ARTICLE

UNINFORMATIVE PATENTS

Sean B. Seymore[*]

ABSTRACT

It is a bedrock principle of patent law that an inventor need not know or understand how or why an invention works. The patent statute simply requires that the inventor explain how to make and use the invention. But explaining how to make and use something without understanding how or why it works yields patents with uninformative disclosures. Their teaching function is limited; someone who wants to understand or figure out the underlying scientific principles must turn elsewhere. This limited disclosure rule does not align with the norms of science and tends to make patent documents a less robust form of technical literature. This Essay explores the contours of the rule, the policy tradeoffs, and the broader implications for the patent system.

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* Professor of Law and Professor of Chemistry, Vanderbilt University. Thanks to Jonas Anderson, Timothy Holbrook, and Dmitry Karshtedt for helpful conversations and insights. Thanks also to the organizers and participants at the Institute for Intellectual Property & Information Law's 2017 National Conference, where I presented an earlier draft of this Essay.

I. INTRODUCTION

It might be surprising that an inventor can invent something and obtain a patent without understanding how or why it works. Yet such knowledge is not required.[1] If the patent document's disclosure is sufficiently detailed to explain to those skilled in the technology of the invention how to make and use the invention, that is enough to satisfy patent law's so-called enablement requirement.[2] But this minimal disclosure threshold can produce patents that are *uninformative* from a technical standpoint, meaning that they provide little meaningful information to truly fulfill patent law's disclosure function.[3] Uninformative patents have far-reaching and perhaps unintended consequences which, until now, have not been explored.

To illustrate, consider the following hypothetical. Suppose that an inventor-researcher seeking to address the diabetes epidemic[4] discovers how to reverse the disease by administering a

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1. Eames v. Andrews (The Driven-Well Cases), 122 U.S. 40, 55–56 (1887) ("It may be that the inventor did not know what the scientific principle was . . . That does not vitiate the patent."); Fromson v. Advance Offset Plate, Inc., 720 F.2d 1565, 1570 (Fed. Cir. 1983) ("[I]t is axiomatic that an inventor need not comprehend the scientific principles on which the practical effectiveness of his invention rests."). *See also infra* Part III.A.

2. Enablement is one of the three disclosure requirements set forth in 35 U.S.C. § 112(a):

> 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 or joint inventor of carrying out the invention.

35 U.S.C. § 112(a) (emphasis added). Enablement is discussed *infra* Part II.B.

3. *See* discussion *infra* Part II.A.

4. *See, e.g.*, Jane E. Brody, *Diabetes: A Crisis of Inaction*, N.Y. TIMES, Sept. 9, 2014, at D5 (describing the diabetes epidemic); Brady Dennis, *29 million Americans have diabetes—but a quarter of them don't realize it*, WASH. POST (Nov. 21, 2014), https://www.washingtonpost.com/postlive/29-million-americans-have-diabetes—but-a-quarter-of-them-dont-realize-it/2014/11/20/0831a908-6e84-11e4-ad12-3734c461eab6_story.html?utm_term=.ecc704a64633 (explaining that twenty-nine million Americans have diabetes and eighty-six million have pre-diabetes and noting that "the risk of death for adults with diabetes is 50 percent higher than it is for adults without the disease").

mixture of green coffee extract and ginger oil to affected individuals.[5] Although the inventor can describe how to make the mixture, provide a therapeutically effective dosage range, and disclose data from successful use in human subjects, the inventor does not know how or why the mixture works. It is unknown, for example, if the therapeutic activity is due to the combined effect of two or more components in the mixture[6] or possibly a new chemical species that is created upon mixing or entry into the body. While figuring out these details would be a prerequisite for acceptance of the inventor's claim in the scientific community,[7] the minimal disclosure would be sufficient to satisfy patent law's enablement requirement.[8]

Yet while enabling, the resulting patent raises several concerns that cannot be overlooked. First, an inventor like the one in the hypothetical has no incentive to figure out how or why the invention works.[9] This produces an uninformative patent because the document merely explains how to *practice* the invention[10] (or replicate what the inventor did).[11] Such minimal disclosure places a drag on technological progress because it lacks meaningful,

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5. *Cf.* Composition and Method for Blood Sugar Modulation, U.S. Patent No. 9,333,126 (filed Mar. 14, 2014) (issued May 10, 2016) (disclosing a method of treating or preventing Type 2 diabetes by administering a daily dose of a mixture which includes the herbal extracts green coffee, grape seed, hibiscus, cinnamon, holy basil, Russian tarragon, ginger, and turmeric).

6. Green coffee extract contains over 100 compounds. Conchita Cid & Maria-Paz de Peña, *Coffee: Analysis and Composition*, *in* 1 ENCYCLOPEDIA OF FOOD AND HEALTH 224 (Benjamin Caballero et al., eds. 2016). Ginger oil contains eighty to ninety compounds. Fen-Chen et al., *Natural Flavors*, *in* 2 HANDBOOK OF FOOD SCIENCE, TECHNOLOGY, AND ENGINEERING 88-10 (Y. H. Hui ed. 2006).

7. *See* Sean B. Seymore, *Patently Impossible*, 64 VAND. L. REV. 1491, 1508–09 (2011) (discussing scientific gatekeeping and the requirements for communal acceptability).

8. *In re* Libby, 255 F.3d 412, 415 (C.C.P.A. 1958) ("It is not necessary that a patentee should understand the scientific principles underlying his invention, so long as he makes a sufficient disclosure to enable other persons skilled in the art to practice the invention."). The C.C.P.A. was a five-judge Article III appellate court on the same level as the U.S. Courts of Appeals. 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 C.C.P.A. decisional law as binding precedent. *See* S. Corp. v. United States, 690 F.2d 1368, 1370 (Fed. Cir. 1982) (en banc).

9. This is because inventors have an incentive to disclose as little as possible in the patent document. *See infra* note 104 and accompanying text.

10. The courts often use the term "practice" when referring to the how-to-make and how-to-use prongs of the enablement requirement of § 112(a). *See In re* Swartz, 232 F.3d 862, 863 (Fed. Cir. 2000) (per curiam) ("To satisfy the enablement requirement of [§ 112], a patent application must adequately disclose the claimed invention so as to enable a person skilled in the art to practice the invention at the time the application was filed without undue experimentation.").

11. *Cf. In re* Isaacs, 347 F.2d 887, 892 (C.C.P.A. 1965) ("All that an applicant need do is enable a person skilled in the art to duplicate [the inventor's] efforts . . . ").

substantive technical information that interested researchers can build upon.[12]

Second, interested researchers must fill this knowledge void. Since they can neither rely on their own knowledge nor knowledge in the technical field to figure out the omitted information,[13] interested researchers must engage in their own experimentation. But experimental activity by anyone other than the patentee would require a license to avoid infringement.[14] Of course, obtaining a license raises its own problems.[15]

Third, any subsequent experimentation may come at a point far into the future—perhaps at the end of the twenty-year patent term[16]—or maybe not at all. This would be a terrible outcome; particularly if the inventor could have figured out how and why the invention works and disclosed that information in the patent. The biggest loser is the public, which may get little benefit from the patent other than a "cookbook recipe" which replicates what the inventor did.[17] This knowledge void should be cause for concern given the tremendous public benefits that can enure to the public from a robust disclosure.[18]

This Essay attempts to address these issues and illuminate broader problems that arise from uninformative patents. It fills a gap in patent scholarship and contributes to ongoing debates over patent reform. It is part of a larger project that seeks to develop a more robust disclosure function for the patent system and to bridge the disconnect between patent law and the norms of science.[19]

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12. The current enablement standard has been criticized as being a de minimis disclosure requirement. *See infra* notes 19 and 104.

