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# The Null Patent

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# THE NULL PATENT

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ABSTRACT

*Failure is the basis of much of scientific progress because it plays a key role in building knowledge. In fact, negative results compose the bulk of knowledge produced in scientific research. This is not a bad thing because failures always produce valuable technical information—whether it be a serendipitous finding, an abundance of unexpected technical data, or simply knowledge that an initial hypothesis was totally wrong. Though some have recognized that the dissemination of negative results has many upsides for science, transforming scientific norms toward disclosure is no easy task. As for patent law, the potentially important role that negative results can play in determining patentability has heretofore been overlooked. This Article addresses these issues by proposing a new medium of disclosure called the null patent. Whereas null patents would lack claims and therefore not confer a right to exclude, they would strongly resemble other patent documents in substantive technical content and bibliographic information—thus making them amenable to technology-based classification, indexing, and open-access searching. This new medium of disclosure has potentially transformative implications for both patent law and science. Providing the Patent Office with ready access to a vast body of technical information would lead to a more thorough examination and, as a consequence, improve patent quality. Providing inventors with access to*

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*this information would allow them to gauge patentability ex ante with greater certainty. And because the null patent repository would be freely accessible, it would serve the public good by enriching the public storehouse of knowledge. Finally, null patents would promote broader policy goals shared by both science and patent law—namely, to promote technological progress through the dissemination of knowledge, to coordinate the future development of technology, and to spur innovation.*

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## INTRODUCTION

A fundamental goal of the patent system is to encourage the dissemination of technical knowledge.[1] As soon as a patent document publishes,[2] there is hope that the public will use the technical details disclosed therein to improve upon the invention, to design around it, or to engage in other innovative activities.[3] Although the patentee maintains the right to "exclude others from practicing the invention until the patent term expires, the technical information disclosed in the patent document has potential immediate value to the public, which can use the information for any purpose that does not infringe upon the claims."[4] This supports the patent system's broader mission to promote scientific progress and extend the frontiers of knowledge.[5]

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1. Brenner v. Manson, 383 U.S. 519, 533 (1966) ("[O]ne of the purposes of the patent system is to encourage dissemination of information concerning discoveries and inventions."); *see also* EDWARD C. WALTERSCHEID, THE NATURE OF THE INTELLECTUAL PROPERTY CLAUSE: A STUDY OF HISTORICAL PERSPECTIVE 143 (2002) (explaining that an essential purpose of the patent system under the quid pro quo rationale "is to assure [the] dissemination to the public of technical information" it would not otherwise get). Recent amendments to the patent statutes facilitate quick dissemination. For instance, until recently, patent applications were kept in secret unless and until the patent issued. *See* Press Release, U.S. Patent & Trademark Office, USTPO Will Begin Publishing Patent Applications (Nov. 27, 2000), *available at* http://www.uspto.gov/news/pr/2000/00-72.jsp. Now, most patent applications in the United States—and the rest of the world—filed on or after November 29, 2000, publish eighteen months after the earliest filing date. *See* American Inventors Protection Act of 1999, Pub. L. No. 106-113, app. I, 113 Stat. 1501A-552, 1501A-561, 1501A-566-67 (codified at 35 U.S.C. § 122(b)(1)(A) (2006)).

2. Patent documents include issued patents and published patent applications. Note that once a patent application publishes, the information disclosed therein is considered known to the public even if it never matures into a patent. *See* 35 U.S.C. § 102.

3. *See* MICHAEL A. GOLLIN, DRIVING INNOVATION: INTELLECTUAL PROPERTY STRATEGIES FOR A DYNAMIC WORLD 15-19 (2008) (explaining that disclosure adds to the pool of accessible knowledge that other creative individuals can use and improve upon).

4. Sean B. Seymore, *The Teaching Function of Patents*, 85 NOTRE DAME L. REV. 621, 624 (2010) (citing Kirin-Amgen Inc. v. Hoechst Marion Roussel Ltd., [2004] UKHL 46, [2005] R.P.C. 9 ¶ 77 (Hoffmann, L.J.)); Diane Leenheer Zimmerman, *Is There a Right to Have Something to Say? One View of the Public Domain*, 73 FORDHAM L. REV. 297, 303 n.23 (2004) ("A patent application must disclose the nature of the invention in detail, and although the public cannot practice the art during the period of the patent, it can use the information disclosed in a variety of other ways.").

5. This goal emanates from the Intellectual Property Clause of the Constitution: "To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and

But another important goal of the patent system is to protect knowledge already in the public domain.[6] Two statutory patentability requirements, novelty and nonobviousness, accomplish this task.[7] Each requires a comparison of the invention that the applicant seeks to patent with the "prior art," which refers to preexisting knowledge and technology already available to the public.[8] Novelty ensures that an invention is truly new,[9] meaning that a patent will not issue for an invention that "is identically disclosed ... in the prior art."[10] In contrast, nonobviousness ensures that an invention is "new enough,"[11] denying patentability for trivial extensions of what is already in the public domain.[12]

Given that novelty and nonobviousness both involve prior art, a patent examiner reviewing an application needs a complete picture of extant knowledge in the public domain. When this is not the case, the patent system cannot fulfill its constitutional and statutory mandate to extend patent protection to inventions that actually enrich the public domain.[13] In recent times, the U.S. Patent and

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Inventors the exclusive Right to their respective Writings and Discoveries." U.S. CONST. art. I, § 8, cl. 8; *see also* Eldred v. Ashcroft, 537 U.S. 186, 223 (2003) (Stevens, J., dissenting) (noting that the constitutional command is the patent system's "ultimate purpose"); Motion Picture Patents Co. v. Universal Film Mfg. Co., 243 U.S. 502, 511 (1917) (observing that "the primary purpose of our patent laws ... is to promote the progress of science and useful arts").

6. Aronson v. Quick Point Pencil Co., 440 U.S. 257, 262 (1979) ("[T]he stringent requirements for patent protection seek to assure that ideas in the public domain remain there for the free use of the public."); Graham v. John Deere Co., 383 U.S. 1, 6 (1966) ("Congress may not authorize the issuance of patents whose effects are to remove existent knowledge from the public domain, or to restrict free access to materials already available.").

7. 35 U.S.C. §§ 102-03.

8. § 102 (defining the documents and activities that can serve as prior art); Kimberly-Clark Corp. v. Johnson & Johnson, 745 F.2d 1437, 1453 (Fed. Cir. 1984) (citing *Graham*, 383 U.S. at 6).

9. "Whoever invents or discovers any *new* and useful process, machine, manufacture, or composition of matter ... may obtain a patent." 35 U.S.C. § 101 (emphasis added).

10. *In re* Marshall, 578 F.2d 301, 304 (C.C.P.A. 1978). The U.S. Court of Customs and Patent Appeals (C.C.P.A.) was a predecessor to the Federal Circuit. The Federal Courts Improvement Act of 1982 abolished the C.C.P.A. *See* Pub. L. No. 97-164, 96 Stat. 25 (codified as amended in scattered sections of 28 U.S.C.). Soon after its creation, the Federal Circuit adopted the C.C.P.A. decisional law as binding precedent. South Corp. v. United States, 690 F.2d 1368, 1370 (Fed. Cir. 1982) (en banc).

11. 1 DONALD S. CHISUM, CHISUM ON PATENTS § 3.01 (2011); *see also* 2 PETER K. YU, INTELLECTUAL PROPERTY AND INFORMATION WEALTH: ISSUES AND PRACTICES IN THE DIGITAL AGE 2 (2007) ("[N]onobviousness divides the patentably new from the unpatentably new.").

12. *See infra* Part III.A.2.

13. *See* 35 U.S.C. § 102(a) (mandating that an invention actually add something new to

Trademark Office (PTO) has come under fire for issuing a large number of "bad" or low-quality patents that fail to do so.[14] Several commentators contend that one cause is the patent examiner's failure to obtain or consider the most relevant prior art.[15] This is a persistent topic in debates over patent reform.[16]

The importance of extant knowledge in the patentability analysis makes one wonder how many patents would issue if an examiner had *complete* knowledge of the state of the relevant art. Although omniscience is impossible, it is certainly possible to expand the quantity of technical knowledge available to the examiner. One way to do this is to tap into the vast body of negative results that constitute most of the information generated in scientific research.[17] Perhaps counterintuitively, this information can play an important role in determining patentability.[18]

At present, there are several obstacles that make it hard to collect this information and put it into the examiner's hands. First, for a variety of reasons, the prevailing norm in science is *not* to publish details about failed experiments.[19] Second, even if this information were to make its way into the mainstream technical literature, examiners are much more likely to gauge patentability in light of prior patents or published patent applications.[20] This makes sense

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the public domain); Pfaff v. Wells Elecs., Inc., 525 U.S. 55, 64 (1998) ("Consistent with [the constitutional mandate], § 102 of the Patent Act serves as a limiting provision, both excluding ideas that are in the public domain from patent protection and confining the duration of the monopoly to the statutory term.").

14. *See* ADAM B. JAFFE & JOSH LERNER, INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT 171 (2004) (defining bad or low-quality patents as those that cover inventions that lack novelty or nonobviousness). Patent quality is discussed in more detail in Part III.B.1.

15. *Id.* at 139 (noting situations in which the examiner's inability to obtain relevant prior art led to the issuance of a patent of dubious quality); *see also* Jay P. Kesan & Andres A. Gallo, *Why "Bad" Patents Survive in the Market and How Should We Change?—The Private and Social Costs of Patents*, 55 EMORY L.J. 61, 63-68 (2006) (exploring additional criticisms); Mark A. Lemley & Bhaven Sampat, *Is the Patent Office a Rubber Stamp?*, 58 EMORY L.J. 181, 181-82 (2008) (same).

16. *See infra* Part III.B.1.

17. *See infra* notes 31-34 and accompanying text.

18. *See infra* Part III.A.

19. *See infra* Part I.B.

20. *See, e.g.*, John R. Allison & Mark A. Lemley, *The Growing Complexity of the United States Patent System*, 82 B.U. L. REV. 77, 101-02 (2002) (presenting empirical findings on references to prior art); Bhaven N. Sampat, Determinants of Patent Quality: An Empirical Analysis 3 (Sept. 2005) (unpublished manuscript), *available at* http://www.immagic.com/

because examiners are familiar with patent documents and have easy access to them.[21]

Thus, the challenge is to figure out how to both liberate information about experimental failure and to package it in a format amenable to patent searching, as well as for broader dissemination to society. This Article explains how to do just that. Recognizing that the legal system lacks a structured mechanism for capturing and disseminating negative information,[22] it proposes the creation of a new medium of disclosure called the *null patent*.[23] Although it would lack claims and therefore not confer a right to exclude,[24] the null patent would strongly resemble other patent documents in its substantive technical content, bibliographic information, and conformity to formatting conventions.[25] And although they would not be examined, null patents would be indexed by technology, making them amenable to open-access searching akin to, and perhaps concurrent with, the PTO's own patent databases.[26]

This proposal has potentially transformative implications for both patent law and science. Providing the examiner with ready access to a vast body of technical information would lead to a more thorough examination and, as a consequence, improve patent quality.[27] Providing inventors with access to this information would allow them to gauge patentability ex ante with greater certainty.[28] And

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eLibrary/ARCHIVES/GENERAL/COLUMBIA/C050902S.pdf (finding that examiners are less likely to find nonpatent prior art).

21. *See infra* note 113.

22. John T. Cross, *Dead Ends and Dirty Secrets: Legal Treatment of Negative Information*, 25 J. MARSHALL J. COMPUTER & INFO. L. 619, 620-21 (2008).

23. Here the word "null" has two implications. First, the experimental results disclosed within the document did not produce the expected outcome. *See* ALLAN FRANKLIN, NO EASY ANSWERS: SCIENCE AND THE PURSUIT OF KNOWLEDGE 169 (2005) (defining null results in experimental research). Second, the document would have no legal effect vis-à-vis a normal patent. *See infra* note 24.

24. A patent confers upon its owner the "right to exclude others from making, using, offering for sale or selling, the invention throughout the United States or importing the invention into the United States" during the patent term. 35 U.S.C. § 154(a)(1) (2006).

25. Issued patents and published patent applications are nearly identical in appearance. *See* Seymore, *supra* note 4, at 623 nn.2 & 4.

26. *See, e.g.*, USTPO PATENT FULL-TEXT DATABASES, http://patft.uspto.gov (last visited Mar. 28, 2012).

27. *See infra* Part III.B.1.

28. Negative results can play either a patent-defeating or patent-obtaining role. *See infra* Part III.A.

given that the liberated knowledge would be freely accessible to all, it would promote the public good[29] and further the patent system's broader policy objectives: to reduce R&D waste, spur creativity, and ultimately extend the frontiers of science and technology.[30] As for science, there is hope that by raising the profile of negative results, this proposal will induce a change in scientific norms toward heightened disclosure and broader dissemination of technical knowledge.

This Article proceeds as follows. Part I explores the roots of the norm of nondisclosure of negative results in science and the adverse consequences for both science and patent law. Part II begins by discussing why the null patent is the best mechanism not only for harvesting negative results from the sea of squandered knowledge, but for ensuring that the captured information is both easily accessible to the PTO and readily disseminated to the scientific community and the interested public. This Part then describes how to incentivize researchers to disclose negative results by offering a straightforward scheme for knowledge capture and identifying specific inducements that would motivate individual researchers to participate. Finally, Part III explores the fruits and broader impact of the liberated knowledge. It begins by describing the important and often underappreciated role of negative results in patent law and how implementing the proposed regime could improve patent quality and promote broader policy goals of patent law and science. This Part concludes by responding to possible criticisms and concerns.

29. *See generally* Joseph E. Stiglitz, *Knowledge as a Global Public Good*, *in* GLOBAL PUBLIC GOODS: INTERNATIONAL COOPERATION IN THE 21ST CENTURY 308 (Inge Kaul, Isabelle Grunberg & Marc A. Stern eds., 1999) (maintaining that knowledge is a public good and enables society's development).

30. *See infra* Part III.B.2.

## I. UNDERSTANDING EXPERIMENTAL FAILURE

### *A. The Ubiquity of Failure in Science*

An experiment fails when it does not produce the expected outcome.[31] This can happen because of poor experimental design, sloppy research technique, a flawed hypothesis, or for reasons unknown:

> No matter how well understood the theories leading up to the experiments are or how well-designed those experiments are or how carefully the experiments are done, the end result often is nothing like what was expected. The results can be thought of as failures or as a learning that the plan was based on an unknown flaw. Experimental science delves into the unknown, so the work beforehand is a best guess at what might be. Sometimes these best guesses end up being totally wrong and the series of experiments yield nothing other than the fact that there is something unexplained.[32]

Regardless of the cause, in science it is often the case that experiments do not work as planned.[33]

In fact, negative results comprise the bulk of knowledge produced in scientific research.[34] But this is not a bad thing because failure

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31. *See* Jonathan Knight, *Null and Void*, 422 NATURE 554, 554-55 (2003) (investigating the fate of negative results). For the purposes of this Article, the terms *negative results* and *failed experiment* are used interchangeably to include experiments that do not work as planned as well as *orphan* or *abandoned* results—experiments that yield positive results but are deemed unpublishable by the researcher. *See* Chris Patil & Vivian Siegel, *Shining a Light on Dark Data*, 2 DISEASE MODELS & MECHANISMS 521, 521-22 (2009) (identifying the various types of results that lie "inside the black hole of dark data").

32. JOHN FETZER, CAREER MANAGEMENT FOR CHEMISTS: A GUIDE TO SUCCESS IN A CHEMISTRY CAREER 14-15 (2004); *see also* RICHARD H. MCCUEN, THE ELEMENTS OF ACADEMIC RESEARCH 275-77 (1996) (explaining why experiments fail).

33. MCCUEN, *supra* note 32, at 51-53; *see also* FETZER, *supra* note 32, at 13 ("One of the most important lessons that a young scientist must learn is that good and innovative research is a delicate balance of many failures and few successes."); *id.* at 15 ("[G]ood science inherently is full of failed experiments."). Failed experiments can lead to accidental discoveries, thereby converting failure into success. *See* DOROTHY LEONARD-BARTON, WELLSPRINGS OF KNOWLEDGE: BUILDING AND SUSTAINING THE SOURCES OF INNOVATION 119-20 (1998) (recounting the story of penicillin); Sean B. Seymore, *Serendipity*, 88 N.C. L. REV. 185, 196-211 (2009) (exploring the role of accidental discoveries in patent law).

34. Patil & Siegel, *supra* note 31, at 521; *see also* sources cited *supra* note 32.

plays a key role in knowledge building.[35] Scientists can always extract *something* from a failed experiment. As one commentator has explained, "The best failures produce[ ] an abundance of data, and, at the very least, a failed experiment eliminate[s] whatever approach to a problem was under consideration and thereby ma[kes] way for some alternative."[36] This is why "[w]ords like 'positive,' 'significant,' 'negative' or 'null'[—though] common scientific jargon [—]are obviously misleading, because *all* results are equally relevant to science, as long as they have been produced by sound logic and methods."[37] So Thomas Edison was right when he said, "No experiments are useless."[38]

### *B. The File Drawer Problem*

#### *1. Why It Exists*

The problem with data generated from failed experiments is that most of this valuable technical information is never disclosed.[39] Indeed, the prevailing norm in science is *not* to report negative results. This practice of nondisclosure is often called the "file drawer

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35. *See* LEONARD-BARTON, *supra* note 33, at 119-20 (presenting stories of "failing forward" from scientific research, which is defined as "creating forward momentum with the learning derived from failures"); *see also* STEFAN H. THOMKE, EXPERIMENTATION MATTERS: UNLOCKING THE POTENTIAL OF NEW TECHNOLOGIES FOR INNOVATION 23 (2003) ("Innovators learn from failure.... [K]nowledge of either failure or success itself can be stockpiled, providing a resource that, if not applicable to one set of experiments, can be used for subsequent inquiries.").

36. ALAN AXELROD, EDISON ON INNOVATION: 102 LESSONS IN CREATIVITY FOR BUSINESS AND BEYOND 40-41 (2008); *see also* FETZER, *supra* note 32, at 17 ("[U]nexpected results created challenges and forced new innovative thinking because the accepted theories fail [because they neither] predict nor explain failed experiments that were planned using their premises.").

37. Daniele Fanelli, *Do Pressures to Publish Increase Scientists' Bias? An Empirical Support from US States Data*, PLOS ONE, 1 (Apr. 21, 2010), http://www.plosone.org/article/info:doi/10.1371/journal.pone.0010271 (emphasis added).

38. NEIL BALDWIN, EDISON: INVENTING THE CENTURY 50-51 (1995) (quoting Thomas Edison's remarks to critical financial supporters, reminding them that they were paying for not just the successful results but also for the experiments themselves).

39. *Cf.* David Alcantara, Joe Blois & Carlos Juan Ceacero, Editorial, 1 ALL RESULTS J. BIOLOGY 1, 1 (2010), http://www.arjournals.com/ojs/index.php?journal=Biol&page=index (follow "Archives" hyperlink to "Vol. 1, No. 1 (2010)") (describing the "huge untapped resource of experimental data locked up in laboratory notebooks that could be of great service to the scientific community").

problem"[40] because it is imagined that scientists bury negative results deep in their file drawers never to see the light of day.[41]

The file drawer problem has several causes. First, the bias against disclosing negative results has a psychological component. As one commentator explains, "Like all human beings, scientists are confirmation-biased (i.e. tend to select information that supports their hypotheses about the world), and they are far from indifferent to the outcome of their own research: positive results make them happy and negative ones make them disappointed."[42]

Second, a researcher often has little incentive to disclose negative results. Since 1665, the peer-reviewed scientific journal[43] has been the principal medium "through which scientists have chosen to both communicate to their peers" and to archive their "research findings, ... observations, interpretations, and conclusions."[44] But it would be inaccurate to view manuscripts submitted for peer review as "historical records of the scientific process."[45] Rather, they are ahistorical texts written to maximize their chances of publication in a prestigious journal.[46] And it is no secret that

> the success of a scientific paper partly depends on its outcome. In many fields of research, papers are more likely to be pub-

40. Robert Rosenthal, *The "File Drawer Problem" and Tolerance for Null Results*, 86 PSYCHOL. BULL. 638, 638 (1979) (coining the term).

