*. at 1367 ("[K]nowledge is not an element of direct infringement.").

68. *Id*. at 1367.

transmitting was of no consequence. Given a Ninth Circuit decision squarely on point,[69] there was also "no question,"[70] that (1) the transient collections of bits on Netcom's disk drives constituted "copies" within the meaning of the Copyright Act;[71] (2) while the infringing messages remained on Netcom's system "for at most eleven days," they were nonetheless "sufficiently 'fixed' to constitute recognizable copies under the Copyright Act";[72] (3) although one could argue that "there *should* still be some element of volition or causation"[73] in a copyright claim, there was no such element; and (4) the defense of "lots of other people are doing what I'm doing, so you should not hold me liable," was not established in copyright law.

On the other hand, imposing liability on Netcom for these activities somehow "does not make sense,"[74] in Judge Whyte's words. The individual acts on the basis of which Netcom was charged with infringement were "functionally identical" to any number of things we had seen before. After all, whether you are operating a photocopying machine, a CD-burner, or a Usenet server, you are making a copy of a document, hardly an unfamiliar activity. But the system within which those acts were embedded had changed, and application of the settled law to the *aggregate* of those individual actions somehow needed to change along with it.

The file storage and reproduction activities in which Netcom was engaged were "necessary to having a working system for transmitting Usenet postings to and from the Internet."[75] If Netcom were deemed liable for copyright infringement, "*any* storage of a copy that occurs in the process of sending a message to the Usenet [would be] an infringement,"[76] and "every single Usenet server in the worldwide link of computers transmitting Erlich's message to every other computer"[77] would be liable. Carried to its "natural extreme"[78]—scaled up, we might say—application of settled law in this case "would lead to *unreasonable liability*."[79] It "does not make sense," Judge Whyte wrote, "to adopt a rule that could lead to the liability of countless parties whose role in the infringement is nothing more than setting up and operating a system that is necessary for the functioning of the Internet."[80] A theory of infringement that holds *every Internet server worldwide* liable for activities that each of them was undertaking thousands of times a second was not "*workable*."[81] Because there was no "meaningful distinction . . . between what Netcom did and what every other Usenet server does,"[82] Judge Whyte found that Netcom "cannot be held liable for direct infringement."[83]

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69. MAI Sys. Corp. v. Peak Computer, Inc., 991 F.2d 511 (9th Cir. 1993).
70. *Religious Tech. Ctr.*, 907 F. Supp. at 1368.
71. *Id*.
72. *Id*.
73. *Id*. at 1370 (emphasis added).
74. *Id*. at 1372.
75. *Id*. at 1368.
76. *Id*. at 1370 (emphasis added).
77. *Id*. at 1369.
78. *Id*.
79. *Id*. (emphasis added).
80. *Id*. at 1372.
81. *Id*. at 1372 (emphasis added).
82. *Id*. at 1373.
83. *Id*. A different judge—a less creative, or a less courageous judge, perhaps—

Settled law, in other words, did not *scale*. So Judge Whyte unsettled it.

VI. EFFECTS

> [A] nation's right to control events within its territory and to protect its citizens permits it to regulate the local effects of extraterritorial acts.[84]

> [P]revailing concepts of territorial sovereignty *permit a nation to regulate the local effects of extraterritorial conduct* even if this regulation produces spillover effects in other jurisdictions[, and] . . . such spillover effects are a commonplace consequence of the unilateral application of any particular law to transnational activity in our increasingly interconnected world.[85]

We live in a world of inter-connected and geographically complex causes and effects; a butterfly flapping its wings in Beijing can change weather patterns in New York, the presence of poisons in the soil in Central Asia can affect the abundance of fish in the Gulf of Mexico, a local currency trader, or bolt manufacturer, in Hong Kong can cause the crash of markets, or automobiles, in Frankfurt.

Imagine for the moment something we might call an "effects map." To construct such a map, we mark the location of every event taking place at any specific moment, the "effects" of which will be felt in, say, Singapore. An "effects map" would look something like the familiar nighttime satellite images of "The Earth from Space" seen in Figure 1. Each point of light on the effects map, however, would represent not an actual source of illumination but rather the location of an event or transaction whose effects were felt by some person, or institution, in Singapore.