13. If interested researchers could merely rely on their own knowledge or knowledge in the technical field to fill the void, the invention would be unpatentable by statute for lacking novelty or nonobviousness. *See infra* note 103 and accompanying text.

14. Practicing the claimed invention without the patentee's permission constitutes patent infringement. *See* 35 U.S.C. § 271(a) ("[W]hoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States or imports into the United States any patented invention during the term of the patent therefor, infringes the patent.").

15. The patentee may decide not to bargain, thereby leading to a hang-up or holdout. Clarisa Long, *Proprietary Rights and Why Initial Allocations Matter*, 49 EMORY L.J. 823, 827 (2000).

16. The patent term begins on the day of issuance and expires twenty years from the filing date. 35 U.S.C. § 154(a)(2).

17. *Cf.* MARTIN J. ADELMAN ET AL., CASES AND MATERIALS ON PATENT LAW 397 (4th ed. 2015) (explaining that an enabling disclosure provides a "cookbook recipe" for those skilled in the technology of the invention).

18. *See infra* Part II.A; Kevin Emerson Collins, *The Structural Implications of Inventors' Disclosure Obligations*, 69 VAND. L. REV. 1785, 1790–91 (2016) (discussing the public-knowledge theory of disclosure and its grounding in social benefit).

19. *See generally* Sean B. Seymore, *Heightened Enablement in the Unpredictable*

The remainder of the Essay proceeds as follows. Part II explores the teaching function of patent documents. It begins by discussing the primacy of disclosure in patent law and then explains how the enablement requirement seeks to ensure that the disclosure is meaningful. Next, Part III examines the rule that permits uninformative disclosures and examines the problems that arise from it. Finally, Part IV explores the policy implications of uninformative patents and the tradeoffs that must be made between the interests of the inventor, the patent system, and the public.

II. PATENTS AS TEACHING DOCUMENTS

A principal function of the patent document is to disclose the invention to the public.[20] An often-overlooked aspect of disclosure is teaching.[21] The basic idea is that, while the patentee can exclude others from practicing the invention until the patent term expires,[22] the technical information disclosed in the written description[23] has potential *immediate* value to the public,[24] which

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Arts, 56 UCLA L. REV. 127 (2008) [hereinafter Seymore, *Heightened Enablement*] (proposing a new approach for examining patent applications in unpredictable technologies which, by requiring applicants to disclose actual experimental results, resolves a striking incongruity between patent law and the experimental sciences); Sean B. Seymore, *The Teaching Function of Patent*s, 85 NOTRE DAME L. REV. 621, 641, 656–57 (2010) [hereinafter Seymore, *Teaching Function*] (proposing a disclosure regime that would allow patents to compete with other forms of technical literature as a source of substantive technical information); Sean B. Seymore, *The Presumption of Patentability*, 97 MINN. L. REV. 990, 1037 (2013) [hereinafter Seymore, *Presumption*] (articulating a proposal that "is designed to strike a balance between an inventor's need to file early and a broader interest in using disclosure to promote the patent system's overarching goal of scientific and technological progress").

20. *See infra* note 27 and accompanying text.

21. *See* Univ. of Rochester v. G.D. Searle & Co., 358 F.3d 916, 922 n.5 (Fed. Cir. 2004) ("[W]hile the role of the claims is to give public notice of the subject matter that is protected, the role of the specification is to *teach*, both what the invention is (written description) and how to make and use it (enablement).") (emphasis added)).

22. *General information concerning patents*, USPTO (Oct. 2017), https://www.uspto.gov/patents-getting-started/general-information-concerning-patents#heading-24 [https://perma.cc/7RMJ-R6U2].

23. The written description is the part of the patent document that completely describes the invention. 35 U.S.C. § 112(a), (b) ("The specification shall contain a written description . . . It shall conclude with one or more claims . . ."). Although I will not do so in this Essay, it is worth noting that the terms "written description" and "specification" are often used interchangeably (and mistakenly) in patent law. F. SCOTT KIEFF ET AL., PRINCIPLES OF PATENT LAW 155 n.4 (5th ed. 2011).

24. As noted by one commentator:

> Because every patent application contains a complete description of someone's technology, and because patent applications are published, and now appear in on-line databases, you can trawl [through them] for information vital to your own research and development efforts. Why struggle to solve a technical problem already solved by another and published in an application?

can use the information for any purpose that does not infringe upon the claims.[25] Thus, the patent document is a form of technical literature.[26]

A. The Primacy of Disclosure

The essence of the U.S. patent system is a quid pro quo between the patentee and the public.[27] The basic idea is that in order to promote the full disclosure of information about the invention to the public, the patentee must receive something in return.[28] What the patentee gets is the limited period of exclusivity conferred by the patent grant.[29] The public gets detailed knowledge about the invention as soon as the patent document publishes[30] and possession of it at the end of the patent term.[31]

It is often forgotten that the inventive act produces *two* things that are potentially useful to the public: the invention itself, which will be defined here as the subject matter claimed in the patent (i.e., machine, product, process, composition of matter)[32] and the *disclosure*, which furnishes technical details about the invention (i.e., how to make it, how to use it).[33] Though the invention is probably the first thing that comes to mind when patents are discussed, the importance of the disclosure cannot be overlooked. Indeed, the Supreme Court has said that "the ultimate goal of the patent system is to bring new ideas and technologies into the public domain *through disclosure*."[34]

Anthony Murphy, *Intellectual Property*, *in* INNOVATION: HARNESSING CREATIVITY FOR BUSINESS GROWTH 87, 92 (Adam Jolly ed., 2003).

25. Seymore, *Teaching Function*, *supra* note 19, at 624 n.9 (citing Kirin-Amgen Inc. v. Hoechst Marion Roussel Ltd., [2004] UKHL 46, [2005] R.P.C. 9 at P 77 (Hoffmann, L.J.)).

26. *See infra* note 37 and accompanying text.

27. *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.").

28. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480–81 (1974).

29. *Id.* at 480 ("In return for the right of exclusion—this 'reward for inventions'—the patent laws impose upon the inventor a requirement of disclosure." (citation omitted)).

30. *See id.* at 481 (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).

31. 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.").

32. *See* 35 U.S.C. § 101 ("Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor . . .").

33. *See infra* Part II.B.

34. Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 151 (1989)

So why is disclosure so important? First, since the public gets many new and useful things through trade secrecy,[35] the patent system incentivizes the disclosure of information that the public might not otherwise get.[36] This is particularly important for "non-self-disclosing" inventions like chemical compounds or industrial processes which cannot be easily replicated or reverse engineered.[37]

Second, the disclosure conveys technical information (and becomes a part of the technical literature),[38] which "add[s] to the sum of useful knowledge"[39] immediately—not at the end of the patent term but as soon as the patent document publishes.[40] Patent theory posits that the early entry of useful information

(emphasis added).