41. Donald Kennedy, *The Old File-Drawer Problem*, 305 SCIENCE 451, 451 (2004); *see also* 1 ENCYCLOPEDIA OF RESEARCH DESIGN 490 (Neil J. Salkind ed., 2010) ("The file drawer problem ... arose from the image that ... nonsignificant results are placed in researchers' file drawers, never to be seen by others."); Fanelli, *supra* note 37, at 1 (attributing the term to the notion that unpublished "negative papers are imagined to lie in scientists' drawers").

42. Fanelli, *supra* note 37, at 1 (citations omitted).

43. Peer review refers to the screening of research results by colleagues in a particular discipline. Peter Hernon & Candy Schwartz, *Peer Review Revisited*, 28 LIBR. & INFO. SCI. RES. 1, 1 (2006). The mechanics of peer review typically work as follows: First, the researcher submits the work to a journal. Second, the editor sends it to one or more reviewers knowledgeable about the problem to judge its merit—uniqueness, methodology, adequacy of research design, and potential contribution to the field. Third, the editor makes a final publication decision. *Id.*

44. RICHARD D. WALKER, PATENTS AS SCIENTIFIC AND TECHNICAL LITERATURE 1 (1995); *see also* DARYL E. CHUBIN & EDWARD J. HACKETT, PEERLESS SCIENCE: PEER REVIEW AND U.S. SCIENCE POLICY 85 (1990) (explaining that publishing in journals replaced haphazard modes of circulating science and "facilitate[s] communication, allocation of credit, and authentication of research results").

45. Patil & Siegel, *supra* note 31, at 522.

46. *Id.*

> lished, to be cited by colleagues, and to be accepted by high-profile journals if they report results that are "positive" ... all results that support the experimental hypothesis.[47]

Disclosing negative results runs the risk of tainting the research project as inferior—despite the novelty and integrity of the work—or not conforming to the reviewers' expectations.[48] Either form of publication bias could mean the "kiss of death" for the manuscript[49] or its delayed publication and relegation to an obscure journal.[50]

Third and relatedly, publishing negative results in the peer-reviewed literature can have negative career consequences. One commentator explains how:

> Since papers reporting positive results attract more interest and are cited more often, journal editors and peer reviewers might tend to [favor] them, which will further increase the desirability of [publishing] a positive outcome to researchers, particularly if their careers are evaluated by counting the number of papers listed in their CVs and the impact factor of the journals they are published in.[51]

In addition, a recent study reveals that publishing results that do not positively align with then-existing mainstream ideas can have a devastating effect on the researchers' reputation and future income.[52] Given these risks, it is easy to understand why a scientist

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47. Fanelli, *supra* note 37, at 1.

48. David Alcantara & Rafael Prado Gotor, Editorial, 1 ALL RESULTS J. CHEMISTRY 1, 1-2 (2010), http://www.arjournals.com/ojs/index.php?journal=Chem&page=index (follow "Archives" hyperlink to "Vol. 1, No. 1 (2010)") (exploring "submission bias" which leads researchers to publish only positive results because they "want their competitors to think they succeed at every project designed"); Stan Szpakowicz, *Failure Is an Orphan (Let's Adopt)*, 36 COMPUTATIONAL LINGUISTICS 157, 157-58 (2010).

49. Szpakowicz, *supra* note 48, at 157-58.

50. Alcantara & Gotor, *supra* note 48, at 1 ("[P]ositive results have a better chance of being published, are published earlier, and are published in journals with higher impact factors."); Richard Smith, *Peer Review: A Flawed Process at the Heart of Science and Journals*, 99 J. ROYAL SOC'Y MED. 178, 180 (2006) (describing the bias against work that discloses negative results).

51. Fanelli, *supra* note 37, at 1.

52. *See* Arthur M. Diamond, Jr., *The Career Consequences of a Mistaken Research Project: The Case of Polywater*, 68 AM. J. ECON. & SOC. 387, 407 (2009) (concluding that researchers who wrote about polywater, either pro or con, suffered a negative impact on their future citations and a concomitant loss of financial income).

might conclude that peer review is not the best venue for disclosing negative results.

But hurdles that tip the scales toward nondisclosure still exist outside of the peer review context. Logistical issues related to formatting, collection, and storage of negative results must be resolved.[53] In addition, a researcher might be less inclined to invest time and energy in writing up failed experiments out of a sense that the scientific community tends to be more interested in positive findings than negative ones.[54] Finally, some researchers simply do not want their competitors to know the seemingly fruitless paths that they have been exploring.[55]

*2. Consequences*

*a. For Science*

There is little doubt that any upside that comes from nondisclosure is far outweighed by the potential downside to the public storehouse of technical knowledge.[56] The most apparent problem is that there is a cost to science, in terms of time and money, when other researchers waste resources on experiments that have failed previously.[57] A good example is when a scientist publishes an incomplete story of a research project in which the scientifically obvious—but undisclosed—path failed and a not-so-obvious path worked: "[O]ther scientists may look at the work and think, 'Why did they not do this? It's obvious' and then proceed to redo the failures. Thus, by not reporting on the 'obvious' course that failed, one scientist sets

53. Thomas Goetz, *Freeing the Dark Data of Failed Science Experiments*, WIRED MAGAZINE (Sept. 25, 2007), http://www.wired.com/science/discoveries/magazine/15-10/st_essay.

54. Knight, *supra* note 31, at 554. The commentator goes on to ask, "[I]s our scientific understanding in some cases biased by a literature that might be inherently more likely to publish a single erroneous positive finding than dozens of failed attempts to achieve the same result?" *Id.*

55. *Id.*

56. For commentary on the purpose and composition of the public storehouse of knowledge, see *infra* notes 201 and 262.

57. There are several well-publicized examples. *See, e.g.*, Sharon Begley, *New Journals Bet "Negative Results" Save Time, Money*, WALL ST. J., Sept. 15, 2006, at B1 (describing how publication bias suppressing negative results tied to a link between oral contraceptives and cervical cancer led to erroneous conclusions and wasted time and money).

up others to do a wasted redundancy."[58] Unfortunately, this occurs all the time in scientific research.[59]

A related concern is that withholding negative results can overrepresent the rate of success—or mask problems—in a particular field.[60] Indeed, "for many current scientific fields, claimed research findings may often be simply accurate measures of the prevailing bias."[61] The incomplete information can improperly skew debates,[62] lead to an imprudent allocation of resources,[63] or even jeopardize public health.[64] Yet despite these potential concerns, an otherwise

58. FETZER, *supra* note 32, at 17-18.

59. *Id.*

60. For example, a recent study of publication bias in animal studies found that published animal trials overestimate by approximately 30 percent that a specific treatment works because negative results go unpublished. Emily S. Sena et al., *Publication Bias in Reports of Animal Stroke Studies Leads to Major Overstatement of Efficacy*, PLOS BIOLOGY, 4 (Mar. 30, 2010), http://www.plosbiology.org/article/info:doi/10.1371/journal.pbio.1000344.

61. John P.A. Ioannidis, *Why Most Public Research Findings Are False*, 2 PLOS MED. 696, 696 (2008).

62. *See, e.g.*, Knight, *supra* note 31, at 554 (noting how the nonpublication of negative results pertaining to genetically modified crops has skewed the debate; suggesting that there are no adverse health effects or environmental consequences).

63. For example, a funding agency might decide to approve a research proposal that it otherwise would deny if the agency knew the full story of the research project. BERNARD LO, ETHICAL ISSUES IN CLINICAL RESEARCH: A PRACTICAL GUIDE 113 (2010) (explaining how withholding negative results wastes scarce resources because it can direct funding away from more meritorious research projects).

64. One pharmaceutical company conducting clinical trials for a new drug deliberately suppressed negative results to make the drug appear safer and more effective than it really was. *See* David Egilman & Emily Ardolino, *The Pharmaceutical Industry, Disease Industry: A Prescription for Illness and Death*, *in* THE BOTTOM LINE OR PUBLIC HEALTH: TACTICS CORPORATIONS USE TO INFLUENCE HEALTH AND HEALTH POLICY, AND WHAT WE CAN DO TO COUNTER THEM 193, 193-201 (William H. Wiist ed., 2010) (explaining how Merck's suppression of Vioxx's negative cardiovascular side effects led to adverse events in patients including bleeding, heart attacks, and death). One physician explains that "[b]y altering the apparent risk-benefit ratio of drugs, selective publication can lead doctors to make inappropriate prescribing decisions that may not be in the best interest of their patients and, thus, the public health." Erick H. Turner et al., *Selective Publication of Antidepressant Trials and Its Influence on Apparent Efficacy*, 358 NEW ENG. J. MED. 252, 259 (2008); *cf.* Drummond Rennie & Annette Flanagin, *Publication Bias: The Triumph of Hope over Experience*, 267 JAMA 411, 412 (1992) (explaining that the editors of the journal accept the view that "when investigators undertake research involving humans, they take on a public trust that is violated when [all of] the results are not disseminated by publication" (citation omitted)). In addition to new federal disclosure requirements, many prestigious medical journals like the *New England Journal of Medicine* and the *Journal of the American Medical Association* refuse to publish research involving clinical trials unless all of the data is disclosed beforehand in a public registry. *See* Catherine De Angelis et al., *Clinical Trial Registration: A Statement from the International Committee of Medical Journal Editors*, 351 NEW ENG. J. MED. 1250,

honest scientist might be tempted to withhold negative results if doing so increases the possibility of future funding or other academic rewards.[65]

Perhaps the biggest drawback is that nondisclosure causes a drag on scientific progress.[66] Among other things, negative results "serve to drive the scientific method forward by showing the path *not* to follow."[67] Other scientists could possibly fix the error or use the failed experiment as a building block for other scientific endeavors.[68] But nondisclosure condemns this valuable technical information to the sea of squandered knowledge.[69]

*b. For Patent Law*

All research endeavors—including failed experiments—produce technical information that can contribute to the public storehouse of technical knowledge.[70] Although the composition of the storehouse clearly impacts science, it also affects patent law because determining whether an invention satisfies the substantive standards of patentability depends on its relation and potential contribution to the storehouse.[71] This is yet another example of how scientific norms can affect patent law.[72]

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1250-51 (2004) (presenting the new publication policy of the International Committee of Medical Journal Editors member journals); *infra* note 161 (discussing the federally mandated disclosure requirements of clinical trial results for drugs subject to FDA regulation).

65. CYNTHIA CROSSEN, TAINTED TRUTH: THE MANIPULATION OF FACT IN AMERICA 167 (1994). Such behavior may not be overt, "but it's the kind of thing where you might be tempted to put a more glowing cast on a medium-successful outcome because if the results are good, you might be invited to go to a meeting in San Francisco next year to give a presentation." *Id.* (quoting a medical ethicist).

66. Goetz, *supra* note 53; *see also* Turner et al., *supra* note 64, at 259 (arguing that the nondisclosure of negative results in drug studies "hinder[s] the advancement of medical knowledge").

67. Alcantara et al., *supra* note 39, at 1 (emphasis added).

68. *See* ANDREW HARGADON, HOW BREAKTHROUGHS HAPPEN: THE SURPRISING TRUTH ABOUT HOW COMPANIES INNOVATE 55-57 (2003) (describing the role of failed experiments in innovation); *supra* notes 35-38 and accompanying text.

69. *See* Alcantara et al., *supra* note 39, at 1 ("There is a huge untapped resource of experimental data locked up in laboratory notebooks that could be of great service to the scientific community."); P. Bryan Heidorn, *Shedding Light on the Dark Data in the Long Tail of Science*, 57 LIBR. TRENDS 280, 286-88 (2008) (describing the benefits of bringing "dark data" to light).

70. *See infra* note 262.

71. *See infra* Part III.A.

72. *See, e.g.*, Seymore, *supra* note 4 (proposing a disclosure regime that would allow

## II. HARVESTING SQUANDERED KNOWLEDGE

### *A. Why a Patent-Like Document?*

In theory, there are a variety of ways to harvest negative results from the sea of squandered knowledge. Given the importance of this information to both scientists and patent examiners, the challenge is to design a regime whose costs of disclosure, in terms of both time and risk, are low for researchers and that also puts the captured technical information into a repository readily accessible to patent examiners, other researchers, and members of the interested public.[73] This Subsection explains why a patent-like document is the best disclosure mechanism to achieve these goals.

#### *1. Risky Alternatives*

Despite the growing awareness of the usefulness of negative results, very little progress has been made in harvesting this information. Efforts include one journal's willingness to publish negative results as long as the quality of the submitted data "meet[s] the same rigorous standards that [the] journal applies to all other submissions";[74] an open-access website[75] for researchers to post preliminary findings, including negative results, as a "complement" to the formal peer review process;[76] and the creation of a handful of

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patents to compete with other forms of technical literature as a source of substantive technical information); Seymore, *supra* note 33 (arguing that although accidental discoveries pervade science, inventors who invent by accident can be unjustly deprived of patents because such discoveries do not mesh with the substantive law of invention); Sean B. Seymore, *Heightened Enablement in the Unpredictable Arts*, 56 UCLA L. REV. 127 (2008) (proposing a new approach for examining patent applications in unpredictable technologies that, by requiring applicants to disclose actual experimental results, resolves a striking incongruity between patent law and the experimental sciences).

73. Of course, there must also be sufficient inducements to encourage individual researchers to participate. *See infra* Part II.B.

74. Ulrich Dirnagl & Martin Lauritzen, *Fighting Publication Bias: Introducing the Negative Results Section*, 30 J. CEREBRAL BLOOD FLOW & METABOLISM 1263, 1264 (2010) (describing the journal's author guidelines for submitting negative results).

75. NATURE PRECEDINGS, http://precedings.nature.com (last visited Mar. 28, 2012).

76. Andrea Gawrylewski, *New Site Pits 'Published' vs. 'Posted,'* THE SCIENTIST (June 19, 2007, 08:46 PM GMT), http://www.the-scientist.com/news/display/53294/ (quoting the Director of Web Publishing at Nature Publishing Group).

open-access, peer-reviewed nonprint journals that explicitly target manuscripts disclosing negative results.[77]

Though laudable, these efforts have neither attracted many submissions nor induced any perceptible change in scientific norms. This is understandable because publishing in these forums carries significant risks. For example, although everyone in science knows that most experiments fail,[78] listing a publication in a negative results journal on a curriculum vitae can nevertheless tarnish a scientist's reputation.[79] And then there is the Ingelfinger Rule[80]—a policy followed by many prominent journals stating that a journal will only consider a manuscript for publication if the findings have not been previously published elsewhere.[81] Fearful that a misstep might jeopardize their chances of publication in a prestigious journal, it is understandable why scientists tread carefully in prepublication activities involving either positive or negative results.[82]

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77. *See* Deepak Kanojia, *Journal of Negative Results*, 90 CURRENT SCI. 8, 8 (2006) (listing five journals). The most recent entrants are the *All Results Journals*—launched in 2010 as a collection of individual negative results journals in biology, chemistry, nanotechnology, and physics. These journals share a common focus:

> At present, more than 60% of the experiments fail to produce results or expected discoveries. This high percentage of "failed" research generates high level knowledge. But generally, all these negative experiments have not been published anywhere .... The main objective of The All Results Journals focuses on recovering and publishing negative results, valuable pieces of information in [s]cience. These experiments are considered a vital key for the development of science and the catalyst for a real science-based empirical knowledge.

THE ALL RESULTS JOURNALS, http://www.arjournals.com (last visited Mar. 28, 2012) (emphasis omitted).

78. *See supra* notes 31-34 and accompanying text.

79. *See* Gawrylewski, *supra* note 76 (exploring the risk in the context of tenure review); *supra* note 52 and accompanying text.

80. *See* Editorial, *Definition of "Sole Contribution,"* 281 NEW ENG. J. MED. 676, 676-77 (1969) (articulating the rule). Frank Ingelfinger was the editor of the *New England Journal of Medicine* from 1967 to 1977. *See* VINCENT KIERNAN, EMBARGOED SCIENCE 18-21 (2006) (providing history and commentary).

81. A survey of journal publishers revealed that almost three-fourths of them adhere to the rule. KIERNAN, *supra* note 80, at 19; *see also* Marcia Angell & Jerome P. Kassirer, *The Ingelfinger Rule Revisited*, 325 NEW ENG. J. MED. 1371, 1371-73 (1991) (arguing that the rule is necessary to preserve the journal's "newsworthiness" and to ensure that medical research has been subjected to appropriate peer review before it is publicized); Arnold S. Relman, *The Ingelfinger Rule*, 305 NEW ENG. J. MED. 824, 824-26 (1981) (same).

82. *See* DENNIS MEREDITH, EXPLAINING RESEARCH: HOW TO REACH KEY AUDIENCES TO ADVANCE YOUR WORK 100 (2010) (advising scientists to be preemptive in protecting their scientific publications and listing prominent journals that adhere to the rule, including the *New England Journal of Medicine*; *Science*, *Nature*, *Cell*, *Proceedings of the National Academy*

To the extent that these issues primarily affect academic scientists, disclosing negative results in patent documents does not present these risks.[83] This is largely because patents were long ignored or avoided by academic scientists because they were seemingly incongruent with the norms and incentives of academic research.[84] For instance, one line of thought urges that scientific knowledge is common knowledge—reinforced by full and open communication of research findings.[85] Incentives like patents were considered unnecessary, at least in academic settings, because scientists pursue "knowledge for knowledge's sake."[86] But scientific norms have adapted to accommodate patents,[87] perhaps because they can generate and reinforce academic rewards,[88] serve as a rev-

*of Sciences*; *Journal of the American Medical Association*; and journals of the American Chemical Society).

83. For instance, though there has been some wrangling about which of the various forms of online posting constitute prior publication for the purposes of the Ingelfinger Rule, patent documents have not drawn attention. *See* CHRISTINE L. BORGMAN, SCHOLARSHIP IN THE DIGITAL AGE: INFORMATION, INFRASTRUCTURE, AND THE INTERNET 98-99 (2007) (exploring the rule in the Internet age).

84. *See* Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1017 (1989) ("Yet the idea that exclusive rights in new knowledge will promote scientific progress is counterintuitive to many observers of research science, who believe that science advances most rapidly when the community enjoys free access to new discoveries."); Rebecca S. Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 YALE L.J. 177, 184 (1987) (explaining that to the extent that patents "limit the ability of other scientists to use published knowledge, intellectual property law has been perceived within the scientific research community as conflicting with the traditional norms and rewards of science").

85. ROBERT K. MERTON, THE SOCIOLOGY OF SCIENCE: THEORETICAL AND EMPIRICAL INVESTIGATIONS 274 (Norman W. Storer ed., 1973); *see also* John M. Golden, *Principles for Patent Remedies*, 88 TEX. L. REV. 505, 521-22 (2010) (describing the substantial norm of secrecy with respect to innovation and scientific discovery that once existed); Arti Kaur Rai, *Regulating Scientific Research: Intellectual Property Rights and the Norms of Scienc*e, 94 NW. U. L. REV. 77, 89-94 (1999) (exploring the conflict between scientific norms favoring broad and rapid dissemination of knowledge and commercial norms favoring secrecy and proprietary rights in that knowledge).

86. Fiona Murray, *The Oncomouse that Roared: Hybrid Exchange Strategies as a Source of Distinction at the Boundary of Overlapping Institutions*, 116 AM. J. SOC. 341, 348 (2010).

87. Peter Lee, *Contracting to Preserve Open Science: Consideration-Based Regulation in Patent Law*, 58 EMORY L.J. 889, 943-44 (2009); *see also* Murray, *supra* note 86, at 350 (describing the emerging porous boundary between academic and commercial science); Fiona Murray & Scott Stern, *When Ideas Are Not Free: The Impact of Patents on Scientific Research*, *in* 7 INNOVATION POLICY AND THE ECONOMY 33, 52 (Josh Lerner & Scott Stern eds., 2007) (explaining that patents have been "co-opted into science" and "have become part of every day scientific life").

88. *See* Murray, *supra* note 86, at 375-76 (explaining that academic scientists have started

enue source for research,[89] and merge with journal articles as a mechanism for knowledge transfer.[90]

### *2. The Well-Established Framework of Patent Information*

The patent literature—comprising patent documents and published patent applications—is "the most highly concentrated collection[] of technical information" in the world.[91] It consists of over 80 million published patent documents worldwide[92] spanning all possible technical fields and growing by about 1.5 million documents per year.[93] Most of the information disclosed in patent documents is never published elsewhere.[94]

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to recognize that patents can provide scientific credit and help attract industrial interest and support for research projects); Sean B. Seymore, *The "Printed Publication" Bar After* Klopfenstein*: Has the Federal Circuit Changed the Way Professors Should Talk About Science?*, 40 AKRON L. REV. 493, 500 n.43 (2007) (noting that some universities consider patents favorably in promotion and tenure decisions).