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would have taken the time-honored route of obfuscation, twisting the "fuzzball factors" of the fair use doctrine to fit the facts at hand. *See* Frank E. Easterbrook, *Cyberspace and the Law of the Horse*, 1996 U. CHI. LEGAL F. 207, 208 (1996); *see also Religious Tech. Ctr.*, 907 F. Supp. at 1378-81 (holding that Netcom's copying was not a "fair use" as a matter of law).

84. *Against Cyberanarchy*, *supra* note 2, at 1239.

85. *Id*. at 1212 (emphasis added).

Figure 1

Consider an effects map depicting a moment in 1450. Inasmuch as the effects of most activity taking place in 1450 declined rapidly with increasing geographical distance, most events or transactions having an effect in Singapore would themselves take place in, or around, Singapore. Our effects map would therefore show the territory around Singapore itself as a dense concentration of points, a small patch of intense light, with the remainder of the globe in almost total darkness.

An effects map for 1950 would undoubtedly show greater relative "brightness" *outside* of Singapore's borders, reflecting changes in communication and transportation technologies over the past several centuries, and the increased numbers of border-crossing events and transactions with widely dispersed geographical effects—"airplane crashes, mass torts, multistate insurance coverage, or multinational commercial transactions."[86]

But the 1950 map would, I submit, retain its geographical coherence because the effects of most human activity in 1950, notwithstanding "mail, the telephone, and smoke signals," remained geographically constrained. There would still be a bright cluster of points down on the southern tip of the Malaysian peninsula. On the basis of this patch of relative brightness alone, we would probably be able to reconstruct those boundaries with reasonable accuracy without too much trouble, even if Singapore's actual political boundaries were omitted from our effects map.

However, an effects map plotting events and transactions taking place today in *cyberspace* would look very different from this. A plot of the location of all events and transactions taking place in cyberspace that have an effect on persons and property in Singapore will have virtually no geographical structure at all; points of light will be wildly scattered about the map, seemingly at random. It is a cliché, but it is true nonetheless: On the global network all points are (virtually) equidistant from one another, irrespective of their location in real space, and the effects of the butterfly on the website in Beijing can be felt as strongly in Philadelphia as in Shanghai. *All* transactions in cyberspace are potentially border-crossing, *all* have geographically indeterminate effects, *all* resemble the "airplane crashes, mass torts, multistate insurance coverage, and multina-

86. *Id*. at 1234.

tional commercial transactions" of realspace.[87] We would have much, much more trouble reconstructing Singapore's actual boundaries from a map limited to cyberspace events and transactions in 2002 than in any of our previous maps.

With respect to the "Effects Principle" at the heart of the Unexceptionalist argument—the principle that "a nation's right to control events within its territory and to protect its citizens permits it to regulate the local effects of extraterritorial acts"[88]—the world *has* changed, rather dramatically. Border-crossing events and transactions, previously at the margins of the legal system and of sufficient rarity to be cabined off into a small corner of the legal universe ("airplane crashes, mass torts, multistate insurance coverage, or multinational commercial transactions"[89]) have migrated, in cyberspace, to the core of that system.

A world in which virtually *all* events and transactions have border-crossing effects is surely not "functionally identical" to a world in which most do not, at least not with respect to the application of a principle that necessarily requires consideration of the distribution of those effects. A world in which the Effects Principle returns the result "No Substantial Effects Outside the Borders" when applied to the vast majority of events and transactions is not "functionally identical" to a world in which application of the same principle to the vast majority of events and transactions returns the opposite result. A world in which, on occasion, bullets are fired from one jurisdiction into another[90] is not "functionally identical" to a world in which all jurisdictions are constantly subjected to shrapnel from a thousand different directions.

To paraphrase Judge Whyte: carried to its "natural extreme,"[91] application of the (settled) Effects Principle is not "workable."[92] Like Judge Whyte, I "cannot see any meaningful distinction . . . between what [Digitalbooks.com does] and what every other [website does],"[93] and subjecting *all* websites to dozens, or perhaps hundreds, of different and possibly conflicting legal regimes "does not make sense."[94] Like Judge Whyte, I "do[ ] not find workable"[95] a theory of prescriptive jurisdiction that would hold Digitalbooks.com (and all website operators) responsible for complying, simultaneously, with the laws of all jurisdictions worldwide. Like Judge Whyte, I think that, "carried to its natural extreme,"[96] the Effects Principle leads to "unreasonable liability."[97]

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87. *Id.* at 1234.
88. *Id*. at 1239.
89. *Id.* at 1234.
90. *See* RESTATEMENT (THIRD) FOREIGN RELATIONS LAW OF THE UNITED STATES § 402 cmt. d (1987) ("The effects principle is not controversial with respect to acts such as shooting or even sending libelous publications across a boundary.").
91. *Religious Tech. Ctr.*, 907 F. Supp. at 1369.
92. *Id*. at 1372.
93. *Id*. at 1373.
94. *Id*. at 1372.
95. *Id*.
96. *Id*. at 1369.
97. *Id*.