35. Famous examples are the public's enjoyment of Coca-Cola's syrup formula and use of Google's search algorithm. *See Coca-Cola Moves Its Secret Formula to The World of Coca-Cola*, COCA-COLA (Dec. 8, 2011), http://www.coca-colacompany.com/press-center/press-releases/coca-cola-moves-its-secret-formula-to-the-world-of-coca-cola [https://perma.cc/KS6D-4MEV]; *see also* Nathaniel Tower, *Why Google Shouldn't Reveal Its Search Algorithm*, FIRST SCRIBE (Sept. 25, 2014), https://www.firstscribe.com/google-shouldnt-reveal-search-algorithm/ [https://perma.cc/RY7A-9XUF]; Michael Abramowicz & John F. Duffy, *The Inducement Standard of Patentability*, 120 YALE L.J. 1590, 1622 (2011) ("[T]rade secrecy protection can theoretically provide even more powerful incentives than patents because trade secrecy rights are potentially infinite in duration."); J. Jonas Anderson, *Secret Inventions*, 26 BERKELEY TECH. L.J. 917, 923–27 (2011) (exploring the patent vs. trade secret distinction).

36. The "incentive to disclose" rationale for patents is based on the notion that "the patent system is designed to bring inventions out into public view." J. Jonas Anderson, *Nontechnical Disclosure*, 69 VAND. L. REV. 1573, 1585 (2016). Without the patent system, inventors would monetize their inventions through trade secrecy; thereby depriving the public of the benefit of technical information about the invention. *Id.* Thus, the quid pro quo—the patent bargain—is required to induce the inventor to disclose (which adds this technical information to the public storehouse of knowledge). Katherine J. Strandburg, *The Research Exemption to Patent Infringement: The Delicate Balance Between Current and Future Technical Progress*, *in* 2 INTELLECTUAL PROPERTY AND INFORMATION WEALTH 107, 108 (Peter K. Yu ed., 2007).

37. Katherine J. Strandburg, *What Does the Public Get? Experimental Use and the Patent Bargain*, 2004 WIS. L. REV. 81, 83 (2004); *id.* at 105–06 ("For such non-self-disclosing inventions, the disclosure of the invention in the patent [document] is valuable to society . . . because it adds something the inventor could have kept secret to the store of public technical knowledge.").

38. Giles S. Rich, *Principles of Patentability*, 28 GEO. WASH. L. REV. 393, 400 (1960). Like technical journals, for example, patent disclosures can show the state of technology, set forth what others have already achieved, and provide technical information that others can avoid repeating. Seymore, *Teaching Function*, *supra* note 19, at 623–24.

39. Graham v. John Deere Co., 383 U.S. 1, 6 (1966).

40. 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); Integra Lifesciences I, Ltd. v. Merck KGaA, 331 F.3d 860, 873 (Fed. Cir. 2003) (Newman, J., dissenting) ("The purpose of a patent system . . . serves to add to the body of published scientific/technologic knowledge.").

into the public storehouse of technical knowledge[41] reduces research-and-development (R&D) waste,[42] spurs creativity,[43] leads others "to climb onto the patentee's shoulders in seeking improvements or wholly new inventions,"[44] and, of course, extends the frontiers of science and technology.[45]

It is for these reasons that disclosure is regarded as the "centerpiece of patent policy."[46] As discussed below, the patent system goes to great lengths to promote and safeguard the disclosure function.

B. The Enablement Requirement

An oft-touted justification for the patent system is that society will get some benefit from the invention's disclosure.[47] In theory, the disclosure adds to the public storehouse of useful knowledge which, in turn, promotes technological progress.[48] But this paradigm only works if the disclosure is sufficiently robust from a technical standpoint to actually teach meaningful information about the invention to the public.

Enablement is the patentability requirement with the principal task of safeguarding the teaching function.[49] It compels

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41. *See* cases cited *supra* note 40; *In re* Argoudelis, 434 F.2d 1390, 1394 (C.C.P.A. 1970) (Baldwin, J., concurring) (noting that the full disclosure of how to make and use the invention "adds a measure of worthwhile knowledge to the public storehouse").

42. Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 267 n.79 (1994).

43. *Kewanee*, 416 U.S. at 481; *see also* MICHAEL A. GOLLIN, DRIVING INNOVATION 15–19 (2008) (explaining that disclosure adds to the pool of accessible knowledge that other creative individuals can use and improve upon).

44. Dam, *supra* note 42, at 264; *cf.* Rich, *supra* note 38, at 400 ("The literature of the art is enriched, another way of doing something is made known and even if it be inferior to the means already known, there is no telling when it may give another inventor an idea or when someone will improve on it in such a way as to surpass all that is known.").

45. *See* Rich, *supra* note 38, at 400 ("Whenever novel subject matter, unobvious to the workers of ordinary skill in an art, is published, progress in the art is promoted.").

46. Note, *The Disclosure Function of the Patent System (or Lack Thereof)*, 118 HARV. L. REV. 2007, 2011 (2005); *see also* Pfaff v. Wells Elecs, Inc., 525 U.S. 55, 63 (1998) (explaining that the patent system should be viewed as "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").

47. *See Kewanee*, 416 U.S. at 481 (explaining that the federal government "is willing to pay the high price" of exclusivity conferred by a patent for its disclosure, which, "it is assumed, will stimulate ideas and the eventual development of further significant advances in the art").

48. *See Argoudelis*, 434 F.2d at 1394 (Baldwin, J., concurring).

49. FED. TRADE COMM'N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY ch. 4, at 3–4 (2003) (explaining that enablement plays a central role in "safeguard[ing] the patent system's disclosure function by ensuring relatively swift dissemination of technical information from which others . . . can learn") [hereinafter FTC REPORT].

an applicant to prepare a written description of the invention sufficient to teach a person having ordinary skill in the art (PHOSITA)[50] how to make and use it without undue experimentation.[51] Enablement is the quid pro quo of the patent bargain[52] because it ensures that (1) the applicant's disclosure sufficiently enriches the public storehouse of technical knowledge and (2) the public will get complete possession of the invention once the patent expires.[53]

Enablement is a standard.[54] Determining whether a disclosure was enabling as of its filing date[55] is a legal conclusion that rests on underlying factual inquiries.[56] The Federal Circuit set forth several factors relevant to the enablement analysis in *In re Wands*.[57] They are: (1) the amount of direction or guidance presented in the disclosure, (2) the existence of working examples, (3) the nature of the invention, (4) the predictability or unpredictability of the art, (5) the PHOSITA's level of skill, (6) the state of the prior art (preexisting knowledge and technology already available to the public),[58] (7) the scope of the claims,[59] and

50. The PHOSITA is a hypothetical construct of patent law akin to the reasonably prudent person in torts. *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 the sophistication of the technology, the educational level of the inventor, the educational level of active workers in the field, the types of problems encountered in the art, prior art solutions to those problems, and the rapidity with which innovations are made. Envtl. Designs, Ltd. v. Union Oil Co. of Cal., 713 F.2d 693, 696 (Fed. Cir. 1983).

51. *In re* Wright, 999 F.2d 1557, 1561 (Fed. Cir. 1993). While "undue experimentation" does not appear in the statute, "it is well established that enablement requires that the specification 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).

52. *See supra* note 27 and accompanying text.

53. *See supra* note 31.

54. Atlas Powder Co. v. E.I. du Pont de Nemours & Co., 750 F.2d 1569, 1576–77 (Fed. Cir. 1984); Seymore, *Heightened Enablement*, *supra* note 19, at 130.

55. MagSil Corp. v. Hitachi Glob. Storage Techs., Inc., 687 F.3d 1377, 1380 (Fed. Cir. 2012) ("The enablement determination proceeds as of the effective filing date of the patent.").