89. Robert P. Merges, *Property Rights Theory and the Commons: The Case of Scientific Research*, *in* SCIENTIFIC INNOVATION, PHILOSOPHY, AND PUBLIC POLICY 145, 155 (Ellen Frankel Paul et al. eds., 1996). "Regardless of what *motivates* a scientist ... he or she cannot make any progress in the vast majority of scientific disciplines without a great deal of money." *Id.*

90. Murray, *supra* note 86, at 345 (citing Ajay Agrawal & Rebecca M. Henderson, *Putting Patents in Context: Exploring Knowledge Transfer at MIT*, 48 MGMT. SCI. 44, 47-60 (2002) (presenting an empirical study of faculty patenting and publishing behavior)); Murray & Stern, *supra* note 87, at 52 (explaining that scientists "are more active participants in building commercial strategies around patents ... even while they continue to publish in prestigious scientific journals").

91. Doreen Alberts et al., *Introduction to Patent Searching*, *in* CURRENT CHALLENGES IN PATENT INFORMATION RETRIEVAL 3, 7 (Mihai Lupu et al. eds., 2011); *see also* DAVID HUNT ET AL., PATENT SEARCHING: TOOLS & TECHNIQUES 110 (2007).

92. *See, e.g.*, Press Release, CPA Global Ltd., World's Most Sophisticated Patent Research Platform, CPA Global Discover, Soon to Be Launched (Sept. 29, 2010), *available at* http://www.cpaglobal.com/media_centre/press_releases/4674/ (explaining that the new search platform will allow customers to access more than eighty million patent documents from ninety jurisdictions in seconds).

93. SHAHID ALIKHAN & RAGHUNATH MASHELKAR, INTELLECTUAL PROPERTY AND COMPETITIVE STRATEGIES IN THE 21ST CENTURY 8 (2d ed. 2009).

94. WALKER, *supra* note 44, at 1 ("[M]uch of the information appearing in patent documents is never published in any other format, including the [archival] journal."); *see also* JILL LAMBERT & PETER A. LAMBERT, FINDING INFORMATION IN SCIENCE, TECHNOLOGY, AND MEDICINE 9 (2003) (estimating that about 15 percent of the technical information disclosed in patents is available elsewhere); Esteban Burrone & Guriqbal Singh Jaiya, Intellectual Property (IP) Rights and Innovation in Small and Medium-Sized Enterprises 3 (unpublished manuscript), *available at* http://www.wipo.int/sme/en/documents/pdf/iprs_innovation.pdf ("It has been estimated that patent documents contain 70% of the world's accumulated technical knowledge and that most of the information contained in patent documents is either never

Another hallmark of the patent literature is its searchability.[95] When compared to other information sources,[96] the patent literature stands apart in its overall level of organization and accessibility.[97] All patent documents adhere to a standardized, predictable format that includes bibliographic information such as a title, abstract, filing date, citations to other documents, and the inventor's name. To facilitate retrieval, the technical content of each document is catalogued and indexed in a hierarchical classification system that covers all fields of technology and therefore represents the entire body of searchable technical information.[98] The level of uniformity between individual patent documents, regardless of origin, is extremely consistent.[99] This is not the case with other types of technical literature, which vary widely in their levels of organization[100] and coverage.[101]

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published elsewhere or is first disclosed through the publication of the patent application.").

95. *See* Alberts et al., *supra* note 91, at 6 (explaining that "buckets" of technical information can be grouped based on the extent to which each is readily searchable). The term "searchable" refers to seeking information from an electronic database or retrieving and reviewing print materials. *Id.*

96. The body of searchable technical information can be divided into three types: the patent literature; technical journals; and everything else (conference proceedings, product literature, textbooks, drawings, diagrams, industry publications, etc.). *Id.*

97. *Cf. id.* at 7 (using four metrics, rather than just organization and accessibility, to gauge searchability).

98. There are two major patent classification systems. The PTO uses the U.S. Patent Classification system (USPC), which divides all technical subject matter into over 450 main classes and approximately 150,000 subclasses. *See* MANUAL OF PATENT CLASSIFICATION, http://www.uspto.gov/web/patents/classification/help.htm (last visited Mar. 28, 2012). Most countries use the World Intellectual Property Organization's International Patent Classification system (IPC), which divides patentable technologies into 8 main sections, 120 classes, 640 subclasses, and about 70,000 groups. *See* INT'L PATENT CLASSIFICATION (IPC), http://www.wipo.int/classifications/ipc/en/faq/index.html (last visited Mar. 28, 2012). Both systems are regularly revised and amended to follow technological progress.

99. Alberts et al., *supra* note 91, at 7.

100. With technical journals, "[t]he level of uniformity between documents is mostly consistent, however, the data fields that journal-grade literature documents have in common are many fewer than patent documents ...[, which] yields fewer and less sophisticated options to search the data." *Id.* at 8. At the far end of the spectrum are all other forms of literature, which "are scattered across all reaches and resources ... [and] under most circumstances need to be searched separately." *Id.*

101. The point here is that sometimes the exact scope of information being searched is unknown. For example, given that a significant amount of technical journal literature remains undigitized, and must be searched manually within printed publications, a comprehensive search might require a considerable amount of effort that extends beyond searching a literature database. *Id.*

The patent literature is also extremely accessible. The digital age now makes patent documents available to all interested parties either through free-of-charge patent information databases[102] or through commercial databases that offer value-added tools.[103] This makes the patent literature the greatest publicly-accessible technical library in the world.[104]

Taken together, these characteristics of the patent literature further explain why a patent-like document—the *null patent*—is the best medium for disseminating negative results.[105] It would strongly resemble other patent documents in structure, format, and content, including a detailed description of the work performed—such as sufficient technical information to replicate the failed experiment[106]—and bibliographic information. Perhaps the key difference between the null patent and a traditional patent is that the former would lack claims. This does not matter because from a *knowledge* perspective, patent documents are not important for their legal significance but rather for the volume of technical knowledge that they disclose to the public.[107] And like other patent documents, this technical knowledge could be catalogued and indexed using an established hierarchical classification system. Thus, a collection of null patents could be structured into an information database in much the same way as the current patent literature. In theory, this

102. *See, e.g.*, USTPO PATENT FULL-TEXT DATABASES, *supra* note 26 (U.S. patent documents); EPO-ESPACENET, http://www.epo.org/searching/free/espacenet.html (last visited Mar. 28, 2012) (Europe's patent databases); PATENTSCOPE, http://www.wipo.int/patentscope/en/dbsearch/ (last visited Mar. 28, 2012) (database of all patent applications filed under the Patent Cooperation Treaty and links to patent databases in more than twenty-five nations).

103. A value-added tool adds material to the information that it retrieves, such as an abstract prepared by a subject-matter expert or information about related patent documents. HUNT ET AL., *supra* note 91, at 82 & 107 n.23; *see, e.g.*, *Derwent World Patents Index*, THOMSON REUTERS, http://thomsonreuters.com/products_services/legal/legal_products/a-z/derwent_world_patents_index/ (last visited Mar. 28, 2012) (the best-known and most comprehensive collection of value-added patent documents).

104. *See* sources cited *supra* note 91.

105. Again, the word "null" has two implications: first, that the experimental results disclosed within the document did not produce the expected outcome; and second, that the document would have no legal effect vis-à-vis a traditional patent. *See supra* note 23.

106. *See infra* Part II.B.2. The sufficiency of the detailed description would be determined by scientific norms.

107. STEPHEN R. ADAMS, INFORMATION SOURCES IN PATENTS 4 (2d ed. 2006).

would allow free open-access searching akin to, and perhaps concurrently with, other patent information databases.[108]

*3. The Need to Mitigate the PTO's Information Deficit*

It is worth reiterating that the purpose of the null patent is twofold: first, to serve as a medium for disclosing and disseminating negative results; and second, to put that information into the examiner's hands for assessing patentability.[109] Although there might be other ways to achieve the former, the null patent's ability to achieve *both* goals makes it unique.

Recall that an examiner is more likely to assert references found in patent databases than from other information sources,[110] essentially making the former "a sort of filing cabinet of all human knowledge."[111] This raises the question of who should host the null patent information database—the PTO or a third party. The PTO might be preferable for at least two reasons. First, if it is true that "[e]xaminers give more weight to their *own* database[s],"[112] then hosting the null patent database at the PTO would increase the chances that an examiner would search it.[113] Second, the PTO already knows how to build and maintain a patent-like information database.[114] Since 1985, inventors who decide not to obtain a patent can pay a hefty fee[115] and request that the PTO publish the tech-

108. It appears that the PTO has the capacity and expertise to implement this type of framework. *See infra* notes 116-20 and accompanying text.

109. *See supra* notes 23-30 and accompanying text.

110. *See supra* note 20 and accompanying text.

111. James Gleick, *Patently Absurd*, N.Y. TIMES MAG., Mar. 12, 2000, at 44.

112. *Id.* (emphasis added).

113. *See* Allison & Lemley, *supra* note 20, at 102 ("The predominance of ... U.S. patents [as cited prior art] may ... reflect the limitations of the PTO systems for searching: the PTO is much more likely to find documents that it itself has generated."); John R. Thomas, *Collusion and Collective Action in the Patent System: A Proposal for Patent Bounties*, 2001 U. ILL. L. REV. 305, 318 ("In comparison to much of the [nonpatent] literature, patents are readily accessible, conveniently classified and printed in a common format. Identification of a [nonpatent] reference, and full comprehension of its contents, often prove[s] to be more difficult.").

114. *Cf.* Michael J. Burstein, *Rules for Patents*, 52 WM. & MARY L. REV. 1747, 1783-90 (2011) (arguing that in deciding which institutional actor is best equipped to make patent policy choices, the PTO is best equipped to do so because of its expertise, ability to gather relevant information, and other reasons).

115. *See infra* note 116. Recall that publishing in the null patent database would be free.

nical details in a patent-like document called a Statutory Invention Registration (SIR).[116] Like the null patent, SIRs lack claims and therefore confer no legal rights.[117] But more importantly, published SIRs "are classified, cross-referenced, ... placed in the search files, disseminated to foreign patent offices, stored in [PTO] computer tapes, [and] made available in commercial data bases."[118] The existence of the SIR program, which is set to be eliminated as part of patent reform,[119] shows that the PTO has the experience and infrastructure required to develop and maintain the null patent information database.[120]

Including the null patent database in the examiner's suite of online search tools[121] would expand the universe of easily-accessible

116. *See* Patent Law Amendments Act of 1984 § 102, 35 U.S.C. § 157 (2006) (repealed 2011). The purpose of an SIR is to dedicate the disclosed subject matter to the public, meaning that an SIR becomes prior art when it publishes. U.S. PATENT & TRADEMARK OFFICE, MANUAL OF PATENT EXAMINING PROCEDURE § 1111 (8th ed. 8th rev. 2010) [hereinafter MPEP] ("[A] published SIR will be treated the same as a U.S. patent for all defensive purposes, usable as a reference as of its filing date in the same manner as a patent."). The PTO may grant an SIR if three conditions are met. First, the disclosed subject matter must satisfy the enablement, written description, and best mode requirements of paragraph 1 of § 112. *See* § 157(a)(1). Second, the applicant must pay filing, processing, and publication fees. § 157(a)(4). Third, the applicant must waive the right to receive a patent on the disclosed subject matter. § 157(a)(3). As of 2010, the fee to publish an SIR can be as high as $1840. *See* 37 C.F.R. § 1.17 (n)-(o) (2010) (presenting the SIR fee schedule).

117. *See* 35 U.S.C. § 157(a)(3), (b) (stating that upon publication, the applicant for an SIR waives the right to receive a patent on the disclosed subject matter); § 157(c) (stating that, inter alia, an SIR does not confer the right to a remedy for patent infringement).

118. MPEP, *supra* note 116, § 1111. Though SIRs are expensive, they can be an excellent source of prior art because the examiner is obliged to search them when they reside in the PTO's own databases. *See infra* note 120.

119. *See* Leahy-Smith America Invents Act, H.R. Res. 1249, 112th Cong. § 103(c) (2011) (enacted) (repealing 35 U.S.C. § 157).

120. One might ask if a researcher could currently use an SIR as a medium for disclosing negative results. The answer is no, primarily because SIRs must disclose enabled subject matter. *See supra* note 116. Now that most patent applications publish automatically eighteen months after filing, SIRs are often unnecessary because an inventor who wants the subject matter to enter the public domain can simply abandon the application after its publication. *See* MPEP, *supra* note 116, § 1120(II). With that said, from a strategic point of view, SIRs are an excellent source of prior art. *See* ADAMS, *supra* note 107, at 50 ("The inventor, by deliberately laying open their invention, will ensure that the information is in the public domain and unpatentable in other jurisdictions as well."); *supra* note 118.

121. *See* MPEP, *supra* note 116, § 901.06(a)(IV)(B) (listing several online search tools available to aid examiners in discharging their duties); Iain M. Cockburn, Samuel Kortum & Scott Stern, *Are All Patent Examiners Equal? Examiners, Patent Characteristics, and Litigation Outcomes*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY 19, 24-25 (Wesley M. Cohen & Stephen A. Merrill eds., 2003) (describing how examiners conduct searches with

technical information and might do much to mitigate the current information deficit in the PTO.

### *B. Incentivizing Disclosure*

#### *1. The Challenge*

Having explained why the null patent is the best medium for disseminating negative results, the next question is how to encourage researchers to disclose them. There is little doubt that disclosure is the biggest hurdle for capturing, and ultimately disseminating, negative information.[122] Overcoming this hurdle is difficult not only because of the file drawer problem[123] but also because of differences between industrial and academic science,[124] differences within each of the two sectors and across disciplines,[125] and potential trade

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patent databases and other forms of technical literature).

122. *See* Cross, *supra* note 22, at 623 (recognizing the disclosure problem).

123. *See supra* Part I.B.

124. *See* Henry Sauermann & Paula E. Stephan, *Twins or Strangers? Differences and Similarities Between Industrial and Academic Science* 3 (Nat'l Bureau of Econ. Research, Working Paper No. 16113, 2010), *available at* http://www.nber.org/papers/w16113.pdf; *see also* DAVID B. RESNIK, THE PRICE OF TRUTH: HOW MONEY AFFECTS THE NORMS OF SCIENCE 41 (2007) (describing the traditional differences between industrial and academic science, including those related to research independence, motivation, and the freedom to decide how and to whom data will be shared). For a discussion of disclosure norms between the academic and industrial sectors, see ALAN L. PORTER & SCOTT W. CUNNINGHAM, TECH MINING: EXPLOITING NEW TECHNOLOGIES FOR COMPETITIVE ADVANTAGE 10 (2005) (showing empirically that academic scientists contribute most of all publicly available R&D and are more likely to publish research than their industrial counterparts). But as the line between academic and industrial science continues to blur, disclosure norms also evolve. *See* Sauermann & Stephan, *supra*, at 3 ("[S]cientists in *both* sectors publish extensively, with 60% of scientists in industry having published in a 5-year span. Over the same period, 16% of academics have applied for a patent."); *supra* notes 86-90 and accompanying text.

125. *See, e.g.*, Walter W. Powell & Jason Owen-Smith, *The New World of Knowledge Production in the Life Sciences*, *in* THE FUTURE OF THE CITY OF INTELLECT: THE CHANGING AMERICAN UNIVERSITY 107, 107-09, 111-15 (Steven Brint ed., 2002) (noting that unlike other technical disciplines, in the life sciences there is no longer a distinction between basic or applied research, academic or industrial practice, or proprietary or scientific approaches to information disclosure); Sauermann & Stephan, *supra* note 124, at 3 (explaining that the differences between academic and industrial practice are smaller in the life sciences than in the physical sciences); *see also* TAMAS BARTFAI & GRAHAM V. LEES, DRUG DISCOVERY: FROM BEDSIDE TO WALL STREET 86-87 (2006) (explaining that disclosure norms at pharmaceutical companies have evolved to openly and extensively disclose positive results, in part to attract academic collaborators and reassure investors).

secret concerns for researchers who change jobs.[126] Furthermore, designing a disclosure scheme presents a twofold challenge: first, to devise a mechanism for knowledge capture that is not so burdensome or complex that it is impractical; and second, to create specific inducements that would motivate individual researchers to participate.[127]

Although there is no easy solution to the disclosure problem, the three subsections that follow propose a framework to mitigate it. Though it is hard to predict the quantum of negative information that the framework could capture, given the infinitesimal amount that is currently disclosed,[128] this Article takes the position that *any* information that the framework's implementation could harvest from the sea of squandered knowledge would be a substantial improvement over the status quo.

### *2. A Straightforward Scheme for Knowledge Capture*

Capturing negative results, at least in theory, should be straightforward. This is because it is gospel in research to record the details of *all* experiments—successes and failures—in a laboratory notebook.[129] The notebook is the official documentation system in

126. Although a full discussion is beyond the scope of this Article, the drafters of the Uniform Trade Secrets Act believed that negative know-how can be protected as intellectual property. *See* UNIF. TRADE SECRETS ACT § 1 cmt. (amended 1985) (defining "trade secret" to "include[ ] information that has commercial value from a negative viewpoint, for example the results of lengthy and expensive research which proves that a certain process will not work could be of great value to a competitor") (emphasis omitted). Negative know-how has been described as a "strange[] theory of trade secret law ... under which an employee who resigns and joins a different business can be liable for *not* repeating the mistakes ... of his or her former employer." Charles Tait Graves, *The Law of Negative Knowledge: A Critique*, 15 TEX. INTELL. PROP. L.J. 387, 388 (2007) (emphasis added). Graves argues that the doctrine is "conceptually unworkable"; "bestows intellectual property rights in accidents, mistakes, incorrect theories, failed tests, dead ends, and obsolete approaches"; and "[lacks] the usual theoretical justification for intellectual property." *Id.* at 388. To be sure, the case law is split in the handful of states that recognize negative know-how. *See* ROGER MILGRIM & ERIC E. BENSEN, MILGRIM ON TRADE SECRETS § 1.02[1] n.21 (2010) (collecting cases).

127. *Cf.* Patil & Siegel, *supra* note 31, at 523 ("[A]lthough the arguments in favor of [publishing negative results] all seem to revolve around benefits to the community, the costs of [disclosure] would fall on individual authors. If the community is to reap the benefits, then the costs to the individual authors must be driven to zero—or associated with some reward.").

128. *See supra* notes 39-41 and accompanying text.

129. *See* KATHY BARKER, AT THE BENCH: A LABORATORY NAVIGATOR 89-98 (2005) (explaining how to maintain a laboratory notebook).

scientific research, which captures everything done on a research project, including results, data interpretation, and observations.[130] Whereas successful experiments are eventually written up for publication elsewhere, the current norm in science is to leave the negative results behind in the notebook.[131]

A modern trend in laboratory knowledge management should make it fairly easy to extract negative results from the notebook. Electronic laboratory notebooks (ELNs) are computer systems that create, store, archive, retrieve, and share records, data, and other technical information in the research laboratory.[132] ELNs have become quite popular in both academic and industrial research and "will eventually be used by *all* R&D scientists to record all of their research, and will become their central application."[133]

Three key features of ELNs are important for present purposes. First, unlike paper notebooks, ELNs are designed to facilitate the sharing of information.[134] Although sharing clearly impacts the infrastructural aspects of the ELN software, it might also improve the substantive technical content vis-à-vis a paper notebook because researchers are "a bit more particular" when recording information that they know will be shared.[135] Second, ELNs can fully integrate with external databases, meaning that ELNs can send information to databases and receive information from them over the Internet.[136] Third, ELNs accommodate user-configurable and third-party tem-

130. MAXINE LINTERN, LABORATORY SKILLS FOR SCIENCE AND MEDICINE: AN INTRODUCTION 45-46 (2007).

131. *See supra* Part I.B.

132. Ping Du & Joseph A. Kofman, *Electronic Laboratory Notebooks in Pharmaceutical R&D: On the Road to Maturity*, 12 J. ASS'N LAB. AUTOMATION 157, 158 (2007).

133. Keith T. Taylor, *The Status of Electronic Laboratory Notebooks for Chemistry and Biology*, 9 CURRENT OPINION DRUG DISCOVERY & DEV. 348, 351 (2006) (emphasis added). Examples of major companies that had implemented ELNs as of 2007 include AstraZeneca, Eli Lilly, Johnson & Johnson, Merck, and Schering Plough. *See* Du & Kofman, *supra* note 132, at 164.