VII. CONSENT

If governments "deriv[e] their just powers from the consent of the governed,"[98] how can Singapore, or England, legitimately exercise law-making power over Digitalbooks.com?

The Unexceptionalists are not unduly troubled by this question, because they believe, apparently, that settled principles of international law have already resolved it: While consent may be a prerequisite for the legitimate exercise of *private* power, it is no longer a prerequisite for the legitimate exercise of *governmental* power.[99] Thus, Goldsmith writes, it is an "uncontested assumption" of the international legal order that the "need to demonstrate consent" to assertions of sovereign power "begins from the premise that *in its absence, national regulation of local effects is a legitimate incident of sovereignty*,"[100] that "in the *absence* of consensual international solutions, *prevailing concepts of territorial sovereignty permit a nation to regulate the local effects of extraterritorial conduct.*"[101]

The Effects Principle itself, in other words, is, as a normative matter, a source of sovereign authority, independent of the consent of the governed. Transactions "can *legitimately* be regulated [by] the jurisdictions where significant effects of the transaction are felt,"[102] whether or not the parties engaged in or affected by those transactions have consented to the application of the laws of those jurisdictions.

Though I find this view of the relationship between the Consent Principle and the Effects Principle normatively unappealing, this is not the place to engage in that argument. Though I happen to believe, contra Goldsmith et al., that the former principle should take precedence over the latter in the event of a conflict between them, I raise the issue here merely to suggest that scale may matter here as well, that the way we resolve this conflict

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98. THE DECLARATION OF INDEPENDENCE, pmbl. (U.S. 1776).

99. *See* Stein, *supra* note 15, at 1176 ("Unlike the law of sovereigns, the scope of. . . *private ordering* is limited to persons who have consented to the particular rules in question.") (emphasis added); *Against Cyberanarchy*, *supra* note 2, at 1216 (concluding that because there are many "[c]yberspace activities for which *ex ante* consent to a governing legal regime is either infeasible or unenforceable," these activities "are not amenable to *private* ordering") (emphasis added); *id.* at 1215 ("[I]t remains an open question how to generate consent across cyberspace networks."); *id*. at 1216 ("[*P*]*rivate* legal ordering . . . has the potential to resolve many, but not all, of the challenges posed by multijurisdictional cyberspace activity.") (emphasis added); *id.* ("Consent-based legal orders are limited by a variety of national mandatory law restrictions."); *see also* Netanel, *supra* note 35, at 410, 492-93 (acknowledging the argument that application of foreign law to Digitalbooks.com's website "belies the liberal democratic principle of 'government by consent of the governed,'" but concluding that because consent is only one "side of the liberal democracy equation," where "foreign resident conduct has substantial effect within the legislating country and runs strongly against that country's fundamental public policy, the prescriptive outcome of the legislating country's democratic process should prevail").

100. *Against Cyberanarchy*, *supra* note 2, at 1241 (emphasis added). That is an odd, though telling, formulation; I would have thought that the need to demonstrate consent "begins" with the "self-evident truth" that governments "derive their just power from the consent of the governed." THE DECLARATION OF INDEPENDENCE pmbl. (U.S. 1776).

101. *Against Cyberanarchy*, *supra* note 2, at 1212 (emphasis added).

102. *Id*. at 1208 (emphasis added).

at one scale, in the conditions of realspace, does not necessarily dictate how we should resolve it at a different scale, in cyberspace. I suggest, in other words, that cyberspace is, for these purposes and with respect to this question, different.

Consider an expanding balloon. Molecules at the surface of the balloon are giving off prodigious amounts of heat (per molecule) as the energy from the inrushing air causes some of the bonds between the balloon's atoms to shear apart (releasing small quanta of energy in the form of heat). As the expanding surface rubs up against outside air molecules, it causes the production and release of more heat through friction. Fortunately for whomever is holding the balloon, not all molecules are exploding in this way, or the balloon would quickly become too hot to handle.