56. Sitrick v. Dreamworks, LLC, 516 F.3d 993, 999–1000 (Fed. Cir. 2008).

57. *In re* Wands, 858 F.2d 731, 737 (Fed. Cir. 1988).

58. *See* Kimberly-Clark Corp. v. Johnson & Johnson, 745 F.2d 1437, 1453 (Fed. Cir. 1984) (defining prior art) (citing Graham v. John Deere Co., 383 U.S. 1, 6 (1966)). Prior art is used to determine the novelty or nonobviousness of claimed subject matter in a patent application or patent. *Id.*; *see also infra* note 103 and accompanying text.

59. Claim scope is the "technological territory" that the inventor claims is his or hers to control. Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 844 (1990). The enablement provided in the patent document serves as a constraint on claim scope. O'Reilly v. Morse, 56 U.S. (15 How.) 62, 121 (1854); *see also* Nat'l Recovery Techs., Inc. v. Magnetic Separation Sys., Inc., 166 F.3d 1190, 1196 (Fed. Cir. 1999) (noting that enablement's purpose is to "ensure[] that the public knowledge is enriched by the patent specification to a degree at least commensurate with the scope of

(8) the quantity of experimentation necessary to practice the claimed invention.[60] While not mandatory,[61] the *Wands* factors are ubiquitous in evaluating enablement[62]—probably because they touch on issues that are important in virtually all enablement determinations.[63] These include issues related to the technical scope and substance of the disclosure (factors one and two),[64] the nature of the technology (factors three and four),[65] the PHOSITA's knowledge and skill (factor five),[66] and the scope of the claim sought (factor seven).[67]

Given that enablement is a standard, the *Wands* factors can be manipulated to modulate the enablement threshold. For example, a PHOSITA might benefit from more teaching in a nascent technology because there is little extant knowledge in the field to draw from.[68] This would also be true for fields where results are "uncertain, unpredictable, and unexpected."[69] But even in these cases where there is a high enablement threshold, such as when "full scope" enablement is demanded,[70] enablement still has

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the claims"). The scope of enablement is the sum of what is taught in the written description plus what a PHOSITA already knows. *Id.*

60. *Wands*, 858 F.2d at 737 (factors reordered from original text).

61. Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1213 (Fed. Cir. 1991) (noting that the *Wands* factors are illustrative and not mandatory).

62. *See* 3 DONALD S. CHISUM, CHISUM ON PATENTS § 7.03 (1978).

63. The factors are interrelated. For example, if the PHOSITA is highly intelligent (factor five), an applicant need not disclose what the PHOSITA already knows or can easily figure out (factors one and two). Spectra-Physics, Inc. v. Coherent, Inc., 827 F.2d 1524, 1534 (Fed. Cir. 1987).

64. The two factors are clustered together because working examples are a form of guidance. Seymore, *Teaching Function*, *supra* note 19, at 641–46.

65. *See infra* note 111 (discussing predictable and unpredictable technologies).

66. This factor has become increasingly important over the past decade as the Federal Circuit has compelled patentees to enable the full scope of the claimed invention. *See infra* note 70.

67. Enablement places an outer limit on claim scope. *See* sources cited *supra* note 59.

68. Chiron Corp. v. Genentech, Inc., 363 F.3d 1247, 1254 (Fed. Cir. 2004) ("The law requires an enabling disclosure for nascent technology because a person of ordinary skill in the art has little or no knowledge independent from the patentee's instruction.").

69. Schering Corp. v. Gilbert, 153 F.2d 428, 433 (2d Cir. 1946).

70. The U.S. Court of Appeals for the Federal Circuit has reiterated that "[c]laims are not enabled when, at the effective filing date of the patent, [a PHOSITA] could not practice their *full scope* without undue experimentation." Wyeth & Cordis Corp. v. Abbott Labs, 720 F.3d 1380, 1384 (Fed. Cir. 2013) (emphasis added) (citing MagSil Corp. v. Hitachi Glob. Storage Techs., Inc., 687 F.3d 1377, 1380–81 (Fed. Cir. 2012)). For commentary, see Sean B. Seymore, *The Enablement Pendulum Swings Back*, 6 NW. J. TECH. & INTELL. PROP. 278, 284–89 (2008) [hereinafter Seymore, *Enablement Pendulum*] (describing the emergence of "full scope" enablement as a "lever to invalidate patents"); James Farrand et al., *"Reform" Arrives in Patent Enforcement: The Big Picture*, 51 IDEA 357, 415, 417 (2011) (describing the full scope enablement doctrine and noting that it "can invalidate many existing broad patent claims, particularly if it continues to be applied as broadly as it is being stated").

a limited teaching function. After all, requiring an inventor to describe how to make and use all that is claimed does not shed light as to how or why the invention works. Thus, more rigorous enforcement of the extant enablement requirement cannot solve the problem with uninformative patents.

III. PERMITTING UNINFORMATIVE DISCLOSURES

A. Understanding the Nondisclosure Rule

The rule that an inventor need not know how or why an invention works has an interesting history in patent law. Consider the 1911 Supreme Court case *Diamond Rubber Co. v. Consolidated Rubber Tire Co.*[71] In that case, the patent at issue was for "improvements in rubber tire wheels . . . designed for use on ordinary vehicles, such as wagons, buggies, and carriages."[72] The patentee's tire became a commercial success because it had an anti-tilting feature that distinguished it from tires in the prior art (preexisting knowledge and technology already available to the public).[73] But since the inventor did not discuss the anti-tipping feature in the patent's written description, the accused infringer argued that the patent was invalid.[74] The Court disagreed:

> A patentee may be baldly empirical, seeing nothing beyond his experiments and result . . . . It is certainly not necessary that [an inventor] understand or be able to state the scientific principles underlying his invention, and it is immaterial whether he can stand a successful examination as to the speculative ideas involved.[75]

Thus, an invention is patentable even if "the theory of operation is not correctly explained or even understood."[76] All that matters is if the disclosure is sufficiently enabling to allow a PHOSITA to practice the invention.[77]

This nondisclosure rule explains why inventions are patentable even if they come about through guessing, dumb luck,

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71. Diamond Rubber Co. v. Consolidated Rubber Tire Co., 220 U.S. 428, 435–36 (1911).

72. *Id.* at 430.

73. *See* Kimberly-Clark Corp. v. Johnson & Johnson, 745 F.2d 1437, 1453 (Fed. Cir. 1984) (defining prior art) (citing Graham v. John Deere Co., 383 U.S. 1, 6 (1966)). An invention that is identical to or a trivial extension of what is known in the prior art is unpatentable. 35 U.S.C. §§ 102(a), 103.

74. *Diamond Rubber*, 220 U.S. at 434.

75. *Id.* at 435–36.