134. *See* Editorial, *Share Your Lab Notes*, 447 NATURE 1-2 (2007) (describing the collaborative benefits of ELNs); sources cited *supra* notes 132-33.

135. Declan Butler, *A New Leaf*, 436 NATURE 20, 20 (2005) (quoting a researcher who also states that "it's easy to be sloppy when writing a [non-ELN] personal lab book").

136. *See, e.g.*, Michael Rubacha, Anil K. Rattan & Stephen C. Hosselet, *A Review of Electronic Laboratory Notebooks Available in the Market Today*, 16 J. ASS'N LAB. AUTOMATION 90, 90-91, 93-97 (2011) (exploring features of thirty-five commercially available ELNs).

plates, enabling them to generate documents and transmit technical information in a standardized format.[137]

When viewed together, these features reveal that ELNs could serve as conduits for the transfer of knowledge from the research laboratory to the null patent information database.[138] More concretely, it is conceivable that if a null patent template were available, ELN software could compile the data, observations, and other technical information from a failed experiment and create a null patent document in a standardized format. With a few mouse clicks, the null patent could be transmitted to the null patent information database. Thus, "[t]he act of conducting research would ... become practically synonymous with the act of disseminating the resulting knowledge."[139]

*3. Quid Pro Quo Incentives*

Perhaps the most basic strategy for incentivizing disclosure is to give the researcher something in return—a quid pro quo situation. The quid pro quo rationale for patents is to incentivize the disclosure of information that the public might not otherwise get.[140] For the patentee, the incentive for full public disclosure of the invention is the limited period of exclusory rights.[141] For the public, the exchange serves the public good because the disclosed information

137. *See id.* at 93-97.

138. Although considerably less precise about the mechanics and contours, two commentators have floated a similar idea of using electronic laboratory records to disseminate negative results:

> We are increasingly keeping scientific records in electronic form; it would be straightforward to wrap our notebook pages describing [a negative] result with a bit of searchable text, generate a web page, and submit the whole thing to a database.... Along the way, we would have to spend some energy improving the records that we keep in order to ensure that our notebooks were more accessible to outside readers.

Patil & Siegel, *supra* note 31, at 524.

139. *Id.*

140. WALTERSCHEID, *supra* note 1, at 143.

141. *See* J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc., 534 U.S. 124, 142 (2001) ("The disclosure required by the Patent Act is the quid pro quo of the right to exclude." (internal quotation marks omitted)); Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480-81 (1974) (describing the quid pro quo that supports the patent grant as a constitutional objective).

enriches the public storehouse of technical knowledge once the patent document publishes.[142]

In parallel to traditional patents, the null patent regime postulates that disclosure of negative information would also enrich public knowledge.[143] But because a null patent would not confer exclusory rights,[144] the question becomes what could serve as a surrogate incentive.

Although one could envision several possibilities,[145] this Article focuses on two specific types: PTO-based incentives and publication incentives. The first type would target researchers who patent. Conceivably, the PTO could incentivize participation in the null patent program by providing patentees with a perk during patent examination. For example, in exchange for filing one null patent, the PTO could expedite its review of another, traditional, patent application. Or, perhaps in exchange for filing one null patent, the PTO could provide a fee discount for any service that it provides. These incentives seem feasible because the PTO already uses—or plans to use—fast-track examination[146] and fee reductions[147] to achieve certain objectives.[148] Finally, to help ensure that the dis-

142. For commentary on the purpose and composition of the public storehouse of knowledge, see *infra* notes 201 and 262. It must be emphasized that "the patent document has potential *immediate* value to the public, which can use the information for any purpose that does not infringe upon the claims." Seymore, *supra* note 4, at 624 (emphasis added) (citations omitted).

143. *See* discussion *supra* Part II.A.; *infra* Part III.B.2.

144. *See supra* note 24 and accompanying text.

145. *See, e.g.*, Cross, *supra* note 22, at 623-24 (exploring the idea of a royalty system and then identifying the major problems and pitfalls).

146. *See* Changes to Implement the Prioritized Examination Track (Track I) of the Enhanced Examination Timing Control Procedures, 76 Fed. Reg. 18,399, 18,400 (Apr. 4, 2011) (to be codified at 37 C.F.R. pt. 1) (describing a program that allows applicants to accelerate examination to one year).

147. For example, Congress has directed the PTO to reduce fees for independent inventors and other small entities. *See* 35 U.S.C. § 41(h)(1) (2006) (mandating a 50 percent reduction). One statutory objective is to provide incentives to invent and patent. *See* H.R. REP. NO. 102-382, at 13 (1991), *reprinted in* 1991 U.S.C.C.A.N. 1320, 1328 (explaining that "the small entity fee structure is important to encourage innovation in the United States" because without it, independent inventors "would be disinclined to protect their inventions because of a lack of resources").

148. *See, e.g.*, Request for Comments on Incentivizing Humanitarian Technologies and Licensing Through the Intellectual Property System, 75 Fed. Reg. 57,261, 57,261 (Sept. 20, 2010) (requesting comments for a pilot program that would offer an ex parte reexamination voucher to patentees demonstrating humanitarian uses of patented technologies "as an incentive to stimulate technology creation ... that addresses humanitarian needs").

closed negative information is fully disclosed and legitimate,[149] the null patentee could be held subject to the duty of candor and good faith owed by patent applicants to the PTO.[150]

The second type of incentives would target researchers who choose to publish in the peer-reviewed literature. Like the PTO, journal editors could provide perks to those researchers who disclose negative results through the null patent program. For example, consortia of journals[151] could agree that a researcher who files a null patent would receive an expedited review of a manuscript submitted to any of the member journals. In terms of feasibility, expedited review is already used by many journals, often as a mechanism to quickly disseminate important new research.[152] Although this perk would clearly benefit the researcher, it would also benefit the journal editors because they could foster the dissemination of negative results[153] without having to sacrifice space in their own publications.[154]

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149. For a discussion of the sufficiency of disclosure, see *supra* note 106 and accompanying text.

150. *See* 37 C.F.R. § 1.56 (2011) ("Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office."); *cf.* Honeywell Int'l Inc. v. Universal Avionics Sys. Corp., 488 F.3d 982, 999 (Fed. Cir. 2007) ("[Patent applicants] have a duty to prosecute patent applications in the Patent Office with candor, good faith, and honesty."). As the Federal Circuit has explained, "[a] breach of this duty—including affirmative misrepresentations of material facts, failure to disclose material information, or submission of false material information—coupled with an intent to deceive, constitutes inequitable conduct." *Id.* The PTO does not investigate duty of disclosure issues; rather, inequitable conduct is usually asserted as a defense to patent infringement. MPEP, *supra* note 116, § 2010. For traditional patents, a determination of inequitable conduct can render the patent-at-issue and related patents and patent applications unenforceable. Nilssen v. Osram Sylvania, Inc., 504 F.3d 1223, 1230 (Fed. Cir. 2007). As applied to null patents, a finding of inequitable conduct could render a patent obtained through the perk unenforceable.

151. An example of a consortium is the International Committee of Medical Journal Editors (ICMJE), which includes several hundred member journals. *See ICMJE: Journals Following Uniform Requirements for Manuscripts*, ICMJE, http://www.icmje.org/journals.html (last visited Mar. 28, 2012).

152. *See, e.g.*, Margaret A. Winker & Phil B. Fontanarosa, JAMA-*EXPRESS: Rapid Peer Review and Publication*, 281 JAMA ASS'N 1754, 1754-55 (1999) (providing the criteria for expedited consideration of research results of major importance).

153. The file drawer problem continues to gain traction in the sphere of peer review, including some attention—and action—from the editors of prestigious journals. *See, e.g.*, discussion *supra* note 64.

154. *See* Marvin R. Goldfried & Gary C. Walters, *Needed: Publication of Negative Results*, 14 AM. PSYCHOLOGIST 598, 598 (1959) (noting that space constraints contribute to the nonpublication of negative results). For criticism of the lack-of-space argument, see Iain

*4. The Special Case of Federally Funded Research*

The federal government is heavily involved in funding domestic research and development efforts.[155] It funds nearly 60 percent of basic research[156] and over 25 percent of total research[157] conducted in the United States.[158] This means that incentivizing the disclosure of negative results emerging from federally funded research could go a long way in shrinking the sea of squandered knowledge. And because the federal government remains the dominant funding source for university research, which is mostly basic research supported by grants from the National Science Foundation and the National Institutes of Health,[159] that incentive would help change academic attitudes about failure and ultimately transform scientific norms toward disclosure.

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Chalmers, *Underreporting Research Is Scientific Misconduct*, 263 JAMA 1405, 1407 (1990) ("[J]ournal editors should acknowledge that shortage of space in printed journals can no longer be invoked as a reason for ... [the] underreporting of research.").

155. Of the nearly $400 billion in total U.S. R&D expenditures in 2007, $116 billion came from the federal government. *See* JOHN F. SARGENT, JR., CONG. RESEARCH SERV., R41098, FEDERAL RESEARCH AND DEVELOPMENT FUNDING: FY2011, at 1 (2010), *available at* http://assets.opencrs.com/rpts/R41098_20100310.pdf; Michael Yamaner, *Federal R&D Support Shows Little Change in FY 2008*, NAT'L SCI. FOUND., 2 tbl.1 (2009), http://www.nsf.gov/statistics/infbrief/nsf09320/nsf09320.pdf.

156. There are two generally accepted types of research. The first, basic research, consists of "systematic study directed toward fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind." OFFICE OF MGMT. & BUDGET, EXEC. OFFICE OF THE PRESIDENT, CIRC. No. A-11, PREPARATION, SUBMISSION, AND EXECUTION OF THE BUDGET § 84, at 8 (2010).

157. Applied research, the other type, consists of "systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met." *Id.*

158. *See* Mark Boroush, *National Patterns of R&D Resources: 2008 Data Update*, NAT'L SCI. FOUND., 26 tbl.6 (2010), http://www.nsf.gov/statistics/nsf10314/pdf/nsf10314.pdf (providing expenditures for basic research in 2007); *id.* at 22 tbl.5 (providing expenditures for basic and applied research in 2007). In 2007, the federal government spent about $26.87 billion on basic research and $27.23 billion on applied research. Yamaner, *supra* note 155, at 2 tbl.1.

159. *See* OFFICE OF SPECIAL PROJECTS, NAT'L RES. COUNCIL, HARNESSING SCIENCE AND TECHNOLOGY FOR AMERICA'S ECONOMIC FUTURE: NATIONAL AND REGIONAL PRIORITIES 33-34 (1999) ("[M]ost basic research is performed in universities, and most university research is supported by federal agencies."); Michael Yamaner, *Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions: FY 2007*, NAT'L SCI. FOUND., 26-27 tbl.8 (2009), http://www.nsf.gov/statistics/nsf12301/pdf/nsf12301.pdf (providing figures for federal research support to universities). In 2007, approximately 60 percent of university research funding came from federal sources. Boroush, *supra* note 158, at 22 tbl.5. That same year, more than 76 percent of university research was basic research. *Id.* at 22 tbl.5, 26 tbl.6.

Crafting an incentive, at least in theory, is actually quite simple. Federal agencies could require funding recipients to disclose the *entire* body of experimental data—including negative results through the null patent information database. Funding recipients would agree to this policy as a condition of agency support.[160] Agencies would gauge compliance throughout or perhaps at the end of the funding period. They could use a funding recipient's degree of compliance to weigh heavily in evaluating requests for continued or future agency support.

Though one could argue that agencies would have to develop larger bureaucratic structures to gauge compliance, that burden would be justified by a growing push for agencies to give the public, the scientific community, and Congress greater insight into the results achieved with federally funded research.[161] But in order for transparency to serve as an effective accountability tool, it is necessary to implement a regime that compels funding recipients to provide a full and truthful disclosure that accounts for 100 percent of the research effort.[162] This would include experiments that produced both positive and negative results. The null patent could thus help provide a more accurate and complete picture of "how federal research dollars are being spent, what research is being performed,

160. As one commentator has noted, "It is surprising that so many research-funding organizations do not make an award of funds to researchers conditional on a full report [of all results] being prepared and published." Chalmers, *supra* note 154, at 1407.

161. *See, e.g.*, Food and Drug Modernization Act of 1997, 42 U.S.C. § 282(i)-(j) (2006) (instructing the NIH to establish, in conjunction with the FDA and the Centers for Disease Control and Prevention, a publicly accessible clinical trial registry and results database for drugs, products, or devices subject to FDA regulation); Omnibus Appropriations Act of 2009, 42 U.S.C.A. § 282(c) (West 2009) (requiring recipients of NIH funding to make electronic versions of peer-reviewed manuscripts publicly accessible); America COMPETES Act, 42 U.S.C.A. § 1862o-2 (West 2007) (requiring research outcomes for projects funded by the NSF be made available to the public in a timely manner electronically); America COMPETES Reauthorization Act of 2010, 42 U.S.C.A. § 6623 (West 2011) (instructing the Office of Science and Technology Policy to establish an interagency working group to coordinate public access to develop policies to help promote the dissemination of the results of federally funded research).

162. *Transparency Through Technology: Evaluating Federal Open-Government Initiatives: Hearing Before the H. Comm. on Oversight & Gov't Reform*, 112th Cong. 3 (2011) (statement of Jerry Brito, Senior Research Fellow, Mercatus Ctr., George Mason Univ.), *available at* http://oversight.house.gov/wp-content/uploads/2012/01/Brito_Testimony-Bio_3-11-11.pdf.

and how the outcomes of research are benefiting society as a whole."[163]

*5. An Exceptional Tool for Defensive Publication*

The ability to control the technological landscape can provide a strong incentive to disclose negative results. For instance, disseminating negative results helps coordinate the future development of technology by reducing duplicative research efforts and providing technical fodder that can spur additional innovative activity.[164] But this is only part of the story. Given that negative results can potentially defeat patentability,[165] their dissemination can be used strategically to control the patent landscape around the disclosed information. Thus, a research organization might engage in defensive publication, which occurs when information "[is] intentionally made available to the public as prior art in order to render any subsequent claims of invention or discovery ineligible for a patent."[166] With negative results, the expectation is that publishing them will create an insurmountable obviousness hurdle around the disclosed information.[167]

The importance of defensive publication as a strategic tool cannot be overstated.[168] Research organizations use it as a low-cost mech

163. *Research Spending and Results*, RESEARCH.GOV, http://www.research.gov (follow "Research Spending and Results" hyperlink) (last visited Mar. 28, 2012). The site seeks to provide a more open and transparent government by sharing the outcomes of federally funded research projects. *See id.*

164. *See infra* notes 318-20 and accompanying text.

165. *See* discussion *supra* Part I.B.2(b); *infra* Part III.A (describing how negative results can play either a patent-defeating or patent-obtaining role in patentability).

166. STEPHEN A. HANSEN & JUSTIN W. VANFLEET, TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY: A HANDBOOK ON ISSUES AND OPTIONS FOR TRADITIONAL KNOWLEDGE HOLDERS IN PROTECTING THEIR INTELLECTUAL PROPERTY AND MAINTAINING BIOLOGICAL DIVERSITY 24 (2003), *available at* http://shr.aaas.org/tek/handbook; *see also* Scott Baker & Claudio Mezzetti, *Disclosure as a Strategy in the Patent Race*, 48 J.L. & ECON. 173, 175 (2005) (explaining that defensive publications "are designed to preempt patents in instances in which the disclosing firm does not itself plan to pursue patent protection but fears that its rivals might").

167. Baker & Mezzetti, *supra* note 166, at 175-76; *infra* Part III.A.2 (discussing nonobviousness). For a scenario in which experimental failure can be used to establish nonobviousness, see *infra* note 237 and accompanying text.

168. *See, e.g.*, Bill Barrett, *Defensive Use of Publications in an Intellectual Property Strategy*, 20 NATURE BIOTECH. 191, 191-93 (2002) (providing specific drafting strategies for creating prior art); Douglas Lichtman, Scott Baker & Kate Kraus, *Strategic Disclosure in the*

anism both for preventing competitors from obtaining patents and for guaranteeing the organization's freedom to practice:

> [A]s the costs of patent applications and litigation continue to rise[,] defensive publishing is offering scientists another option: by making published descriptions of their innovative research products available to the public, they prevent others from patenting them, thus they ensure the results' continued availability without incurring the significant legal and filing fees involved in patenting.[169]

Thus, defensive publication can serve as a key element in a research organization's overall intellectual property management strategy.[170]

Venues for defensive publication abound. They include company-generated prior art journals,[171] commercial prior art websites,[172] peer-reviewed literature,[173] and patent documents.[174] These venues vary widely in financial cost, human capital required to prepare them, timeliness, and accessibility.[175] Clearly, the incentive to

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*Patent System*, 53 VAND. L. REV. 2175, 2175-76 (2000) (discussing a research organization's strategic incentive to create prior art); Gideon Parchomovsky, *Publish or Perish*, 98 MICH. L. REV. 926, 927 (2000) (same).

169. Stephen Adams & Victoria Henson-Apollonio, *Defensive Publishing: A Strategy for Maintaining Intellectual Property as Public Goods*, INT'L SERV. FOR NAT'L AGRIC. RES., Briefing Paper No. 53, 2002, at 2, *available at* http://pdf.usaid.gov/pdf_docs/PNACS088.pdf (citing Richard Poynder, *On the Defensive About Invention*, FIN. TIMES (London), Sept. 19, 2001).

170. *Id.* at 1-2. Indeed, defensive publication can be "a 'spoiler' tactic—you disclose your technology without pursuing patent protection for yourself just to be sure that no one else can have a patent for it either." Anthony Murphy, *Intellectual Property*, *in* INNOVATION: HARNESSING CREATIVITY FOR BUSINESS GROWTH 89, 92 (Adam Jolly ed., 2003).

171. Famous examples include the *Bell Laboratory Record*, *IBM Technical Disclosure Bulletin*, *Siemens Zeitschrift*, and *Xerox Disclosure Journal*. Adams & Henson-Apollonio, *supra* note 169, at 5. The companies often distribute the journals to the PTO and commercial databases. *Id.*; Baker & Mezzetti, *supra* note 166, at 174.

172. The two most popular sites are IP.com and Research Disclosure. IP.com notes that over sixty companies disclose information in its prior art database, including Abbott Laboratories, BASF, Clorox, Dow Chemical, Eastman Kodak, General Electric, IBM, Polaroid, Samsonite, Siemens, Sony Electronics, and Teva Pharmaceutics. *See Our Clients and Affiliates*, IP.COM, http://ip.com/about/clients.html (last visited Mar. 28, 2012). Research Disclosure asserts that "[90 percent] of the world's leading companies" have used its services. *See* RESEARCH DISCLOSURE, http://www.researchdisclosure.com (last visited Mar. 28, 2012). In addition to their online content, each service also prints a paper journal.

173. *See supra* notes 43-51, 74-77; *infra* note 312 and accompanying text.

174. This could be a published patent application, an issued patent, or a statutory invention registration (SIR). *See supra* notes 115-19 and accompanying text.

175. *See* Adams & Henson-Apollonio, *supra* note 169, at 7 tbl.1 (comparing the various

defensively disclose is strengthened when the publication venue is cheap, easy to produce, timely, and easy for the PTO examiner to find during a prior art search.[176] Because the null patent is the only venue that satisfies all four criteria, it could easily become the preferred medium for defensive publication.[177]

## III. USING THE LIBERATED KNOWLEDGE

### *A. The (Often Overlooked) Role of Failure in Patent Law*

The substantive standards of patentability rely heavily on the knowledge and abilities of the person having ordinary skill in the art (PHOSITA)—a hypothetical construct of patent law akin to the reasonably prudent person in torts.[178] Determining the PHOSITA's precise identity in a particular technical field depends on the avail-

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defensive publication mechanisms); *see also* Poynder, *supra* note 169 (explaining that "[i]t costs $109 ... per document to publish on IP.com" which "compares very favourably with the $20,000 it costs per patent application to file in key locations worldwide" (quoting Tom Colson of IP.com)). Another consideration is whether the cost of defensive publication is cheaper than potential litigation. HANSEN & VANFLEET, *supra* note 166, at 24 ("[T]he costs (both personal and financial) of making a defensive disclosure need to be weighed against the cost of not making that disclosure, specifically the costs of challenging a patent that would not have been granted had the disclosure been made." (citation omitted)).

176. *Cf.* Adams & Henson-Apollonio, *supra* note 169, at 3-8 (listing the factors to consider when choosing a mechanism for defensive publication, including accessibility, timeliness, and cost).