The legal system is the balloon. There has been friction at the surface, border-crossing events and transactions—"airplane crashes, mass torts, multistate insurance coverage, or multinational commercial transactions"—where the Consent Principle and the Effects Principle collide, setting off small explosions. As long as these remain on the surface—at the margin—the system as a whole is stable. If, however, these collisions start to occur throughout the entire volume of the balloon, no longer confined to a narrow band at the surface, the heat generated becomes overwhelming and the balloon explodes.

All conduct in cyberspace has geographically far-flung effects on people and institutions around the world; on this Unexceptionalists and Exceptionalists agree. In cyberspace, there will continually be conflicts between a principle that permits sovereigns to regulate on the basis of those effects, and a principle that sovereigns can only regulate where they have the consent of the regulated. The "prevailing concepts of territorial sovereignty" evolved in a world in which these explosions between the Effects Principle and the Principle of Consent only presented themselves at the margins of the legal system, impacting a relatively small number of transactions. A world in which *all* actors, and *all* transactions, at *all* times, are subject to rules to which they have not consented, is not "functionally identical" to that world. We have a different problem before us now.

VIII. CONCLUDING THOUGHTS

Against Cyberanarchy has been one of the most influential and oft-cited pieces in the cyberspace law canon.[103] I remain, however, unper-

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[103] *Against Cyberanarchy* has been called, among other things, a "trenchant" and "withering" critique of the regulation skeptics' claims, Netanel, *supra* note 35, at 402, and a "decisive response to the widespread view that cyberspace is not regulable." CASS R. SUNSTEIN, REPUBLIC.COM 204 (Princeton Univ. Press 2001). As of this writing (March, 2002) it has been cited, according to a LEXIS search (LEXIS, Lawrev Library), nearly one hundred times. It has also become a staple of cyberspace law courses. For just a small sample of the courses for which Professor Goldsmith's article is required reading, see, e.g., Andrew L. Shapiro, Harvard Law School, New Media, Law, and Democracy, Syllabus (Fall 1999 Semester) *available at* http://cyber.law.harvard.edu/columbia/cgi/syllabus.cgi; University of Melbourne Law School, Electronic Commerce Law, Reading Guide (Spring 2001 Semester) *available at* http://graduate.unimelblaw.com.au/gradlaw2002.nsf/docs/4H33EB355; Susanna Fischer, Catholic University of America, Columbus School of Law, Cyberlaw, Syllabus (Spring 2000 Semester) *available at* http://faculty.cua.edu/fischer/cyberlawsyl.htm; Pamela Samuelson, University of California at Berkeley, Boalt Hall School of Law, Cyberlaw,

suaded—an unrepentant Exceptionalist. I think it does matter that Digitalbooks.com is "in cyberspace," I think that the questions raised by its conduct are indeed different, and more difficult, than the analogous questions raised by its realspace counterpart, and I do not believe that we can resolve the jurisdictional dilemmas posed by Digitalbooks' transactions by applying the "traditional legal tools" developed for similar problems in realspace.

The problem of "jurisdiction," as generations of law students can testify, can glaze over even the most attentive eyes. At its core, though, it reaches fundamental questions of order and legitimacy; lest we forget, we fought a revolution over the jurisdiction to prescribe.[104] Cyberspace should give us pause, and I am not quite ready to throw in the towel just yet. Settled law, and received principles, are worthy of respect; but at times they need to be reconsidered. This is one of those times.

Syllabus (Fall 2000 Semester) *available at* http://www.law.berkeley.edu/institutes/bclt/courses/fall00/cyberlaw/cybersyllabus.html; Michael Froomkin, University of Miami School of Law, The Internet and the State (Fall 2000 Semester) *available at* http://www.law.miami.edu/~froomkin/inet00/syllabus2.htm; Darren Charters, Arts at the University of Waterloo, School of Accountancy, Course Schedule, Cyber Law: Legal Issues in a Digital Business Age (Fall 2001 Semester) *available at* http://www.arts.uwaterloo.ca/ACCT/courses/acc415.

[104] Among the "[f]acts . . . submitted to a candid world" to substantiate "repeated injuries and usurpations" to which the King of England had subjected the American colonists, was that the King had "combined with others to subject us to a jurisdiction foreign to our constitution, and unacknowledged by our laws; giving his Assent to their Acts of pretended Legislation . . . ." THE DECLARATION OF INDEPENDENCE para. 15 (U.S. 1776).