76. Newman v. Quigg, 877 F.2d 1575, 1581–82 (Fed. Cir. 1989) (citing *Diamond Rubber*, 220 U.S. at 435–36).

77. *In re* Chilowsky, 229 F.2d 457, 463 (C.C.P.A. 1956).

or serendipity.[78] Perhaps the quintessential modern illustration of this point is the 1999 case *In re Cortright*.[79] The inventor discovered that Bag Balm, an ointment first made in 1899 for treating irritated cow udders,[80] could successfully treat baldness in humans.[81] While the disclosure speculated as to which Bag Balm ingredient caused the hair growth, no proof was given for the observed physiological phenomenon.[82] Viewing the inventor's observations as inherently suspect,[83] the Patent Office rejected the method-of-treatment claim for non-enablement.[84] Writing for the court, Judge Mayer explained that this was an improper basis for rejection because "an inventor [need not] correctly set forth, or even know, how or why the invention works."[85] It was also improper for the Patent Office to suggest that the inventor had to offer proof for the claimed result.[86] The patent was issued the following year[87] with a single claim[88] and a written description that taught how much Bag Balm to apply and the amount of time in which to expect results.[89] But particularly relevant for present purposes, the patent's disclosure provided no substantive technical information about how or why the invention works.[90]

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78. *See* Sean B. Seymore, *Serendipity*, 88 N.C. L. REV. 185 (2009) (exploring accidental discoveries in patent law and their alignment with the substantive law of invention).

79. *In re* Cortright, 165 F.3d 1353, 1359 (Fed. Cir. 1999).

80. *FAQs*, BAG BALM, http://www.bagbalm.com/shop/faqs [https://perma.cc/4NU6-2SZP].

81. *Cortright*, 165 F.3d at 1355.

82. *Id.* at 1359.

83. The Patent Office and the courts had long regarded baldness treatments as an "inherently unbelievable undertaking." *Id.* at 1357; *see also In re* Oberweger, 115 F.2d 826, 829 (C.C.P.A. 1940) (affirming the Patent Office's rejection for a baldness treatment despite the inclusion of scientific evidence because such preparations were "generally understood to be a fraud upon the public"); *In re* Ferens, 417 F.2d 1072, 1074 (C.C.P.A. 1969) (reaching the same conclusion because baldness treatments belonged to "a field of endeavor where 'little of a successful nature ha[d] been developed' despite constant effort . . . ."); Seymore, *supra* note 7, at 1514–17 (criticizing these views). But *Cortright* explained that views have now changed and the Patent Office had granted approximately one-hundred patents for treating baldness. *Cortright*, 165 F.3d at 1357.

84. *Cortright*, 165 F.3d at 1359.

85. *Id.* (quoting Newman v. Quigg, 877 F.2d 1575, 1581 (Fed. Cir. 1989)).

86. *Id.*

87. *See* Treatment of Scalp Baldness with 8-Hydroxyquinoline Sulfate, U.S. Patent No. 6,033,676 (filed Mar. 11, 1992) (issued Mar. 7, 2000).

88. It recites "[t]he method of treating scalp baldness with an antimicrobial to restore hair growth, which comprises rubbing into the scalp the ointment wherein the active ingredient 8-hydroxy.quinoline sulfate 0.3% is carried in a petrolatum and lanolin base." *Id.* at col. 2 ll. 61–66.

89. *See, e.g.*, *id.* at col. 2 ll. 7–47 (providing working examples with three human subjects).

90. The patent merely speculated as to what was going on. *See id.* col. 2 ll. 1–4 ("*It is believed* that the rubbed-in ointment offsets the effects of lower levels of male hormones in

B. The Transparent-Opaque Invention Dichotomy

It is fair to say that whether an inventor discloses how or why an invention works only matters if a PHOSITA cannot easily elucidate the omitted information. Put differently, if a PHOSITA can look at an invention and figure out how or why it works, there is no need for the inventor to disclose that information in the patent document.[91] Indeed, minimal disclosure is unobjectionable for what I define as *transparent* inventions, which, once seen, can be readily made, used, and understood.[92]

To illustrate, consider a (patented) paper clip.[93] The invention is so simple that a drawing or commercial product is sufficient to adequately disclose how or why it works.[94] A PHOSITA who wanted to understand the physical forces involved in the friction between the wire and the paper that cause binding could turn to readily available knowledge in the field (like a physics textbook) to obtain this information. So asking the inventor to disclose how or why a paper clip works in the patent document would be redundant and unnecessary.[95] In sum, the invention's simplicity makes it transparent with respect to its inner workings.

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the papilla and/or provides an antimicrobial effect on infection." (emphasis added)).

91. Similarly, if a PHOSITA can look at an invention and figure out how to make and use it, there is no need to provide a detailed disclosure. Lawther v. Hamilton, 124 U.S. 1, 9 (1888) ("These several steps being well known in the art when the patent was applied for, required no particular explanation."); *In re* Eltgroth, 419 F.2d 918, 921 (C.C.P.A. 1970) ("This court has often observed that the minutiae of descriptions or procedures perfectly obvious to one of ordinary skill in the art yet unfamiliar to laymen need not be set forth."). This is because "patents are written by and for skilled artisans." Vivid Techs., Inc. v. Am. Sci. and Eng'g, Inc., 200 F.3d 795, 804 (Fed. Cir. 1999); *cf.* S3 Inc. v. NVIDA Corp., 259 F.3d 1364, 1371 (Fed. Cir. 2001) ("The law is clear that patent documents need not include subject matter that is known in the field of the invention and is in the prior art, for patents are written for persons experienced in the field of the invention.").

92. Transparent inventions are akin to—but not the same as—so-called "self-disclosing" inventions. *See* Strandburg, *supra* note 37, at 105–06 (coining the term, "self-disclosing"). They are defined as inventions that are easy to replicate because reproduction is enabled by mere commercialization. *Id.* at 105. In other words, the "invention itself reveals its operation," including how to make and use it. Anderson, *supra* note 36, at 1583. But a self-disclosing invention need not be transparent—that is, the invention itself might reveal how to make and use it but *not* how and why it works. *Id.*

93. *See, e.g.*, Paper Clip, U.S. Patent No. 581,901 (filed Apr. 13, 1896).

94. Christopher A. Cotropia, *Physicalism and Patent Theory*, 69 VAND. L. REV. 1543, 1559 (2016); *cf.* Mark A. Lemley, *The Surprising Virtues of Treating Trade Secrets as IP Rights*, 61 STAN. L. REV. 311, 338–39 (2008) (noting that an invention like a paper clip or wheel is easy to discern by evaluating the product).

95. The same is true for enablement. *See* Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1384 (Fed. Cir. 1986) ("[A] patent need not teach, and preferably omits, what is well known in the art."); Ajinomoto Co. v. Archer-Daniels-Midland Co., 228 F.3d 1338, 1347 (Fed. Cir. 2000) (explaining that a patent "is not a scientific treatise, but a document that presumes a readership skilled in the field of the invention"); *see also* Loom Co. v. Higgins, 105 U.S. 580, 586 (1881) (explaining that an inventor is not required to disclose what is already familiar to the PHOSITA).

Yet the story is quite different for more complex inventions like chemicals, pharmaceuticals, or industrial processes. Here a drawing or physical product neither reveals how to make or use the invention *nor* how or why it works—meaning that this information cannot be discerned by inspection.[96] And elucidating this information through reverse engineering is difficult, if not impossible (at least without considerable effort or expense).[97] I call this type of invention *opaque* with respect to its inner workings.