177. Given that null patents by definition would not satisfy the enablement requirement of § 112 paragraph 1 (discussed *infra* Part III.A.3), their principal role for defensive purposes would be to show a lack of nonobviousness—the greatest hurdle to obtaining a patent. *See infra* Part III.A.2. One might ask if a null patent could be used against the *null patentee* who later seeks a traditional patent covering the subject matter because the failure was overcome. It is true, for example, that an inventor's own prior disclosure can be used as prior art against him or her if it renders the subsequently claimed invention obvious. *See* 2 CHISUM, *supra* note 11, § 5.03[f] (citing Graham v. John Deere Co., 383 U.S. 1, 19-26 (1966) (relying on one of Graham's earlier patents to determine that the patent-at-issue was invalid for a lack of nonobviousness)); *see also* MIT v. AB Fortia, 774 F.2d 1104, 1108-09 (Fed. Cir. 1985) (providing an additional example). To allay this concern, Congress could carve out a statutory exception making the inventor's own work disclosed in a null patent unavailable as prior art.

178. *See* Panduit Corp. v. Dennison Mfg. Co., 810 F.2d 1561, 1566 (Fed. Cir. 1987) (explaining that a PHOSITA is "not unlike the 'reasonable man' and other ghosts in the law"). Factors relevant to constructing the PHOSITA in a particular technical field include "(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field." Envtl. Designs, Ltd. v. Union Oil Co. of Cal., 713 F.2d 693, 696 (Fed. Cir. 1983).

able knowledge in that field at a specific moment in time. Given that negative results can potentially contribute to this available knowledge, they can alter the PHOSITA's identity and therefore play a large role in assessing patentability.

*1. Novelty: A Patent-Obtaining Role*

Perhaps counterintuitively, an applicant can point to evidence of experimental failure to establish novelty. Recall that the purpose of the novelty requirement is to deny a patent for an invention that claims subject matter that has been identically disclosed in the prior art.[179] But if a patentee faced with a novelty rejection can show that the prior art reference, a document asserted against the invention that the applicant seeks to patent,[180] discloses a *failed* experiment, that reference no longer qualifies as novelty-defeating prior art and the rejection disappears. In other words, an applicant can point to past experimental failure as evidence of patentability—at least for the purposes of novelty.[181] This issue is particularly important in the chemical and pharmaceutical arts, where a single novel compound can generate billions of dollars in annual revenue.[182]

*a. The Basic Test*

Determining novelty requires a comparison of the claimed invention with prior art references, typically documents like issued patents and printed publications.[183] To qualify as novelty-defeating prior art, a reference must satisfy three conditions.[184] First, it must predate the applicant's invention or have existed more than one year before the applicant's filing date.[185] Second, the strict identity

179. *See supra* note 10 and accompanying text.

180. *See* HERBERT W. SCHWARTZ, PATENT LAW AND PRACTICE 18 (3d ed. 2001).

181. But the applicant may face an obviousness problem. *See infra* Part III.A.2.

182. *See* Sean B. Seymore, *Rethinking Novelty in Patent Law*, 60 DUKE L.J. 919, 927 & n.41 (2011) (discussing patented blockbuster drugs like Lipitor, "the best-selling drug of all time[,] which generated over $13.6 billion in revenue for Pfizer in 2006").

183. *See supra* note 8 and accompanying text.

184. Prior art is also used to determine if an invention is obvious. *See infra* Part III.A.2.

185. Prior art provisions fall into two main categories: (1) the novelty provisions of § 102(a), (e), and (g), which depend on the invention date; and (2) the loss-of-right provisions of § 102(b), which depend on the applicant's filing date. *See* 2 R. CARL MOY, MOY'S WALKER ON PATENTS § 8:1 (4th ed. 2010) (explaining § 102 of the Patent Act).

requirement mandates that each and every element[186] of the claimed invention be identically disclosed within the four corners of a single prior art reference.[187] Third, and particularly important for present purposes, the reference must be enabling.[188] This means that the reference must disclose the subject matter in sufficient detail to enable a PHOSITA to make it without undue experimentation,[189] a fact-intensive inquiry that depends on interrelated technical issues such as the presence or absence of working examples in the reference, the PHOSITA's knowledge at the time of the reference, and the nature of the technology.[190] If a reference meets all three criteria, it "anticipates" the claim[191] and renders it unpatentable.[192]

### *b. Experimental Failure and Indirect Enrichment of the Public Domain*

To illustrate the role of experimental failure in the novelty context, consider an inventor who seeks a patent on a promising compound, *X*. The invention enjoys a presumption of novelty,[193] meaning that the examiner has both the initial burden of coming

186. A patent claim must define "the subject matter which the applicant regards as his invention." 35 U.S.C. § 112 para. 2 (2006). A claim element further limits the breadth of the claim. 1 CHISUM, *supra* note 11, at Gl-3. For an illustration, see *infra* note 187.

187. *See* Trintec Indus., Inc. v. Top-U.S.A. Corp., 295 F.3d 1292, 1295 (Fed. Cir. 2002); *see also* Structural Rubber Prods. Co. v. Park Rubber Co., 749 F.2d 707, 716 (Fed. Cir. 1984) (explaining that another reference or knowledge in the art cannot supply missing elements). So, for example, if an applicant seeks to claim a hammer with a titanium head and an oak handle—the claim elements—the reference must also disclose a hammer with a titanium head and an oak handle.

188. *See* Amgen Inc. v. Hoechst Marion Roussel, Inc., 457 F.3d 1293, 1306 (Fed. Cir. 2006) ("In order to anticipate, a prior art reference must not only disclose all of the limitations of the claimed invention, but also be enabled.").

189. *See* Impax Labs., Inc. v. Aventis Pharm., Inc., 545 F.3d 1312, 1314 (Fed. Cir. 2008).

190. *See id.* at 1314-15 (discussing the factors set forth in *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988)).

191. *See* W.L. Gore & Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1554 (Fed. Cir. 1983), *aff'd and rev'd on other grounds*, 842 F.2d 1275 (Fed. Cir. 1988).

192. *See* Akzo N.V. v. U.S. Int'l Trade Comm'n, 808 F.2d 1471, 1479 (Fed. Cir. 1986) (explaining that when a claim is anticipated, the public already possesses the subject matter).

193. *See In re* Wilder, 429 F.2d 447, 450 (C.C.P.A. 1970) (quoting and adding emphasis to 35 U.S.C. § 102, which states that "a person shall be entitled to a patent *unless* [one of the statutory exclusions is shown]").

forward with evidence of anticipation[194] and the ultimate burden of proving it.[195] Suppose the examiner finds an expired patent that discloses *X*, by name or structure, but does not explain how to make it. Because the first two parts of the anticipation test are met, the only question is whether the prior art reference is enabling. Though it might appear that the applicant has the upper hand, the presumption of novelty is tempered by a presumption of enablement that attaches to all of the subject matter disclosed in a prior art patent.[196] To move forward, the burden immediately shifts to the *applicant* to prove that the reference is nonenabling, meaning that a PHOSITA could not have made *X* without undue experimentation.[197] If the applicant cannot do this, *X* is unpatentable for a lack of novelty.[198]

This is when experimental failure enters the picture. Fortunately for the applicant, it is well settled that if the asserted reference discloses a failed experiment, that reference is per se nonenabled and unavailable as novelty-defeating prior art.[199] Absent other grounds for unpatentability, the application proceeds to patent issuance.[200]

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194. *See id.*; *see also In re* Oetiker, 977 F.2d 1443, 1445 (Fed. Cir. 1992) (describing the examiner's initial burden of putting forth a prima facie case of unpatentability).

195. *See In re* Warner, 379 F.2d 1011, 1016 (C.C.P.A. 1967); *see also In re* Epstein, 32 F.3d 1559, 1570 (Fed. Cir. 1994) (Plager, J., concurring) (articulating the rule that the PTO carries the burden of persuasion in showing why an applicant should not receive a patent).

196. *See* Amgen Inc. v. Hoechst Marion Roussel, Inc., 314 F.3d 1313, 1355 & n.21 (Fed. Cir. 2003) (explaining the framework and its roots in policy).

197. *See id.* (citing *In re* Sasse, 629 F.2d 675, 681 (C.C.P.A. 1980)).

198. *See In re Wilder*, 429 F.2d at 450-52 (outlining the burden-shifting process for the anticipatory-enablement inquiry); *see also In re* Jacobs, 318 F.2d 743, 745 (C.C.P.A. 1963) (stating that the appellants could prevail only if they carried the burden of proof).

199. *See In re* Wiggins, 488 F.2d 538, 542-43 (C.C.P.A. 1973) (noting that although the reference described *X* by name, its failed synthesis, plus the lack of evidence that a PHOSITA could make it at that time, made the reference nonenabling); *In re* Sheppard, 339 F.2d 238, 241 (C.C.P.A. 1964) (explaining that a compound's decomposition during synthesis created uncertainty about the reference's teaching and thus made the discosure nonenabling); *accord In re* Donohue, 766 F.2d 531, 533 (Fed. Cir. 1985) (explaining that a failed experiment is "strong evidence" that a reference is nonenabling); Fromson v. Advance Offset Plate, Inc., 755 F.2d 1549, 1558 (Fed. Cir. 1985) (noting that a failed experiment reported in a third-party patent makes it irrelevant as a prior art reference). By contrast, a reference that is *silent* about experimental details still qualifies as prior art. *In re Donohue*, 766 F.2d at 533 ("[T]he fact that the author of a [prior art reference] did not attempt to make his disclosed invention does not indicate one way or the other whether the publication would have been enabling.").

200. *In re* Oetiker, 977 F.2d 1443, 1445 (Fed. Cir. 1992); Paul R. Michel, *The Challenge Ahead: Increasing Predictability in Federal Circuit Jurisprudence for the New Century*, 43 AM.

This outcome is congruent with core objectives of the patent system. Consider what would happen if prior experimental failure could foreclose patentability: *X* might never enter the innovation cycle.[201] Because the asserted reference does not enable *X*, its disclosure provides the PHOSITA and the public with no substantive technical information about the compound.[202] If the PTO denies a patent to one who can actually make and use *X*, it not only deprives that inventor of a potential opportunity to reap an economic benefit from the compound but also deprives the patent system of an opportunity to obtain a technically robust disclosure that actually enables *X*.[203] And because it is unlikely that *X* will be disclosed in a medium other than a patent document,[204] the public may never get possession of the compound.[205]

Rendering *X* patentable, on the other hand, has the opposite effect. First, the inventor can exploit the compound, thereby providing a reward for the inventive effort and encouraging further creative activity.[206] Second, *X*'s disclosure adds to the public store-

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U. L. REV. 1231, 1249 (1994) ("If the claimed invention is patentable, the applicant is *entitled* to a patent (because [§ 102 of] the statute says so)—not eventually, but as soon as patentability can be determined.").

201. Innovation is a three-stage cycle that brings inventions into widespread, practical use by "feed[ing] on the known and convert[ing] it into the new." GOLLIN, *supra* note 3, at 11. After individuals first engage in creative labor using existing knowledge, the product of that labor is then distributed among and adopted by society, ultimately adding to the pool of accessible knowledge for other creative individuals to use and improve on. *See id.* at 15-19.

202. It is possible that the PHOSITA may have sufficient knowledge to make *X* though the disclosed method of making it failed. Seymore, *supra* note 182, at 956-57. But this becomes less likely as the subject matter becomes more complex.

203. Rejecting a claim to *X* will essentially foreclose the opportunity to fully exploit the compound. *Cf.* Nuno Pires de Carvalho, *The Problem of Gene Patents*, 3 WASH. U. GLOB. STUD. L. REV. 701, 735 (2004) (arguing that inventions that are never exploited, and thus never reach the market, are economically irrelevant). In addition, if the subsequent inventor abandons the patent application, the public will not gain access to the presumably enabling technical information disclosed therein. It is also unlikely that the subsequent inventor will disclose the information in another medium. *See supra* note 94 and accompanying text.

204. *See supra* note 94 and accompanying text.

205. *See* GOLLIN, *supra* note 3, at 18 ("[The cycle] stops when creative people lack access to information, ... when innovations are lost, and when law and circumstances make innovations inaccessible.").

206. Patent law "seeks to foster and reward invention" with the hope that the disclosure will "stimulate further innovation and ... permit the public to practice the invention once the patent expires." Aronson v. Quick Point Pencil Co., 440 U.S. 257, 262 (1979). But "[e]ven if no incentive is required to produce an innovation, providing a reward after the creative act encourages [the inventor] and others to do more creative work in the future." GOLLIN, *supra*

house of knowledge for others to use. In particular, assuming that the patent application complies with the disclosure requirements of the patent statute,[207] the public gets robust technical information about the compound once the application publishes or the patent issues.[208] Together, these effects promote innovation and other goals of the patent system.

*2. Nonobviousness: A (Predominantly) Patent-Defeating Role*

Experimental failure in the nonobviousness context functions quite differently vis-à-vis its role in novelty. Most importantly, a reference disclosing experimental failure *qualifies* as patent-defeating prior art for the purpose of determining nonobviousness.[209] Funneling more of these disclosures into the public domain would thus greatly expand the universe of such prior art. Given that a lack of nonobviousness is the most significant barrier to patentability,[210] this expansion could render a very large number of inventions unpatentable—or issued patents invalid, as the case may be.[211]

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note 3, at 38.

207. *See infra* note 253 (discussing 35 U.S.C. § 112 para. 1 (2006)).

208. *See* Seymore, *supra* note 4, at 627 (arguing that the teaching function should be an important goal of the patent system).

209. *See infra* notes 222-23.

210. *See generally* NONOBVIOUSNESS—THE ULTIMATE CONDITION OF PATENTABILITY (John F. Witherspoon ed., 1980) (compiling papers celebrating the twenty-fifth anniversary of codification of the nonobviousness doctrine as 35 U.S.C. § 103); Glynn S. Lunney, Jr., *Patent Law, the Federal Circuit, and the Supreme Court: A Quiet Revolution*, 11 SUP. CT. ECON. REV. 1, 19 (2004) (noting that "nonobviousness has traditionally represented the principal substantive hurdle for patentability" due to the scope and flexible nature of the inquiry). The barrier is now higher than before following a recent Supreme Court decision. *See* KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 415 (2007) (rejecting the Federal Circuit's rigid test for nonobviousness due to its inconsistency with the "expansive and flexible approach" set forth in Supreme Court precedent). Nonobviousness is the most common issue raised on appeal in patent cases. *See* Dennis D. Crouch, *Understanding the Role of the Board of Patent Appeals: Ex Parte Rejection Rates on Appeal* 10 (Univ. of Mo. Sch. of Law, Legal Studies Research Paper No. 2009-16, 2009), *available at* http://ssrn.com/abstract=1423922 (finding that 87-90 percent of cases decided a nonobviousness issue). *See also infra* note 211.

211. Note that nonobviousness is the most commonly litigated patent validity issue and the one most likely to result in patent invalidation. Gregory N. Mandel, *Patently Non-Obvious: Empirical Demonstration that the Hindsight Bias Renders Patent Decisions Irrational*, 67 OHIO ST. L.J. 1391, 1398 & n.17 (2006) (collecting empirical sources). For a scenario in which experimental failure can be used to establish nonobviousness, see *infra* note 237 and accompanying text.

*a. The Nonobviousness Standard*

The nonobviousness requirement, embodied in § 103(a) of the Patent Act,[212] denies patents for trivial extensions of what is already in the public domain.[213] It does not target inventions that are identically disclosed in the prior art,[214] but rather those that are sufficiently close to the prior art and within the PHOSITA's technical grasp at the time the claimed invention is made.[215] Thus, nonobviousness "creates a 'patent-free' zone around the state of the art,"[216] allowing the PHOSITA to substitute materials, streamline processes, and "[make] the usual marginal improvements which occur as a technology matures."[217]

In *Graham v. John Deere Co.*, the Supreme Court articulated the basic framework for determining nonobviousness.[218] It is a question of law based on the following pertinent underlying facts: (1) the scope and content of the relevant prior art; (2) the differences between the prior art and the claimed invention; (3) the PHOSITA's level of skill; and (4) secondary considerations that provide objective proof of nonobviousness, such as showing that the invention fulfilled a long-felt but unsolved need.[219] Subsequent case law has established that a conclusion of obviousness must be supported by clearly articulated reasoning.[220]

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212. The statute provides in relevant part that

> [a] patent may not be obtained though the invention is not identically disclosed or described as set forth in Section 102 ... if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a [PHOSITA] to which said subject matter pertains.

35 U.S.C. § 103(a).

213. *See* John F. Duffy, *Inventing Invention: A Case Study of Legal Innovation*, 86 TEX. L. REV. 1, 6-7 (2007) (exploring the wisdom of denying patents for trivial inventions); *supra* notes 11-12 and accompanying text.

214. The novelty requirement performs this function. *See* discussion *supra* Part III.A.1.

215. *See* § 103(a); CRAIG ALLEN NARD, THE LAW OF PATENTS 305 (2d ed. 2010); *cf. In re* Fisher, 421 F.3d 1365, 1382 (Fed. Cir. 2005) (Rader, J., dissenting) ("The proper tool for assessing sufficient contribution to the useful arts is the obviousness requirement of 35 U.S.C. § 103.").

216. MARTIN J. ADELMAN, RANDALL R. RADER & JOHN R. THOMAS, CASES AND MATERIALS ON PATENT LAW 288 (3d ed. 2009).

217. *Id.*

218. 383 U.S. 1, 17 (1966).

219. *Id.* at 17-18.

220. KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 418 (2007) (explaining that in addition to

*b. Experimental Failure: Indirect Protection of the Public Domain*

The framework presented above reveals that the scope of the nonobviousness inquiry is much broader than the one for novelty. Two differences are worth highlighting. First, because nonobviousness does not target identically disclosed inventions, the inquiry extends beyond that of a single reference and contemplates that the PHOSITA will combine and modify the teachings of multiple references.[221] Second, the prior art for nonobviousness as a *whole* must be enabling—not merely any single reference.[222] Thus, a reference disclosing a failed experiment "is prior art for all that it teaches" because a PHOSITA can possibly extract something from it.[223] This explains why such references can play a powerful role in defeating patentability.

To illustrate, consider the following hypothetical. Suppose that in 2007 an inventor develops a five-bladed aircraft propeller made with carbon fiber-reinforced plastic (CFRP), a composite material.[224] The

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the *Graham* factors, "[r]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness" (quoting *In re* Kahn, 441 F.3d 977, 988 (Fed. Cir. 2006))); *see also* MPEP, *supra* note 116, § 2141(III) (listing rationales that examiners can use to support a conclusion of obviousness).

221. 35 U.S.C. § 103(a) (2006); *see also* Cohesive Techs., Inc. v. Waters Corp., 543 F.3d 1351, 1364 (Fed. Cir. 2008) ("Obviousness can be proven by combining existing prior art references, while anticipation requires all elements of a claim to be disclosed within a single reference.").

222. Therasense v. Becton, Dickinson & Co., 593 F.3d 1289, 1297 (Fed. Cir. 2010) ("In order to render a claimed [invention] obvious, the cited prior art as a whole must enable [the PHOSITA] to make and use [it]."); Symbol Techs., Inc. v. Opticon, Inc., 935 F.2d 1569, 1578 (Fed. Cir. 1991) ("While a reference must enable someone to practice the invention in order to anticipate[,] a non-enabling reference may qualify as prior art for the purpose of determining obviousness under § 103."); *see also In re* Kumar, 418 F.3d 1361, 1368 (Fed. Cir. 2005) ("Although published subject matter is 'prior art' for all that it discloses, in order to render an invention unpatentable for obviousness, the prior art must enable a [PHOSITA] to make and use the invention.").

223. Beckman Instruments, Inc. v. LKB Produkter AB, 892 F.2d 1547, 1551 (Fed. Cir. 1989); *accord* Amgen Inc. v. Hoechst Marion Roussel, Inc., 314 F.3d 1313, 1357 (Fed. Cir. 2003) ("Under § 103, ... a reference need not be enabled; it qualifies as a prior art, regardless, for whatever is disclosed therein.").

224. A composite material is a "multiphase material[ ] obtained [by] artificial combination of different materials[, so as] to attain properties that the individual components by themselves cannot attain." DEBORAH D.L. CHUNG, COMPOSITE MATERIALS: SCIENCE AND APPLICATIONS 1 (2d ed. 2010). CFRP is a lightweight composite made by embedding carbon

inventor files a patent application later that year claiming the device. Though five-bladed propellers abound in the prior art, the claimed device is novel because it is not identically disclosed therein. Turning to nonobviousness, the examiner finds two prior art references from the same field of endeavor[225] that teach all of the limitations of the claimed device: a patent issued in 1975 disclosing a five-bladed plastic propeller and a 1990 article in *Aviation Technology* describing the research and development of a six-bladed CFRP propeller. The latter reference reveals, however, that the propeller never worked because a stress fracture produced by imperfect CFRP annealing[226] caused it to fail when mounted on an airplane and spun to operational speed. But an additional reference,[227] a popular composite materials textbook published in 2000, reveals that CFRP annealing technology had advanced so much between 1990 and 2000 that stress fractures are no longer observed. Given this state of the art, the examiner concludes that the prior art would have enabled a PHOSITA to produce the claimed device at the time it was made.[228]

From all this, the examiner concludes that it would have been obvious for a PHOSITA at the time of the invention to combine the teachings of the prior art to produce the claimed device. To support this conclusion, the examiner explains that a PHOSITA could have applied contemporary CFRP annealing technology to the teachings of the 1990 article and combined them with the teachings of the

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fibers, which provide strength and stiffness, into plastic, which acts as a binder. *Id.*

225. A reference qualifies as § 103(a) prior art if it is analogous to the field of invention. *See In re* Kahn, 441 F.3d 977, 986-87 (Fed. Cir. 2006) (citing Graham v. John Deere Co., 383 U.S. 1, 35 (1966)). References drawn from the same field of endeavor are considered analogous. *See id.* at 987.

226. Annealing is a process that removes the stress developed in a material during its fabrication. 2 PLASTICS ENGINEERING, MANUFACTURING, AND DATA HANDBOOK 1397 (Dominick V. Rosato et al. eds., 2001). The process involves heating the material to a certain temperature, holding the material at that temperature for a certain period of time, and cooling it at a controlled slow rate. *Id.*

227. Note that "[p]rior art is not limited just to the references being applied, but includes the understanding of one of ordinary skill in the art." MPEP, *supra* note 116, § 2141.

228. *See supra* note 222 and accompanying text.

1975 patent in a predictable manner[229] to produce the claimed device with a reasonable expectation of success.[230]

Having made a prima facie case of obviousness,[231] the burden of going forward shifts to the applicant.[232] Unable to prove that the prior art is nonenabling,[233] the applicant attempts to rebut the prima facie case by arguing that the claimed device satisfies a long-felt but unresolved need in the art.[234] The examiner responds with a request for actual proof[235]: specifically, "objective evidence that an art recognized problem existed in the art for a long period of time without solution."[236] If the applicant could show, for example, that others had tried to make the identical invention but failed, such evidence could be probative of nonobviousness.[237] But absent such

229. *See* MPEP, *supra* note 116, § 2143(A) (noting that combining references according to known methods to produce a predictable result is an appropriate rationale to support a conclusion of obviousness); *cf.* KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 416 (2007) (explaining that a combination of elements "must do more than yield a predictable result").

230. *See In re* PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360, 1364 (Fed. Cir. 2007) (reaffirming "reasonable expectation of success" jurisprudence post-*KSR*); *In re* O'Farrell, 853 F.2d 894, 903-04 (Fed. Cir. 1988) ("Obviousness does not require absolute predictability.... [A]ll that is required is a reasonable expectation of success." (citations omitted)).

231. The examiner has the initial burden of setting forth a prima facie case of unpatentability. *See In re* Piasecki, 745 F.2d 1468, 1472 (Fed. Cir. 1984) (interpreting *Graham v. John Deere Co.* to require the PTO to provide a factual basis for a § 103 rejection); cases cited *supra* notes 193-94.

232. *In re Piasecki*, 745 F.2d at 1472.

233. Once the examiner has made a prima facie case of obviousness, the burden shifts to the applicant to prove that the asserted prior art is nonenabling. MPEP, *supra* note 116, § 2145 (citing *In re* Hoeksema, 399 F.2d 269, 274-75 (C.C.P.A. 1968)).

234. *See supra* note 219 and accompanying text.

235. During the course of patent examination, the examiner may request "[t]echnical information known to [the] applicant concerning ... the disclosure, the claimed subject matter, other factual information pertinent to patentability, or concerning the accuracy of the examiner's stated interpretation of such item." 37 C.F.R. § 1.105 (a)(1)(viii) (2009).

236. MPEP, *supra* note 116, § 716.04. In addition, "significant improvements in the art that bear on the inventor's solution dilute the significance of prior need and failures." 2 CHISUM, *supra* note 11, § 5.05[1]b.

237. One potential argument is the "failure of others." *See* Graham v. John Deere Co., 383 U.S. 1, 17-18 (1966) (recognizing "failure of others" as a secondary consideration); Advanced Display Sys., Inc. v. Kent State Univ., 212 F.3d 1272, 1285 (Fed. Cir. 2000) (explaining that "failure [of] others" may be "the most probative and cogent evidence of nonobviousness" (citations omitted) (internal quotation marks omitted)). The rationale is that the claimed invention is not a mere trivial advance over the prior art if many have tried to solve the problem but failed. Boehringer Ingelheim Vetmedica, Inc. v. Schering-Plough Corp., 320 F.3d 1339, 1354 (Fed. Cir. 2003) ("While absolute certainty is not necessary to establish a reasonable expectation of success, there can be little better evidence negating an expectation

a showing, "the mere passage of time without the claimed invention is not evidence of nonobviousness."[238] Lacking the requisite evidence, the applicant decides to abandon the application.

Derailing patentability in this context makes sense from a technical standpoint and aligns with core goals of the patent system. Combining known materials—a five-bladed propeller and CFRP—to produce a predictable, trivial modification—a five-bladed CFRP propeller—draws on knowledge already in the public domain and well within the PHOSITA's skill and ordinary creativity.[239] By

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of success than actual reports of failure." (citation omitted)); *In re* Dow Chemical Co., 837 F.2d 469, 472 (Fed. Cir. 1985) ("Recognition of need, and difficulties encountered by those skilled in the field, are classical indicia of unobviousness."). The relevance of the failure of others in rebutting a prima facie case of obviousness depends on several factors. First, others must have failed to make the precisely claimed invention—not at the general concept. *See* Sjolund v. Musland, 847 F.2d 1573, 1582 (Fed. Cir. 1988). Second, the need must have been persistent. *In re* Gershon, 372 F.2d 535, 538 (C.C.P.A. 1967) ("Since the alleged problem in this case was first recognized by appellants, and others apparently have not yet become aware of its existence, it goes without saying that there could not possibly be any evidence of either a long felt need in the ... art for a solution to a problem of dubious existence or failure of others skilled in the art who unsuccessfully attempted to solve a problem of which they were not aware."). Third, the failure must be attributable to a lack of technical know-how rather than to the PHOSITA's lack of interest. Scully Signal Co. v. Elecs. Corp. of Am., 570 F.2d 355, 361 (1st Cir. 1977). Fourth, the claimed invention must actually satisfy the long-felt need. W.L. Gore & Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1555 (Fed. Cir. 1983) (noting that commercial success of the invention can show that it satisfied the long-felt need); *In re* Cavanagh, 436 F.2d 491, 496 (C.C.P.A. 1971). An alternative argument is that the failed experiment disclosed in the asserted prior art "teaches away" from the claimed invention. *See* KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 416 (2007) (recognizing "teaching away" as a viable rebuttal argument for establishing nonobviousness) (citing United States v. Adams, 383 U.S. 39, 51-52 (1966)). A prior art reference teaches away "when a [PHOSITA], upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant." *In re* Gurley, 27 F.3d 551, 553 (Fed. Cir. 1994). Stated another way, "a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant." *Id.*; *see also In re* Icon Health & Fitness, Inc., 496 F.3d 1374, 1381 (Fed. Cir. 2007) (reaffirming *Gurley* post-*KSR*).

238. *In re* Kahn, 441 F.3d 977, 990 (Fed. Cir. 2006) (quoting Iron Grip Barbell Co. v. USA Sports, Inc., 392 F.3d 1317, 1325 (Fed. Cir. 2004)).

239. *Cf. KSR*, 550 U.S. at 421, 427 (noting that the claimed design step was "well within the grasp" of a PHOSITA—a person of "ordinary creativity"); *see also* Anderson's-Black Rock, Inc. v. Pavement Salvage Co., 396 U.S. 57, 60-63 (1969) (explaining that an invention derived from old elements that does no more than expected is obvious, despite being new and useful). Professor Peter Yu elaborates:

> When [a PHOSITA] encounters a new problem, he or she will create a new ordinary invention—an obvious invention—as a matter of course. We do not need to provide a reward to draw into existence the obvious inventions that fall within the [PHOSITA's] skill. The need to solve practical problems is sufficient

constitutional command, a patent can neither remove such knowledge from the public domain nor limit free access to those materials already available.[240] Rather, a patent can be awarded only for technical advances that *add* to the storehouse of useful knowledge.[241] As the Supreme Court recently explained:

> We build and create by bringing to the tangible and palpable reality around us new works based on instinct, simple logic, ordinary inferences, extraordinary ideas, and sometimes even genius. These advances, once part of our shared knowledge, define a new threshold from which innovation starts once more. And as progress beginning from higher levels of achievement is expected in the normal course, the results of ordinary innovation are not the subject of exclusive rights under the patent laws. Were it otherwise patents might stifle, rather than promote, the progress of useful arts.[242]

Thus, the nonobviousness requirement denies patents for inventions that would arise through ordinary technological progress[243] and, as

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> to spark [their development], and their suitability for the needs they satisfy is itself a sufficient reward.

YU, *supra* note 11, at 2.

240. *Graham*, 383 U.S. at 6; *see also* Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 283 (1977) (arguing that patents should not be granted for the use and development of known technical information because "proper incentives for its acquisition and use exist without a property right").

241. *Graham*, 383 U.S. at 6 ("Innovation, advancement, and things which add to the sum of useful knowledge are inherent requisites in a patent system which by constitutional command must 'promote the Progress of ... useful Arts.'"); *cf.* Great Atl. & Pac. Tea Co. v. Supermarket Equip. Corp., 340 U.S. 147, 152 (1950) ("The conjunction or concert of known elements must contribute something; only when the whole in some way exceeds the sum of its parts is the accumulation of old devices patentable.").

242. *KSR*, 550 U.S. at 427; *cf.* Edmund W. Kitch, Graham v. John Deere Co.*: New Standards for Patents*, 1966 SUP. CT. REV. 293, 301 (explaining that nonobviousness is based on the principle that "a patent should not be granted for an innovation unless [it] would have been unlikely to have been developed absent the prospect of a patent").

243. *See* YU, *supra* note 11, at 2 ("It is socially wasteful for us to pay a patent-backed premium for an innovation that we are almost certain to receive for free and just as early."); Michael J. Meurer & Katherine J. Strandburg, *Patent Carrots and Sticks: A Model of Nonobviousness*, 12 LEWIS & CLARK L. REV. 547, 549 (2008) ("The nonobviousness threshold may be used as a 'stick' to induce researchers to pursue more difficult, socially preferred research projects."); *supra* text accompanying notes 216 and 242.

a corollary, seeks to "weed[ ] out those inventions [that] would not be disclosed or devised but for the inducement of a patent."[244]

This last point is important in understanding why the teachings from failed experiments are available as prior art for nonobviousness. Recall that prior art must be enabling,[245] meaning that the PHOSITA could combine the art's teachings with his or her own knowledge and skill to make the claimed invention.[246] For novelty, these teachings must come from a single reference.[247] If that single reference discloses a failed experiment, there is a danger that the PHOSITA could not—relying *solely* on knowledge and skill in the art—fill in the technical gaps omitted from the disclosure to make the invention. This is particularly problematic in unpredictable fields in which the PHOSITA needs more guidance.[248] In sum, denying a patent runs the risk of the enabled invention never being disclosed.[249]

The story is quite different for nonobviousness. Given that it is a flexible standard that can be proven by combining multiple prior art references, enablement need not depend upon a single one.[250] Indeed, nonobviousness contemplates that references can and do vary widely in the teachings that they provide to the PHOSITA,

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244. *Graham*, 383 U.S. at 11.

245. *See supra* notes 188 and 222 and accompanying text.

246. *See In re* Paulsen, 30 F.3d 1475, 1480 (Fed. Cir. 1994) ("[A] prior art reference must be considered together with the knowledge of [the PHOSITA]." (internal quotation marks omitted)); *In re* LeGrice, 301 F.2d 929, 939 (C.C.P.A. 1962) (explaining that the proper test is whether the PHOSITA "could take the description of the invention in the [reference] and combine it with his own knowledge of the particular art and from this combination be put in possession of the invention on which a patent is sought").

247. *See* Scripps Clinic & Research Found. v. Genentech, Inc., 927 F.2d 1565, 1577 (Fed. Cir. 1991) ("If it is necessary to reach beyond the boundaries of a single reference to provide missing disclosure of the claimed invention, the proper ground is not § 102 anticipation, but § 103 obviousness."); *supra* note 187 and accompanying text.

248. The courts refer to chemistry, biotechnology, and related experimental fields as "unpredictable" because PHOSITAs in these fields often cannot predict whether a reaction protocol that works for one embodiment will work for others. *See, e.g.*, Cedarapids, Inc. v. Nordberg, Inc., No. 95-1529, 1997 WL 452801, at *2 (Fed. Cir. Aug. 11, 1997) (explaining that in the chemical arts, "a slight variation ... can yield an unpredictable result or may not work at all"). On the other hand, applied technologies like electrical and mechanical engineering are often regarded as "predictable" arts because they are rooted in well-defined, predictable factors. *See, e.g.*, *In re* Vaeck, 947 F.2d 488, 496 (Fed. Cir. 1991).

249. *See supra* text accompanying notes 201-05.

250. *See supra* note 222 and accompanying text.

which is why the prior art as a *whole* must be enabling.[251] So if one reference discloses a failed experiment, it is reasonable to expect that the PHOSITA could rely on the other references in addition to knowledge and skill in the art to fill in the technical gaps to make the invention.[252]

### *3. Enablement: A Patent-Obtaining or Patent-Defeating Role*

The two previous Subsections explored the role of experimental failure in novelty and nonobviousness—the prior art provisions of the patent statute. Again, those provisions protect the integrity of preexisting knowledge in the public domain. This Subsection explores the importance of references disclosing experimental failure in gauging compliance with another patentability hurdle: the enablement requirement of § 112 paragraph 1.[253] By compelling an applicant to provide a disclosure that enables a PHOSITA to practice the full scope of the claimed invention, it ensures that public knowledge is enriched in exchange for the right to exclude.[254]

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251. *See supra* notes 222-23 and accompanying text.

252. *See, e.g.*, Purdue Pharma Prods. L.P. v. Par Pharm., Inc., 377 F. App'x 978, 982-83 (Fed. Cir. 2010) (explaining in the § 103(a) context, though one reference was nonenabled, the PHOSITA could have achieved the claimed invention through routine experimentation). But if the PHOSITA cannot make the invention, the reference cannot support a determination of nonobviousness. *See* Seymore, *supra* note 182, at 939 n.104 (collecting cases).

253. Enablement is one of the three disclosure requirements appearing in the first paragraph of 35 U.S.C. § 112:

> The specification shall contain a *written description* of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to *enable* any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the *best mode* contemplated by the inventor of carrying out his invention.

35 U.S.C. § 112 para. 1 (2006) (emphasis added).

254. Nat'l Recovery Techs., Inc. v. Magnetic Separation Sys., Inc., 166 F.3d 1190, 1195-96 (Fed. Cir. 1999); *see also* Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 535 U.S. 722, 736 (2002) ("[P]atent rights are given in exchange for disclosing the invention to the public."); Donald S. Chisum, *Comment*: *Anticipation, Enablement and Obviousness: An Eternal Golden Braid*, 15 AIPLA Q.J. 57, 59 (1987) (arguing that disclosure is "a primary purpose" of the enablement requirement).

*a. Statutory Enablement*

Enablement questions typically arise in two contexts in patent law. Thus far, the discussion has focused on the form pertaining to prior art references.[255] This judicially imposed requirement for prior art[256] is referred to as "patent-defeating" enablement because it is used to demonstrate that a PHOSITA could use preexisting knowledge to make the invention.[257] Its statutory cousin, appearing in § 112 paragraph 1 of the Patent Act, compels a patent applicant to submit a written description[258] that enables a PHOSITA to make and use the full scope of the claimed invention at the time of filing[259] without undue experimentation.[260] Aside from policing claim scope,[261] it ensures that the applicant's disclosure will enrich public

255. *See* discussion *supra* Part III.A.1-2.

256. *See In re* LeGrice, 301 F.2d 929, 939 (C.C.P.A. 1962) (discussing the requirement and the underlying rationale).

257. *See* 1 CHISUM, *supra* note 11, § 3.04; F. SCOTT KIEFF, PAULINE NEWMAN, HERBERT F. SCHWARTZ & HENRY E. SMITH, PRINCIPLES OF PATENT LAW 412 (4th ed. 2008).

258. The written description is the part of the patent or patent application that completely describes the invention. 35 U.S.C. § 112. It is often used interchangeably, and mistakenly, with the term *specification*. KIEFF ET AL., *supra* note 257, at 73 n.6.

259. *In re* Glass, 492 F.2d 1228, 1232 (C.C.P.A. 1974); *accord In re* Enzo Biochem, Inc. v. Calgene, Inc., 188 F.3d 1362, 1371-72 (Fed. Cir. 1999) (explaining that in both patent examination and litigation the enablement determination "is made *retrospectively*, *i.e.*, by looking back to the filing date of the patent application and determining whether undue experimentation *would have been* required to make and use the claimed invention at that time"); *In re* Hogan, 559 F.2d 595, 607 (C.C.P.A. 1977) (reaffirming rule).

260. Sitrick v. Dreamworks, LLC, 516 F.3d 993, 999 (Fed. Cir. 2008) (citing AK Steel Corp. v. Sollac, 344 F.3d 1234, 1238-39 (Fed. Cir. 2003)). Although the term "undue experimentation" does not appear in the statute, "it is well established that enablement requires that the [written description] teach those in the art to make and use the invention without undue experimentation." *In re* Wands, 858 F.2d 731, 737 (Fed. Cir. 1988). Other differences between the two forms of enablement, not particularly important for present purposes, have been discussed elsewhere. *See, e.g.*, Janice M. Mueller & Donald S. Chisum, *Enabling Patent Law's Inherent Anticipation Doctrine*, 45 HOUS. L. REV. 1101, 1137-38 (2008); Seymore, *supra* note 182, at 932-33.

261. Claim scope must "be less than or equal to the scope of the enablement." Nat'l Recovery Techs., Inc. v. Magnetic Separation Sys., Inc., 166 F.3d 1190, 1196 (Fed. Cir. 1999). The scope of enablement "is that which is disclosed in the [written description] plus the scope of what would be known to [a PHOSITA] without undue experimentation." *Id.*; *see also* Timothy R. Holbrook, *Equivalency and Patent Law's Possession Paradox*, 23 HARV. J.L. & TECH. 1, 9-10 (2009) (explaining in detail the relationship between enablement and claim scope).

knowledge[262] and that the public will get complete possession of the invention once the patent expires.[263]

Gauging compliance with the enablement requirement is easiest when the applicant actually makes the invention and discloses the technical details in the patent application.[264] But unlike the rules of mainstream science, which "require actual performance of every experimental detail" as a prerequisite for publication,[265] in patent law an inventor needs to provide only sufficient technical information to teach a PHOSITA how to practice the invention without undue experimentation.[266] This means that an applicant usually does not need to actually reduce an invention to practice or produce a physical embodiment[267] of it to obtain a patent.[268]

Inventions disclosed in a patent application, including those not physically made, enjoy a presumption of enablement.[269] This means

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262. *Nat'l Recovery Techs.*, 166 F.3d at 1195-96; *cf.* Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 481 (1974) (explaining that when the information disclosed in a patent becomes publicly available it adds to the "general store of knowledge" and assumedly will stimulate ideas and promote technological development); *In re* Argoudelis, 434 F.2d 1390, 1394 (C.C.P.A. 1970) (Baldwin, J., concurring) (noting that the full and complete disclosure of how to make and use the claimed invention "adds a measure of worthwhile knowledge to the public storehouse").