To illustrate, consider again a patented method for treating baldness with Bag Balm.[98] Bag Balm is comprised of four ingredients—petrolatum, lanolin, 8-hydroxyquinoline, and paraffin wax.[99] The patent teaches that 8-hydroxyquinoline is the active ingredient since it is well known in the art that petrolatum, lanolin, and paraffin wax do not regrow hair.[100] But the patent discloses *nothing* about how or why 8-hydroxyquinoline works to restore hair growth. Again, such disclosure is not required to comply with the enablement requirement.[101] This means that a PHOSITA who wants to figure out how or why 8-hydroxyquinoline works must engage in some experimentation—an activity which certainly would require a license from the patentee.[102] The bottom line is that the omitted technical information will be hard to obtain (otherwise the invention would be unpatentable for lacking novelty or nonobviousness).[103] And under the present disclosure paradigm, the inventor has no incentive to figure out the invention's inner workings before filing or, for that matter, to disclose more information than that minimally required by the

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96. This is also true for non-self-disclosing inventions. Lemley, *supra* note 94, at 338–39.

97. Anderson, *supra* note 35, at 958 n.222 (discussing non-self-disclosing inventions); *see also* Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse Engineering*, 111 YALE L.J. 1575, 1582–90 (2002) (describing legal and economic perspectives on reverse engineering).

98. *See supra* note 87.

99. *See supra* note 80.

100. *See* Treatment of Scalp Baldness with 8-Hydroxyquinoline Sulfate, U.S. Patent No. 6,033,676, col 2 ll. 50–55 (filed Mar. 11, 1992) (issued Mar. 7, 2000).

101. *See supra* notes 1–2 and accompanying text.

102. *See supra* note 14 and accompanying text.

103. Novelty ensures that an invention is new by denying a patent if the claimed subject matter is identical to what is already known. *See* 35 U.S.C. §§ 101–102; *In re* Marshall, 578 F.2d 301, 304 (C.C.P.A. 1978) (citations omitted). Nonobviousness ensures that an invention is "new enough," by denying patents for trivial extensions of technology already in the public domain. 1 CHISUM, *supra* note 62, §§ 3.01, 103(a). Thus, both requirements protect the public domain—novelty targets inventions that are identically disclosed in the prior art and nonobviousness targets those that are sufficiently close to the prior art and within the PHOSITA's technical grasp. *See supra* note 58 and sources cited therein.

patent statute.[104] Thus, the nondisclosure rule is particularly problematic for opaque inventions.

History reveals why the rule developed. At one time most inventions were simple and transparent—they were predominately industrial, electrical-mechanical devices like pressed cork, valve gaskets, die-cast parts, and starter motors.[105] Again, nondisclosure of how or why the invention worked in the patent document was not a major concern because a PHOSITA could figure out their inner workings with minimal effort—through dismantling or perhaps a mere cursory inspection.[106] But by the middle of the twentieth century the invention landscape had become increasingly populated with chemical inventions like drugs, synthetic fibers, and detergents.[107] Disclosure in the patent document became crucial because inspection or chemical analysis revealed very little helpful information about how to make and use the invention, let alone how and why it worked, and "often yield[ed] more questions than answers."[108]

Thus, inventions have become more opaque over time. To be sure, courts contending with patent matters have long recognized the difference between a simple mechanical device and a complex chemical compound.[109] As for enablement, what eventually

104. As a general matter, "under the existing regime, patentees have every incentive to disclose as little as possible." Gideon Parchomovsky & Michael Mattioli, *Partial Patents*, 111 COLUM. L. REV. 207, 209 (2011) (citing R. Polk Wagner, *Understanding Patent-Quality Mechanisms*, 157 U. PA. L. REV. 2135, 2150–51 (2009) (discussing factors that lead applicants to limit their disclosures)); H. JACKSON KNIGHT, PATENT STRATEGY FOR RESEARCHERS AND RESEARCH MANAGERS 88–89 (2d ed. 2001) (explaining how much information an inventor should disclose). Of course, the inventor could forego patent protection and opt to keep the technical information secret. Strandburg, *supra* note 37, at 105–06; Lemley, *supra* note 94, at 339 ("Companies . . . who develop inventions that are not transparent to the world, such as chemical processes and some formulas—might well decide to keep an invention secret in the absence of legal protection.").

105. Daniel C. Munson, *The Patent-Trade Secret Decision: An Industrial Perspective*, 78 J. PAT. & TRADEMARK OFF. SOC'Y 689, 695–96 (1996).

106. *Id.* at 696.

107. *See* John Hoxie, *A Patent Attorney's View*, 47 J. PAT. & TRADEMARK OFF. SOC'Y 630, 636 (1965) (exploring the evolution of inventions from being mostly electrical-mechanical to chemical in nature); William D. Noonan, *Patenting Medical Technology*, 11 J. LEGAL MED. 263, 263–69 (1990) (same).

108. Munson, *supra* note 105, at 698.

109. *See, e.g.*, Tyler v. Boston, 74 U.S. (7 Wall.) 327, 330 (1868) ("Now a machine which consists of a combination of devices is the subject of invention, and its effects may be calculated *a priori*, while a discovery of a new substance by means of chemical combinations of known materials is empirical and discovered by experiment."); Naylor v. Alsop Process Co., 168 F. 911 919 (8th Cir. 1909) ("It should also be borne in mind in considering this subject that reasoning by analogy in a complex field like chemistry is very much more restricted than in a simple field like mechanics.").

emerged[110] was a separate body of enablement jurisprudence for chemistry, pharmacology, and related "unpredictable" fields.[111]

Yet while the courts might require more teaching in the patent document to sufficiently enable a PHOSITA to make and use an opaque invention (particularly if it emerges from an unpredictable field or nascent technology),[112] there is no corresponding obligation to elucidate or disclose how or why it works.[113] Those interested in this omitted information must fend for themselves and try to figure it out. Placing this burden on the public rather than the inventor is the principal consequence of the nondisclosure rule.

But the rule's persistence is an anomaly. Patent law is one of the most dynamic areas of the law because it evolves as technology evolves.[114] This framework in theory allows the patent system "to adapt flexibly to both old and new technologies, encompassing 'anything under the sun that is made by man.'"[115] Maintaining the

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110. Perhaps not surprisingly, courts initially responded by treating all inventions the same. *See* Hoxie, *supra* note 107, at 636 (explaining how the judiciary tried to fit chemical inventions into the mold of mechanical-electrical inventions and contending that the judiciary's interpretation of the patent statute did not change even as chemical inventions became more frequent). "This shoehorning [often] led to nonsensical outcomes . . . ." Sean B. Seymore, *Rethinking Novelty in Patent Law*, 60 DUKE L.J. 919, 947–48 (2011).

111. As previously discussed, enablement depends on the nature of the technology. *See In re* Wands, 858 F.2d 731, 737 (Fed. Cir. 1988), discussed *supra* Part II.B. An enduring approach is to classify a technological field as either "unpredictable" or "predictable." 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. 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"). By contrast, applied technologies like electrical and mechanical engineering are often regarded as "predictable" arts because they are rooted in well-defined, predictable factors. *In re* Vaeck, 947 F.2d 488, 496 (Fed. Cir. 1991). Of course, enablement depends on the facts in a given case because, for example, a mechanical device can have unpredictable features. *See In re* Bowen, 492 F.2d 859, 861–62 (C.C.P.A. 1974) (criticizing the dichotomy and advocating an alternative classification). For a deeper discussion of the predictable-unpredictable dichotomy, see Seymore, *Heightened Enablement*, *supra* note 19, at 136–39; Seymore, *Enablement Pendulum*, *supra* note 70, at 282–84.

112. *See supra* notes 50–51 and accompanying text.

113. *See supra* Part II.A.