263. *See* Spectra-Physics, Inc. v. Coherent, Inc., 827 F.2d 1524, 1532 (Fed. Cir. 1987) ("Enablement looks to placing the subject matter of the claims generally in the possession of the public."); *cf.* Evans v. Eaton, 20 U.S. (7 Wheat.) 356, 418 (1822) ("The object is to put the public in complete possession of the invention ... so that interference with it may be avoided while the patent continues, and its benefits may be fully enjoyed by the public, after the patent expires.").

264. *Cf.* Seymore, *supra* note 4, at 652-53 (advocating a working example requirement for complex technologies that would, among other things, simplify the enablement analysis).

265. Hoffmann-La Roche, Inc. v. Promega Corp., 323 F.3d 1354, 1377 (Fed. Cir. 2003) (Newman, J., dissenting).

266. *Id.*; *see also* Timothy R. Holbrook, *Patents, Presumptions, and Public Notice*, 86 IND. L.J. 779, 781 (2011) ("[T]he description in a patent need not include information already known by the PHOSITA, which permits applicants to submit simpler patent disclosures.").

267. An embodiment is a concrete form of an invention, like a chemical compound or a widget, described in a patent application or patent. ROBERT PATRICK MERGES & JOHN FITZGERALD DUFFY, PATENT LAW AND POLICY: CASES AND MATERIALS 27 (4th ed. 2007).

268. Pfaff v. Wells Elecs., Inc., 525 U.S. 55, 60 (1998) ("[T]he word 'invention' in the Patent Act unquestionably refers to the inventor's conception rather than to a physical embodiment of that idea."). Thus, in patent law, an invention can be actually reduced to practice by physically making it or constructively reduced to practice by filing a patent application that describes how to make and use it. Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986). A constructive reduction to practice presumptively satisfies the disclosure requirements of § 112 paragraph 1. *Id.*

269. *In re* Brana, 51 F.3d 1560, 1566 (Fed. Cir. 1995) ("[A]pplicants should not have been

that an examiner who doubts enablement must establish a prima facie case of nonenablement, which he must support with references.[270] The applicant can rebut the prima facie case with persuasive argument or proof.[271] The burden of production may continue to shift as each side presents new evidence;[272] however, the examiner carries the ultimate burden of persuasion with a preponderance of the evidence as the standard of proof.[273]

*b. Failed Experiments and the Public Storehouse of Knowledge*

Perhaps counterintuitively, both the applicant and the examiner can rely on experimental failure to carry their respective evidentiary burdens when enablement is at issue. For instance, consider a publication from 2007 describing a two-step process that failed to successfully convert compound *A* into compound *C*. It may be that step one, which produced intermediate compound *B*, worked—meaning that it was actually step two that failed. Note that this publication would be enabling with regard to *B* but nonenabling with regard to *C*. So either the applicant or examiner could rely on it as evidence of enablement (*B*) or nonenablement (*C*), respectively.

To illustrate the latter, suppose that in 2008 an inventor at a drug company seeks to patent compound *Y*. Although *Y* is not physically made before filing,[274] the inventor posits in the patent application that a PHOSITA could rely on conventional techniques

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required to substantiate their presumptively correct disclosure to avoid a rejection under the first paragraph of § 112."); *In re* Marzocchi, 439 F.2d 220, 223 (C.C.P.A. 1971) (explaining that the PTO must accept the applicant's disclosure "as in compliance with the enabling requirement of [§ 112 paragraph 1] unless there is reason to doubt the objective truth of the statements contained therein that must be relied on for enabling support").

270. *In re Marzocchi*, 439 F.2d at 224; *see also In re* Brebner, 455 F.2d 1402, 1405 (C.C.P.A. 1972) (holding that the PTO must provide a factual basis for a lack of enablement rejection, rather than conclusory statements about the PHOSITA's level of skill).

271. *In re* Piasecki, 745 F.2d 1468, 1472 (Fed. Cir. 1984).

272. When the applicant submits rebuttal evidence, the examiner must "start over" and "consider all of the evidence anew." *Id.* at 1472-73.

273. *In re* Oetiker, 977 F.2d 1443, 1449 (Fed. Cir. 1992); *see also supra* note 194.

274. There are several reasons why inventors seek to obtain patents at an early stage of research and development. *See, e.g.*, Mark A. Lemley, *Reconceiving Patents in the Age of Venture Capital*, 4 J. SMALL & EMERGING BUS. L. 137, 144 (2000) (attracting or appeasing venture capital); Seymore, *supra* note 4, at 658 (safeguarding patent rights in the United States and abroad).

known in the art to make *Y* by mixing precursor *C* with several well-known chemicals. The examiner rejects the claim as prima facie nonenabled in light of the 2007 reference discussed above, which teaches that *C* cannot be made. In other words, the examiner reasons that if *C* cannot be made, then the applicant's disclosure must also be nonenabling with respect to *Y*. Faced with this evidence, the applicant decides to abandon the application.

Now consider what would have happened if the disclosure from the 2007 reference were *not* in the public domain or was otherwise inaccessible to the examiner. Absent any other grounds for unpatentability, the patent for *Y* would be granted.[275] This result would clearly frustrate fundamental goals of patent policy, the most obvious being that the public would get nothing in exchange for the patent.[276] On the other hand, derailing the applicant's claim to *Y* keeps the doors of patentability open for a subsequent inventor who can actually enable *Y* and, consequently, enrich the public storehouse of knowledge with technical information about the invention.[277]

### *B. Benefits of the Proposal*

#### *1. It Will Improve Patent Quality*

Issues related to patent quality are fueling much of the debate over patent reform.[278] Patent quality can be defined as "the capacity

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275. *See supra* note 199.

276. *See* Pfaff v. Wells Elecs., Inc., 525 U.S. 55, 63 (1998) ("[T]he patent system represents a carefully crafted bargain that encourages both the creation and the public disclosure of new and useful advances in technology, in return for an exclusive monopoly for a limited period of time."); Sitrick v. Dreamworks, LLC, 516 F.3d 993, 999 (Fed. Cir. 2008) ("Enabling the full scope of the claim is part of the quid pro quo of the patent bargain." (internal quotation marks omitted)); FED. TRADE COMM'N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY ch. 4, at 3-4 (2003) [hereinafter FTC REPORT], *available at* http://www.ftc.gov/os/2003/10/innovationrpt.pdf (noting that enablement plays the central role in "safeguard[ing] the patent system's disclosure function by ensuring relatively swift dissemination of technical information from which others ... can learn").

277. *See supra* notes 261-62 and accompanying text.

278. *See, e.g.*, JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK 161-63 (2008) (identifying potential causes of low-quality patents); Patrick Leahy & Orrin Hatch, Op-Ed, *Meaningful Patent Reform*, WASH. TIMES, Feb. 15, 2008, at A19 (advocating the passage of a patent reform bill

of a granted patent to meet (or exceed) the statutory standards of patentability—most importantly, to be novel, nonobvious, and clearly and sufficiently described."[279] Aside from being technically invalid,[280] patents that fall short of the statutory standards of patentability are often worthless[281] and burdensome to the patent system.[282]

Several commentators argue that one of the primary causes of the quality problem is that examiners lack adequate technical information needed to perform a rigorous examination.[283] Given that examiners draw heavily from issued patents and published patent

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that would lead to a better patent system that issues high-quality patents); Editorial, *Patently Ridiculous*, N.Y. TIMES, Mar. 22, 2006, at A24 (arguing that improving patent quality will require action by the PTO, courts, and Congress); Robert C. Pozen, *Inventing a Better Patent System*, N.Y. TIMES, Nov. 17, 2009, at A33 (urging for patent reform because "[t]he quality of American patents has been deteriorating for years; they are increasingly issued for products and processes that are not truly innovative").

279. R. Polk Wagner, *Understanding Patent-Quality Mechanisms*, 157 U. PA. L. REV. 2135, 2138 (2009). This is a legal definition. From an economic perspective, a high-quality patent is "one that covers an invention that would not otherwise be made [but for the incentive of a patent] or one that ensures that a good idea is commercialized." Bronwyn H. Hall & Dietmar Harhoff, *Post-Grant Reviews in the U.S. Patent System: Design Choices and Expected Impact*, 19 BERKELEY TECH. L.J. 989, 991 (2004).

280. *See* Jay P. Kesan, *Carrots and Sticks to Create a Better Patent System*, 17 BERKELEY TECH. L.J. 763, 765 (2002) ("It is widely suggested that the Patent Office issues patents that are either 'facially' invalid or broader than the actual innovation disclosed in the patent application."); *cf.* FTC REPORT, *supra* note 276, executive summary, at 5 ("A poor quality or questionable patent is one that is likely invalid or contains claims that are overly broad.").

281. *See* Edmund W. Kitch, *Property Rights in Inventions, Writings, and Marks*, 13 HARV. J.L. & PUB. POL'Y 119, 122-23 (1990) ("[M]ost issued patents are worthless, or very nearly worthless."); 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, 603 (1999) ("[M]ost [patented] technologies will not be economically viable or commercially successful.").

282. John R. Thomas, *The Responsibility of the Rulemaker: Comparative Approaches to Patent Administration Reform*, 17 BERKELEY TECH. L.J. 727, 731 (2002) (noting that one consequence is the need for legal actors to revisit the work of the PTO to assess patent validity).

283. JAFFE & LERNER, *supra* note 14, at 139-42; *see also* Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1500 (2001) ("[M]uch of the most relevant prior art isn't easy to find—it consists of [third-party activities] that don't show up in any searchable database and will not be found by examiners in a hurry."); Michael Risch, *The Failure of Public Notice in Patent Prosecution*, 21 HARV. J.L. & TECH. 179, 196 (2007) ("A high-quality prior art search is difficult because of resource and time limitations."); Thomas, *supra* note 113, at 318-19 (explaining that in newer technologies, examiners often cannot obtain the most recent technical literature).

applications found in patent databases,[284] critics contend that many searches may not identify other, and perhaps more relevant, technical information available from nonpatent sources.[285] This is particularly problematic in nascent, rapidly changing, or highly specialized fields in which there is a paucity of relevant patent literature.[286] In these fields, one would expect to find the most relevant technical information elsewhere.[287] So to the extent that the examiner skews the search toward patent databases when most of the relevant technical information is embodied in the nonpatent literature, that search will lead to the issuance of a patent covering subject matter that is already in the public domain.[288] The likely result is a low-quality patent.[289]

The foregoing discussion suggests that, to a large extent, "[t]he assurance of a good patent quality is all about information."[290] Clearly an examiner must have all of the relevant technical information in hand in order to accurately gauge patentability. And certainly, for many inventions, no one believes that patent databases sufficiently represent the body of preexisting knowledge.[291] But given their production goals[292] and time pressures,[293] it is quite

284. *See* sources cited *supra* notes 20 and 113.

285. *See* DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 51 (2009) (explaining that although the PTO's accessible information sources might be sufficient to gauge patentability for mechanical and chemical fields, this may not be true in fields like software, where the relevant information is inaccessible to the PTO); sources cited *supra* note 281.

286. *See, e.g.*, Julie E. Cohen, *Reverse Engineering and the Rise of Electronic Vigilantism: Intellectual Property Implications of "Lock-Out" Programs*, 68 S. CAL. L. REV. 1091, 1178-79 (1995) (noting that many developments in computer programming are not documented in previously issued patents or even scholarly publications); *see also* Thomas, *supra* note 113, at 318-19 ("Overreliance upon patents as indicia of the state of the art works far more mischief in fields long believed to be outside the patent system [like] ... software ... and other postindustrial inventions, [where] ... the repository of issued patents insufficiently samples the prior art.").

287. *See* sources cited *supra* notes 283-84.

288. Thomas, *supra* note 113, at 318-19.

289. *See supra* note 276 and accompanying text.

290. Christopher A. Cotropia, *Modernizing Patent Law's Inequitable Conduct Doctrine*, 24 BERKELEY TECH. L.J. 723, 748 (2009).

291. *See supra* notes 283-84 and accompanying text.

292. "Production goals are the number of specific actions and decisions that patent examiners must make about patent applications they review during a 2-week period." U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-07-1102, U.S. PATENT AND TRADEMARK OFFICE: HIRING EFFORTS ARE NOT SUFFICIENT TO REDUCE THE PATENT APPLICATION BACKLOG 2 (2007). Implicit in these goals is an estimate of the time it takes to review a patent application. *Cf.*

understandable why examiners rely so heavily on patent databases. Because patent documents are familiar, readily accessible, conveniently classified, and printed in a common standardized format, turning to nonpatent sources adds time and complexity to the search.[294] Put differently, examiners have little incentive to turn to nonpatent sources if doing so will compromise throughput.[295]

Providing the examiner with more nonpatent technical information alone is no guarantee of improved patent examination quality. Tackling the problem is an issue of substance *and* form, in that there is a need for a source of relevant technical information whose functional attributes resemble that of a patent database. A null patent database would do just that: it would provide technical information about failed experiments in a patent-like form. Here it is worth reemphasizing that such technical information can be extremely important in determining whether an invention is novel, nonobvious, and enabled[296]—patentability criteria that are always front and center in any discussion of patent quality.[297]

The availability of this expanded universe of technical information, particularly when combined with other changes at the PTO,[298]

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*id.* at 5-6 (discussing the discrepancy between ideal production goals and actual time necessary to achieve them).

293. The amount of time the PTO allots for an examiner to dispose of a case depends on factors like seniority and the technology involved. *See id.* at 7. Time estimates vary. *Compare* Thomas, *supra* note 113, at 314 (estimating a sixteen- to seventeen-hour average time allotment), *with* Lemley, *supra* note 283, at 1500 n.19 (aggregating time estimates, which range from eight to thirty-two hours, depending on the technology). As a part of its internal patent reform, the PTO has reevaluated examination timelines. *See supra* Part III.A.

294. *See supra* note 112.

295. *Cf.* BURK & LEMLEY, *supra* note 285, at 23 ("[A]n examiner has no incentive to spend more time on harder cases."); *see also* ANTHONY L. MIELE, PATENT STRATEGY: THE MANAGER'S GUIDE TO PROFITING FROM PATENT PORTFOLIOS 97-98 (2001) (discussing the examiner's concerns and incentives); Nikolas J. Uhlir, Note, *Throwing a Wrench in the System: Size-Dependent Properties, Inherency, and Nanotech Patent Applications*, 16 FED. CIR. B.J. 327, 340 & nn.88-89 (2008) (explaining the compensation system and the incentives it gives to examiners); Megan Barnett, *Patents Pending*, U.S. NEWS & WORLD REP., June 10, 2002, at 33, 34 (contending that the work incentives established by the PTO reward "speed, not quality").

296. *See supra* Part III.A.

297. *See supra* text accompanying note 279.

298. *See, e.g.*, U.S. PATENT & TRADEMARK OFFICE, 2010-2015 STRATEGIC PLAN 9-20 (2010), *available at* http://www.uspto.gov/about/stratplan/USPTO_2010-2015_Strategic_Plan.pdf (describing several initiatives that will improve examination timelines and patent quality); Press Release, U.S. Patent & Trademark Office, Recently Announced Changes to USPTO's Examiner Count System Go Into Effect (Feb. 18, 2010), *available at* http://www.uspto.gov/news/pr/2010/10_08.jsp (announcing changes to the examiner count system that will give

would empower the examiner to conduct a more robust examination of docketed applications and improve the quality of issued patents.[299] This would also affect filing behavior. Whereas a lax examination regime encourages inventors with low-quality applications to file,[300] a robust regime does the opposite because inventors "would understand that [low-quality] applications are a waste of time and money."[301] This would concomitantly reduce the burden on PTO resources.[302]

Improving patent examination quality would reduce uncertainty throughout the patent system.[303] For instance, there would be less "uncertainty about the validity of granted patents, uncertainty about the scope of granted patents, uncertainty about whether a particular invention is patentable, and uncertainty about whether a valid patent will be fully enforced."[304] Increased certainty would discourage opportunistic behavior such as rent-seeking patent acquisition and enforcement activities;[305] lower the overall amount,

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examiners more time to review applications, rebalance incentives, and improve morale in the examining corps).

299. *See* Hall & Harhoff, *supra* note 279, at 993-94 (describing the interrelationship between PTO resources, filing frequency, and the examination of individual applications on patent quality); Craig Allen Nard, *Certainty, Fence Building, and the Useful Arts*, 74 IND. L.J. 759, 777 (1999) ("If the patentee and PTO had knowledge of invalidating prior art during prosecution, it is likely that the bargain struck would have produced patent claims of narrower scope (or a patent may not have issued at all).").

300. JAFFE & LERNER, *supra* note 14, at 175 ("To put it crudely, if the [PTO] allows bad patents to issue, this encourages people with bad applications to show up.").

301. *Id.*

302. The strain on the PTO's limited resources contributes to the well-publicized backlog. *See* Edward Wyatt, *U.S. Sets 21st-Century Goal: Building a Better Patent Office*, N.Y. TIMES, Feb. 21, 2011, at A1 (providing backlog statistics and attributing the recent surge in applications to the Internet age). This strain also precludes a thorough review of patent applications. *See* Doug Lichtman & Mark A. Lemley, *Rethinking Patent Law's Presumption of Validity*, 60 STAN. L. REV. 45, 46-47 (2007).

303. One purpose of patent examination is to remove uncertainty. *See In re* Zletz, 893 F.2d 319, 322 (Fed. Cir. 1989) ("An essential purpose of patent examination is to fashion claims that are precise, clear, correct, and unambiguous. Only in this way can uncertainties of claim scope be removed, as much as possible, during the administrative process.").

304. Wagner, *supra* note 279, at 2140.

305. Thomas, *supra* note 282, at 731. "Rent-seeking behavior may arise when the holder of a poor quality patent seeks to enforce exclusionary rights that are probably invalid or seeks to stretch a valid narrow exclusionary right to cover acts outside the proper scope of the patent." Scott R. Boalick, *Patent Quality and the Dedication Rule*, 11 J. INTELL. PROP. L. 215, 240 (2004) (citing Michael J. Meurer, *Controlling Opportunistic and Anti-Competitive Intellectual Property Litigation*, 44 B.C. L. REV. 509, 512-16 (2003)); *see also* Wagner, *supra*

expense, and complexity of patent infringement litigation;[306] and "strengthen the incentives of private actors to engage in value-maximizing activities such as innovation or commercial transactions."[307]

### *2. It Will Promote Broader Policy Goals of Science and Patent Law*

Both patent law and science promote technological progress through the dissemination of knowledge. For instance, in patent law there is hope that the public will use the technical information disclosed in a patent document to improve upon the invention, design around it, or spur more innovation.[308] Science contemplates that researchers will engage in similar activities upon reading a technical publication.[309] Of course, the two differ in their mechanisms of knowledge transfer. Whereas patent law emphasizes the quick dissemination of technical knowledge to the public,[310] in part because of its indifference to ancillary details like the inventor's identity or acumen,[311] science insists on filtering knowledge through

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note 279, at 2144 (explaining that the uncertainty brought about by a low-quality patent system allows it "[to] be exploited—whether by filing low-probability, high-cost suits or by seeking large numbers of low-quality patents to use as leverage for settlement").

306. Wagner, *supra* note 279, at 2143-44.

307. Wendy H. Schacht & John R. Thomas, *Patent Reform: Innovation Issues*, *in* PATENT TECHNOLOGY: TRANSFER AND INDUSTRIAL COMPETITION 1, 6 (Juanita M. Branes ed., 2007).

308. *See supra* note 4 and accompanying text.

309. *See* Seymore, *supra* note 4, at 663.

310. The statutory scheme helps achieve this goal. For example, an applicant must file a patent application within one year of disclosing the invention in a printed publication. 35 U.S.C. § 102(b)(1) (2006). Likewise, if the invention is used in public, sold, or is subject to an offer for sale in the United States, the applicant must file within one year of the event. *Id.* A fundamental purpose of § 102(b) is to encourage prompt filing. Woodland Trust v. Flowertree Nursery, Inc., 148 F.3d 1368, 1370 (Fed. Cir. 1998). Similarly, § 102(g) "penaliz[es] the unexcused delay or failure of a first inventor to share the benefit of the knowledge of [the] invention with the public after the invention has been completed." Checkpoint Sys., Inc. v. U.S. Int'l Trade Comm'n, 54 F.3d 756, 761 (Fed. Cir. 1995) (internal quotation marks omitted). To aid in quick dissemination, most patent applications publish eighteen months after filing. *See supra* note 1 (discussing § 122(b)).

311. *See* Eames v. Andrews (The Driven-Well Cases), 122 U.S. 40, 56 (1887) (explaining that an inventor's ignorance of the scientific principles is immaterial as long as the patent's disclosure sets forth the "thing to be done ... so ... that it can be reproduced"); Radiator Specialty Co. v. Buhot, 39 F.2d 373, 376 (3d Cir. 1930) ("It is with the inventive concept, the thing achieved, not with the manner of its achievement or the quality of the mind which gave it birth, that the patent law concerns itself."); Earle v. Sawyer, 8 F. Cas. 254, 256 (C.C.D.

a legitimization process known as peer review.[312] Thus, the two disseminate knowledge in related, though dissimilar, ways.

Yet the two spheres have much in common when it comes to the role of disclosure in achieving certain ends. For example, in both spheres there is hope that the disclosed information will actually enrich the public storehouse of technical knowledge. This is why, at a minimum, both patent law and science require a disclosure that teaches something that is novel, nontrivial, and reproducible by skilled artisans in the technical field.[313] In the patent sphere, the preceding discussion explained the null patent's potential role in gauging compliance with these requirements.[314]

But enriching the public storehouse of knowledge is only part of the story of the disclosure function.[315] Disclosure can help to achieve two broader ends shared by patent law and science—namely, to coordinate the future development of technology[316] and to spur innovation.[317] Here too, the null patent can play a critical role.

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Mass. 1825) (No. 4,247) (Story, J.) ("It is of no consequence, whether the thing be simple or complicated; whether it be by accident, or by long, laborious thought ... that it is first done [because the] law looks to the fact, and not to the process by which it is accomplished.").

312. This process ensures that each research claim is reproducible, logical, independent, and satisfies other basic conditions for communal acceptability. JOHN ZIMAN, REAL SCIENCE: WHAT IT IS, AND WHAT IT MEANS 246 (2002). For a discussion of the mechanics of peer review, see *supra* note 43.

313. Seymore, *supra* note 4, at 663.

314. *See supra* Part III.A (discussing the role of failure in determining novelty, nonobviousness, and enablement).

315. For additional perspectives, see Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 548-52 (2009) (cataloguing the beneficial uses for disclosure in patent law); Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. REV. 123, 173-75 (2006) (describing the "pervasive" role of disclosure in patent law and policy, including enriching the state of the art contemporaneously with the invention and showing evidence of possession of the invention).

316. Julie S. Turner, *The Nonmanufacturing Patent Owner: Toward a Theory of Efficient Infringement*, 86 CALIF. L. REV. 179, 194 (1998).

317. *See* Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 151 (1989) ("[The] effectiveness [of the patent system] in inducing creative effort and disclosure of the results of that bargain, depend[s] almost entirely on a backdrop of free competition in the exploitation of unpatented designs and innovations."); *see also* Aronson v. Quick Point Pencil Co., 440 U.S. 257, 262 (1979) (noting that one goal of patent law is "[to] promote[ ] disclosure of inventions to stimulate further innovation"); Transco Prods. Inc. v. Performance Contracting, Inc., 38 F.3d 551, 558 (Fed. Cir. 1994) (rejecting an interpretation of § 112 that would "subvert the patent system's goal of ... encouraging early disclosure"); W.L. Gore & Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1550 (Fed. Cir. 1983) ("Early public disclosure is a linchpin of the patent system.").

Perhaps the most obvious way to coordinate the future development of technology is to structure a disclosure regime that provides researchers who might seek to work on a given problem with a complete picture of the relevant accumulated knowledge. Knowing the lay of the land promotes the efficient allocation of resources.[318] The nondisclosure of negative results prevents this from happening in at least two ways. First, other researchers might waste resources on duplicative efforts, such as trying to develop something that has already been attempted—albeit unsuccessfully—rather than working on more productive activities.[319] Second, ignorance of failure might lead some researchers to avoid risky endeavors or those with uncertain outcomes, and instead be "overly conservative, perhaps even wasting societal resources on too-safe technology that might be spent on other human endeavors or social needs."[320] In both patent law and science, this waste impedes, rather than promotes, technological progress.

That the dissemination of knowledge will promote innovative activity is a firmly held goal shared by patent law and science.[321] The null patent performs two functions that help achieve this end, one that is obvious and the other that is more subtle. The obvious function is to provide substantive technical knowledge from which others can learn.[322] Recall that failed experiments always yield *something*—whether it be a serendipitous result, an abundance of unexpected technical data, or simply knowledge that an initial hypothesis was totally wrong.[323] Regardless, there is hope that someone can extract knowledge from failure and use it to achieve success with the failed experiment or for other creative purposes.[324]

The more subtle function is to help the scientific community develop a tolerance for failure. This is important because of the

318. Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 262-67 & n.79 (1994); Turner, *supra* note 316, at 194.

319. *See* F. Scott Kieff, *The Case for Registering Patents and the Law and Economics of Present Patent-Obtaining Rules*, 45 B.C. L. REV. 55, 99-100 (2003) (describing how disclosure can coordinate downstream activities, including the prevention of duplicative efforts); *supra* notes 56-58 and accompanying text.

320. Henry Petroski, Review Essay, *The Success of Failure*, 42 TECH. & CULTURE 321, 328 (2001); *see also* discussion *infra* notes 325-30 and accompanying text.

321. *See* sources cited *supra* notes 309, 317.

322. *See supra* Part II.A.1.

323. *See supra* notes 34-38 and accompanying text.

324. FETZER, *supra* note 32, at 16-17.

relationship between failure, uncertainty, and innovation. Technological innovation involves uncertainty, including the risk of failure.[325] Uncertainty drives innovative activity because the inability to sufficiently predict the outcome of a project provides the motivation to dive in and figure it out.[326] Put simply, "uncertainty leads to choice, and choice favors mindfulness, which paves the way for creativity."[327] But for this to happen, the scientist must have developed a tolerance for failure.[328] The ability to do so sets the most creative innovators apart from ordinary scientists.[329] It appears that mainstream science is finally learning this lesson.[330]

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325. *See* PAUL R. BEIJE, TECHNOLOGICAL CHANGE IN THE MODERN ECONOMY: BASIC TOPICS AND NEW DEVELOPMENTS 97 (1998) (discussing technological uncertainty and innovation); Göran Ekvall, *Creative Climate*, *in* 1 ENCYCLOPEDIA OF CREATIVITY 403, 407 (Mark A. Runco & Steven R. Pritzker eds., 1999) ("Innovation involves risk.").

326. LEWIS M. BRANSCOMB & PHILIP E. AUERSWALD, TAKING TECHNICAL RISKS: HOW INNOVATORS, EXECUTIVES, AND INVESTORS MANAGE HIGH-TECH RISKS 44-45 (2001); *see also* GUY CLAXTON & BILL LUCAS, BE CREATIVE: ESSENTIAL STEPS TO REVITALIZE YOUR WORK AND LIFE 24 (2004) ("[U]ncertainty requires ... creativ[ity], and creativity requires uncertainty.").

327. Becca Levy & Ellen Langer, *Aging*, *in* 1 ENCYCLOPEDIA OF CREATIVITY, *supra* note 325, at 45, 46. Of course, risk arises in other aspects of innovation. For example, consider a pharmaceutical firm that invests staggering amounts of capital—typically hundreds of millions of dollars—in developing a marketable product. The ability to obtain strong patent protection is essential for the high-risk investment. FTC REPORT, *supra* note 276, ch. 3, at 1-6.

328. FETZER, *supra* note 32, at 16; *see also* ROBERT F. BRANDS WITH MARTIN J. KLEINMAN, ROBERT'S RULES OF INNOVATION: A 10-STEP PROGRAM FOR CORPORATE SURVIVAL 23 (2010) ("Not every idea can, or will, be a winner. Not every *Eureka!* moment pans out.... Champions of ... innovation must have, and encourage, a *tolerance for failure* and *enthusiasm for risk taking*.").

329. WAYNE M. BUNDY, INNOVATION, CREATIVITY, AND DISCOVERY IN MODERN ORGANIZATIONS 220 (2002) ("Fear of failure is anathema to invention."); *see also* RICHARD FARSON & RALPH KEYES, THE INNOVATION PARADOX: THE SUCCESS OF FAILURE, THE FAILURE OF SUCCESS 28-29 (2003) (describing how failure tolerance characterized many of America's prominent inventor-moguls, including Thomas Edison, Henry Ford, and the Wright Brothers); FETZER, *supra* note 32, at 16.

330. For instance, both the National Institutes of Health (NIH) and the National Science Foundation (NSF) have set aside grant money for unconventional, high-risk research ideas that can completely transform science. *See NIH Director's Transformative Research Award Program*, THE NIH COMMON FUND, http://commonfund.nih.gov/TRA (last visited Mar. 28, 2012) (noting that the TR01 program was "created specifically to support exceptionally innovative and/or unconventional research projects that have the potential to create or overturn fundamental paradigms"); NAT'L SCI. FOUND., GRANT PROPOSAL GUIDE II-20 (2009), *available at* http://www.nsf.gov/pubs/policydocs/pappguide/nsf10_1/gpgprint.pdf (explaining that the Early Concept Grants for Exploratory Research funding mechanism may be used to support potentially transformative research that is "especially 'high risk-high payoff'"); Amy Maxmen, *Taking Risks To Transform Science*, 139 CELL 13, 13-15 (2009) (exploring the aforementioned programs and similar initiatives).

### *C. Potential Objections and Implementation Concerns*

#### *1. Technical Junk and Nuisance Prior Art*

Harvesting negative results from the sea of squandered knowledge will increase the amount of technical information in the public domain and, consequently, also expand the universe of potentially patent-defeating prior art. This expansion might raise a concern about so-called "nuisance" prior art.[331] Though often defined as information of dubious value or technical merit ("technical junk")[332] intentionally disclosed by a third party "to muddy the waters in a defensive or nuisance maneuver,"[333] nuisance prior art also includes innocuously disclosed information that has the same effect.[334]

Fortunately, null patents would not be a source of nuisance prior art for two related reasons. First, given that the information disclosed in a null patent would emanate from actual experimentation,[335] it would have intrinsic technical merit. A scientist can always extract something from a failed experiment.[336] On the other hand, nuisance prior art discloses work not actually performed or things not physically made.[337] The classic example is the disclosure of the structure of a hypothetical chemical compound with no details about how to make it.[338] In contrast to actual experimental results,

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331. David S. Wainwright, *Patenting Around Nuisance Prior Art*, 81 J. PAT. & TRADEMARK OFF. SOC'Y 221, 221 (1999).

332. *Id.* at 222, 223 n.3.

333. *Id.* at 221-22.

334. Nuisance prior art describing an unworkable invention "can also be generated as a result of a bona fide attempt at a constructive reduction to practice that for some unexpected reason fails to work as disclosed." *Id.* at 223-24; *see also supra* note 268 (defining constructive reduction to practice). But, in a bona fide disclosure, "it is usually easy to determine that which is known and that which is supposition and there is no attempt therein to mislead or omit relevant information." Wainwright, *supra* note 331, at 224.

335. *See supra* Part II.B.2.

336. *See supra* note 323 and accompanying text.

337. Wainwright, *supra* note 331, at 223-26 (explaining how to recognize nuisance prior art).

338. *See* Andrew Chin, *Artful Prior Art and the Quality of DNA Patents*, 57 ALA. L. REV. 975, 1000 (2006) (exploring novelty issues that can arise when the asserted prior art reference discloses a voluminous list of compounds). To be sure, "[s]avvy third-party patentees ... have an incentive to purposely create [patentability] hurdles for subsequent inventors by strategically disclosing unclaimed, unmade compounds in their patents." Seymore, *supra* note 182, at 944. This is an excellent example of defensive publication. *Id.* at 945-46; *supra* Part II.B.5.

the disclosure of hypothetical subject matter has dubious technical merit and is more likely to be technical junk.[339]

The second reason why null patents would not be a source of nuisance prior art is because they are not true patents. Recall that a presumption of enablement attaches to all of the subject matter disclosed in a patent when it is asserted as prior art.[340] Critically, during the prosecution[341] of the prior art patent, the examiner evaluates only the *claimed* subject matter disclosed in the application; the key corollary being that the *unclaimed* subject matter is not examined for compliance with the enablement requirement.[342] For obvious reasons, it is this unexamined, unclaimed information that is likely to be technical junk.[343] But regardless, when the patent issued, *all* of the technical information disclosed therein—both claimed and unclaimed—morphed into presumptively enabled, patent-defeating prior art.[344] If this patent is later asserted as prior art, the subsequent applicant's inability or unwillingness to rebut

339. Seymore, *supra* note 4, at 631-32 (explaining that particularly in the experimental sciences, there is a real danger that fictitious examples cannot be made and are generally of little use to other researchers); *cf.* Wainwright, *supra* note 331, at 224 (explaining that documents that "suggest broad unsupported concepts or wishes" and lack adequate disclosure do not teach the PHOSITA how to make or reproduce the subject matter without undue experimentation).

340. *See supra* note 196 and accompanying text. In *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, the Federal Circuit held that the underlying presumption of enablement encompasses both claimed and unclaimed subject matter in a prior art patent. 314 F.3d 1313, 1355 (Fed. Cir. 2003). As support for its holding, the court explained that the examiner should not bear the burden of analyzing enablement each time an allegedly anticipating third-party patent is challenged. *Id.* at 1355 & n.21.

341. Patent prosecution describes the process by which an inventor, usually through the help of an attorney, files an application with the PTO for examination. *See* MIELE, *supra* note 295, at 96-97 (describing the patent prosecution process).

342. MPEP, *supra* note 116, § 2164.08 ("All questions of enablement are evaluated against the claimed subject matter."); *see also* Engel Indus., Inc. v. Lockformer Co., 946 F.2d 1528, 1531 (Fed. Cir. 1991) ("Unclaimed subject matter is not subject to the disclosure requirements of § 112; the reasons are pragmatic: the disclosure would be boundless, and the pitfalls endless."). Creating patentability hurdles for subsequent applicants is one reason why patentees disclose information but do not claim it. For other reasons, see Seymore, *supra* note 182, at 944 n.124. Ultimately, disclosed-but-unclaimed subject matter is dedicated to the public. Johnson & Johnston Assocs. v. R.E. Serv. Co., 285 F.3d 1046, 1054 (Fed. Cir. 2002) (en banc).

343. *See* Seymore, *supra* note 182, at 944-45 (criticizing the presumption of enablement for prior art patentees, particularly as it relates to unexamined subject matter); *supra* note 339 and accompanying text.

344. *See supra* note 340.

the presumption of enablement, or otherwise overcome the prior art, will defeat patentability.[345] So now it becomes clear why some unscrupulous third parties intentionally fill their patents with unclaimed technical junk for nuisance purposes.[346] But because the presumption of enablement is presently limited to issued patents, null patents and other forms of nonpatent literature are unlikely sources of nuisance prior art.[347]

*2. Administrative Burden*

The null patent regime proposed herein would admittedly impose on the PTO additional layers of cost and recordkeeping. It would add an extra administrative burden to an agency that is already strained for resources.[348] This proposal certainly cuts against the grain because most other patent reform proposals seek to reduce the burden on the PTO.[349]

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345. *See* Seymore, *supra* note 182, at 944 (explaining the difficulties in proving that a nuisance prior art reference is nonenabling); Wainwright, *supra* note 331, at 222 ("[U]nfortunately many learned applicants may abandon protection of their work when faced with nuisance prior art, even when they perceive a nuisance prior art item as being technical junk.").

346. Wainwright, *supra* note 331, at 223. Thus, creating nuisance prior art is a form of defensive publication. For example:

> [A third-party patentee] could ... generate millions upon millions of plausible chemical structures and load them into multiple patent applications together with one compound that actually meets all of the patentability [requirements] in each patent application. The applicant could then claim that enabled compound and get a patent issued on that compound and have the rest of the [disclosed but unclaimed] structures become enabled prior art.

CHRIS P. MILLER & MARK J. EVANS, THE CHEMIST'S COMPANION GUIDE TO PATENT LAW 170 n.4 (2010); *see also supra* note 170 (discussing strategic disclosure as a "spoiler" tactic).

347. The Federal Circuit has not decided whether nonpatent references are entitled to a presumption of enablement. Amgen Inc. v. Hoechst Marion Roussel, Inc., 314 F.3d 1313, 1355 n.22 (Fed. Cir. 2003) ("We note that by logical extension, our reasoning here might also apply to [nonpatent] prior art printed publications as well, but as Sugimoto is a patent we need not and do not so decide today.").

348. *See* COMM. ON INTELLECTUAL PROP. RIGHTS IN THE KNOWLEDGE-BASED ECON., NAT'L RESEARCH COUNCIL, A PATENT SYSTEM FOR THE 21ST CENTURY 81-83 (Stephen A. Merrill et al. eds., 2004) (describing the additional resources that the PTO will need to improve its performance); Ed O'Keefe, *New Boss Moves Quickly to Change Sluggish Patent Office*, WASH. POST, Oct. 20, 2009, at A17 (noting that the PTO's revenue stream limits modernization efforts and contributes to the agency's sluggish performance); *supra* notes 298-302 and accompanying text.

349. *See, e.g.*, Beth Simone Noveck, *"Peer to Patent": Collective Intelligence, Open Review,*

This increased burden is certainly a legitimate concern, but one to which there are several responses. First, recall that the purpose of the null patent is not only to serve as a medium for disclosing and disseminating negative results, but also to put that information into the examiner's hands for assessing patentability.[350] Although there might be other ways to achieve the former, housing the null patent database at the PTO is the only way to ensure the latter. This is true not only because examiners are more likely to assert references found in patent databases than from other information sources,[351] but also because examiners give more weight to information found in the PTO's own databases.[352] Put simply, hosting the database at the PTO would increase the chances that an examiner would search it and find the relevant technical information.[353]

Second, the PTO has experience generating patent-like documents and including them in databases. Aside from patents, the PTO produces published patent applications and SIRs that are classified, indexed, and cross-referenced.[354] Developing and maintaining the null patent database would not be an unfamiliar task.

Third, any burden required for the PTO to administer the null patent regime would be slight in comparison to the benefits that would flow from it. Perhaps the most obvious benefit is improved patent quality. Critics argue that a major contributor to the quality problem is that examiners lack adequate technical information to conduct a rigorous examination, particularly when that information comes from nonpatent sources.[355] The null patent goes a long way toward solving this problem. And to the extent that null patents would lead to a more robust examination, that would provide a

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*and Patent Reform*, 20 HARV. J.L. & TECH. 123, 143-51 (2006) (proposing an examination paradigm in which "those with the necessary know-how" can participate by submitting and commenting on prior art, thereby reducing the examiner's burden).

350. *See supra* notes 23-30 and accompanying text.

351. *See supra* notes 20, 112 and accompanying text.

352. *See* Gleick, *supra* note 111, at 47; Sampat, *supra* note 20, at 3; sources cited *supra* note 113.

353. *See supra* note 113.

354. For a description of the indexing and classification of patent documents, see *supra* note 98. SIRs are discussed *supra* notes 115-20 and accompanying text.

355. *See supra* notes 283-89 and accompanying text.

disincentive for those with low-quality inventions to file,[356] thereby reducing the burden on PTO resources.

The technical information disclosed through the null patent regime would not only expand the universe of prior art,[357] which is of prime importance to the PTO, but would also enrich the public storehouse of technical knowledge and promote its dissemination.[358] In both patent law and science, there is hope that a richer body of knowledge will both coordinate the future development of technology and spur innovative activity.[359] The point here is that by administering the database, the PTO itself—as opposed to inventors, Congress, and the courts—could play an active role in promoting broader goals of patent law and science.[360]

## CONCLUSION

Negative results fill the sea of squandered knowledge. *Negative* is an unfortunate term because, although experiments often fail to work as planned, these failures always produce valuable technical information—whether it be a serendipitous finding, an abundance of unexpected technical data, or simply knowledge that an initial hypothesis was totally wrong. Though some have recognized that the dissemination of negative results has many upsides for science, transforming scientific norms toward disclosure is no easy task. As for patent law, the potentially important role that negative results can play in determining patentability has heretofore been overlooked. The null patent regime advanced in this Article attempts to address these issues. And, perhaps even more importantly, its implementation would promote broader policy goals shared by both science and patent law—namely, to promote technological progress through the dissemination of knowledge, to coordinate the future development of technology, and to spur innovation.

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356. *Cf.* JAFFE & LERNER, *supra* note 14, at 175 ("To put it crudely, if the [PTO] allows bad patents to issue, this encourages people with bad applications to show up.").

357. *See supra* Part III.A.1-2.

358. *See supra* Part III.B.2.

359. *See supra* Part III.B.2.

360. *Cf. supra* note 114 and accompanying text.