114. A famous example is the removal of judicially-imposed limitations on patent-eligible subject matter. *See* Diamond v. Chakrabarty, 447 U.S. 303, 310 (1980) (holding that live, genetically engineered microorganisms are patentable); Rebecca S. Eisenberg, *The Story of* Diamond v. Chakrabarty*: Technological Change and the Subject Matter Boundaries of the Patent System*, *in* INTELLECTUAL PROPERTY STORIES 327, 327–57 (Jane C. Ginsburg & Rochelle Cooper Dreyfuss eds., 2006) (providing commentary). This responsiveness is not surprising because "any law[s] purporting to provide a regulatory foundation for innovation must be able to account for both the broad range of technologies and the rapid pace of [technological] change." R. Polk Wagner, *Of Patents and Path Dependency: A Comment on Burk and Lemley*, 18 BERKELEY TECH. L.J. 1341, 1344 (2003).

115. Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575,

nondisclosure rule, however, evinces a one-size-fits-all approach to transparent and opaque inventions as they are treated similarly. The rule is a rare example of the patent system's unwillingness to adapt to the evolution of the invention landscape over time.[116] The important question is whether there should be one rule that applies to all inventions or whether the patent law's disclosure function can be improved by tailoring it to the specific attributes of different inventions.[117]

IV. POLICY TRADEOFFS

Most would agree that disclosure of how or why an invention works in the patent document would be ideal—particularly for opaque inventions.[118] Again, the ultimate beneficiary of disclosure is the public, which is able to enjoy the technical knowledge as soon as the patent document publishes.[119] Other researchers could immediately build upon the disclosed knowledge without having to waste time and resources figuring out the invention's inner workings themselves.[120] Yet, courts have been reluctant to demand such additional disclosure, perhaps out of a concern that such a demand would upset the delicate balance in patent law between the public welfare and the inventor's incentives.[121]

A. Early Disclosure

Tinkering with disclosure raises concerns about inventor behavior. For example, *requiring* an inventor to disclose how or why an invention works *as a condition for patentability* could delay filing or possibly push inventors out of the patent system

1576 (2003) (quoting *Chakrabarty*, 447 U.S. at 309).

116. *Id.* at 1633–34, 1653–54.

117. *Cf.* ADAM B. JAFFE & JOSH LERNER, INNOVATION AND ITS DISCONTENTS 203 (2004) (criticizing the one-size-fits-all regime and asking "whether we should have one set of patent rules that govern all inventions, or whether the system can be [improved] by tailoring patent rules to the specific attributes of different technologies").

118. *See supra* Part II.B.

119. *See supra* note 30 and accompanying text; Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 151 (1989) (explaining that "the ultimate goal of the patent system is to bring new . . . technologies into the public domain through disclosure" which aligns "with the very purpose of the patent laws" of providing "building blocks of further innovation").

120. *See supra* text accompanying notes 10–15.

121. *Cf.* DONALD S. CHISUM ET AL., PRINCIPLES OF PATENT LAW 1 (3d ed. 2004) ("Our patent laws are generally seen to operate as part of an interdependent mix of incentives and restraints that bestow benefits and impose costs on society and individuals alike. Under this view, patent law strives to strike a balance between the promotion of technological invention and the dissemination of and access to its fruits.").

altogether.[122] This would give the public a delayed disclosure or perhaps none at all.[123]

Early disclosure is viewed as a basic goal of the patent system. In fact, "the patent law[s] place[] strong pressure on filing the patent application *early* in the development of the technology, often before . . . all of the boundaries [are] fully explored."[124] Inventors file early to attract investors,[125] minimize risk,[126] and to safeguard their patent rights in the United States and abroad.[127] This gives rise to a tradeoff between more pre-filing work to produce a more robust disclosure and the perceived need to race to the Patent Office with an underdeveloped invention.[128] While

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122. *Cf.* Hormone Research Found., Inc. v. Genentech, Inc., 904 F.2d 1558, 1568 (Fed. Cir. 1990) (arguing that limiting the scope of the claims to the specific embodiments disclosed to satisfy the enablement requirement of § 112 is a poor way to stimulate invention and discourages early disclosure). *See infra* note 130 and accompanying text.

123. Recall that the public gets detailed knowledge about the invention as soon as the patent document publishes. *See supra* note 30 and accompanying text. Patent documents include issued patents and published patent applications. Gary M. Hoffman & Michael C. Greenbaum, *The Duty of Disclosure Requirements*, 16 AIPLA Q. J. 124, 146–47 (1988). Since 1999, most patent applications publish eighteen months after the earliest effective filing date. 35 U.S.C. § 122(b)(1)(A) (2012). Once a patent application publishes, the information it discloses is considered known to the public. *See id.* at § 102.

124. Hilton Davis Chem. Co. v. Warner-Jenkinson Co., 62 F.3d 1512, 1536 (Fed. Cir. 1995) (en banc) (Newman, J., concurring) (emphasis added), *rev'd on other grounds*, 520 U.S. 17 (1997); *see also* Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 267–71 (1977) (explaining the rules in patent law that force and permit early filing)).

125. It is axiomatic in patent law that many inventors must rely on investors to cover the hefty costs of patent procurement and commercialization. *See* JOHN SAMSON, INVENTIONS AND THEIR COMMERCIAL DEVELOPMENT 51 (1896) ("To have the use of capital is nearly always indispensable for the development of an invention, and, unless the inventor is of that fortunate class who have the means to work their own patents, he must appeal for support to one or more people with money."); Mark A. Lemley, *Reconceiving Patents in the Age of Venture Capital*, 4 J. SMALL & EMERGING BUS. L. 137, 143–44 (2000) (discussing the need for venture capital); Craig Allen Nard, *Certainty, Fence Building, and the Useful Arts*, 74 IND. L.J. 759, 759 (1999) ("The prospect of certainty in the patentee's property interest has several benefits, one of which is to create a sense of security which permits the patentee to secure risk capital from investors, which in turn facilitates the commercialization of the claimed invention." (citing Patlex Corp. v. Mossinghoff, 758 F.2d 594, 599 (Fed. Cir. 1985) ("[E]ncouragement of investment-based risk is the fundamental purpose of the patent grant . . . .")).

126. *See, e.g.*, Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 393–94 (2010) ("If building a prototype is costly—take, for example, fabricating a new type of computer chip—the risks of not securing a patent [before actual reduction to practice] may be too large to justify doing so.").

127. *See* 35 U.S.C. § 102(a) (2012) (encouraging diligence by penalizing inventors for the delayed filing of patent applications); Convention on the Grant of European Patents, art. 54(2), Oct. 5, 1973, 1065 U.N.T.S. 255, 272 (invoking an absolute novelty requirement which regards any pre-filing disclosure, including activity by the inventor, as patent defeating).

128. In a formal sense, a patent race "is a race among competing firms to be the first to discover and patent some new idea having commercial potential." WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 300

early filing has drawbacks,[129] a new disclosure regime arguably would tip the scales too far in one direction.[130]

However, additional disclosure as to why or how an invention works need not be present when the patent application is initially filed.[131] One can envision a paradigm wherein an inventor submits a patent application at time *X* to secure the early filing date and then supplements the disclosure at time *Y* with additional information about how or why the invention works.[132] More technical information is generated between time *X* and time *Y* because many inventors with commercially-viable inventions continue R&D after filing and inevitably learn more about the invention along the way.[133]

B. Stimulating Innovation

The disclosure function in patent law promotes technological progress by disseminating information.[134] Disclosure adds to the public storehouse of technical knowledge that others can use.[135] This "promote[s] the flow of information about inventions from patentees to potential future innovators, thereby stimulating increased and speedier follow-up innovation."[136] Theory posits that

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(2003). But races sometimes "encourage premature and sketchy technological disclosures in hastily-filed patent applications." Wendy Schacht & John R. Thomas, *Patent Reform: Innovation Issues*, *in* PAT. TECH. 1, 11 (Juanita M. Branes ed., 2007).

129. Seymore, *Teaching Function*, *supra* note 19, at 659–61 (arguing that ex ante incentives which encourage early filing can thwart innovation); Christopher A. Cotropia, *The Folly of Early Filing in Patent Law*, 61 HASTINGS L.J. 65, 88–119 (2009) (discussing the costs of early filing).

130. *See* Paulik v. Rizkalla, 760 F.2d 1270, 1276 (Fed. Cir. 1985) (en banc) (arguing that the obligation to disclose, which adds to the public storehouse of knowledge, should not "diminish[ ] the patent-supported incentive to innovate."). *But see* Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480–81 (1974) (explaining that one purpose of the patent system is to promote disclosure of inventions which stimulates further innovation and permits the public to practice the invention once the patent expires).

131. *In re* Cortright, 165 F.3d 1353, 1359 (Fed. Cir. 1999).

132. The notion of post-filing disclosure to help improve the patent law's disclosure function has attracted the attention of several scholars. *See, e.g.*, Sean B. Seymore, *Patenting Around Failure*, 166 U. PA. L. REV. (forthcoming 2018) (proposing a regime which would encourage applicants to amend patent documents to include information about negative results learned from post-filing experimentation); Sean B. Seymore, *Patent Asymmetries*, 49 U.C. DAVIS L. REV. 963, 1000–01 (2016) (proposing a supplementation rule which would allow an applicant to amend the patent document to include additional technical information to support patentability); Jeanne C. Fromer, *Dynamic Patent Disclosure*, 69 VAND. L. REV. 1715, 1722–28 (2016) (advocating that patentees should be required to disclose information about post-filing commercialization and licensing).

133. Cotropia, *supra* note 129, at 88, 93.

134. *See* discussion *supra* Part II.A.

135. *See* sources cited *supra* note 43. For a discussion of the storehouse, see *supra* text accompanying notes 47–53.

136. Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 599 (2009).

disclosure inspires others to learn about the invention, design around it, improve upon it, or conceive of entirely new inventions—all during the patent term.[137]

The disclosure function rests on the technical robustness of the disseminated information. For instance, if the disseminated information is identical to or a trivial extension of what already exists in the public storehouse, the inventor's disclosure provides no benefit to the public.[138] Importantly for present purposes, a disclosure lacking in technical substance may add very little to the public storehouse for potential future innovators to build upon.[139] This is why some scholars argue that the extant enablement requirement is too weak[140]—the inventor need only provide a cookbook recipe for others to replicate.[141] By contrast, describing how or why an invention works produces a meaningful disclosure because it fills a knowledge void with substantive technical information that future innovators need not fill themselves.[142] This would promote technological progress.

However, disclosing how or why an invention works promotes innovation in at least two other ways. First, the additional technical information reduces uncertainty. Elucidating an invention's inner workings takes time and effort which places it further down the R&D path. If this additional technical information is disclosed at the application stage, it reduces uncertainty about the invention during patent examination. A description of the invention's inner workings not only lends credibility to the inventor's assertions (and to the overall inventive concept),[143] but also bolsters enablement—particularly for

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137. *Id.* at 548–49.

138. And the invention would be unpatentable for lacking novelty or nonobviousness. *See supra* note 103; Graham v. John Deere Co., 383 U.S. 1, 6 (1966) (explaining that Congress cannot, as a constitutional matter, "authorize the issuance of patents whose effects are to remove existent knowledge from the public domain, or to restrict free access to material already available").

139. In other words, the disclosure lacks sufficient technical detail to be helpful. It does little to advance technological progress, which the Constitution requires. *Graham*, 383 U.S. at 6.

140. *See, e.g.*, Parchomovsky & Mattioli, *supra* note 104, at 230 (explaining that "[t]he Patent Act imposes a very modest enablement requirement"); Stuart J. H. Graham & Ted Sichelman, *Why Do Start-ups Patent?*, 23 BERKELEY TECH. L.J. 1063, 1088 (2008) (describing the enablement requirement as "weak"); Merges & Nelson, *supra* note 59, at 845 (explaining how the enablement requirement has been applied "rather loosely").

141. *See supra* note 17 and accompanying text.

142. *See supra* text accompanying notes 13–15.

143. The examiner can reject an invention for lacking utility under § 101 if the applicant's disclosure "suggest[s] an inherently unbelievable undertaking or involve[s] implausible scientific principles." *In r*e Cortright, 165 F.3d 1353, 1357 (Fed. Cir. 1999) (quoting *In re* Brana, 51 F.3d 1560, 1566 (Fed. Cir. 1995)). Inventions emerging from new, poorly understood, and paradigm-shifting technologies as well as those from fields with a

embodiments that the inventor has not made or tested.[144] But even if the additional technical information is disclosed post-issuance, it provides the inventor and potential licensees more certainty as to the invention's potential (commercial) value.[145]

Second, disclosing how or why an invention works places patent documents on par with other forms of technical literature. While inventors and innovators frequently rely on patents as a source of technical knowledge,[146] the disclosed information is often lacking in substance when compared to other forms of technical literature.[147] Those reading the patent may need to turn elsewhere to fill in the gaps.[148] One reason for this knowledge gap is that an inventor can obtain a patent with no (or very little) pre-filing experimentation.[149] Relatedly, an inventor need not verify that everything that is claimed actually works before filing a patent application.[150] The inventor "may include one or more 'prophetic'

poor track record of success are the most vulnerable. Seymore, *supra* note 7, at 1494.

144. An inventor can obtain a patent without actually making and testing everything that is claimed. *In re* Angstadt, 537 F.2d 498, 502–03 (C.C.P.A. 1976); *see also In re* Chilowsky, 229 F.2d 457, 461 (C.C.P.A. 1956) ("The mere fact that something has not previously been done clearly is not, in itself, a sufficient basis for rejecting all applications purporting to disclose how to do it."). It is well settled in U.S. patent law that the mental act of conception of the idea, and not any physical act, is the most important facet of the inventive process. Pfaff v. Wells Elecs., Inc., 525 U.S. 55, 60–61 (1998). Thus, an applicant who "constructively" reduces an invention to practice by filing a patent application which describes the invention presumably has complied with the disclosure requirements of 35 U.S.C. § 112(a), including enablement. *In re* Borst, 345 F.2d 851, 855 (C.C.P.A. 1965); Yasuko Kawai v. Metlesics, 480 F.2d 880, 886 (C.C.P.A. 1973).

145. *Cf.* Cotropia, *supra* note 129, at 37 ("As time goes on—and development continues—more technical and market information is generated.").

146. Lisa Larrimore Ouellette, *Do Patents Disclose Useful Information?*, 25 HARV. J.L. & TECH. 545, 562 (2012) (evaluating empirical evidence and concluding that "many innovators are currently using patents as a source of useful technical information"); Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CALIF. L. REV. 803, 808 n.9, 809 (1988) ("There is a significant amount of evidence showing that inventors in many fields rely on published patents for technical information . . . .").

147. *See* Alan Devlin, *The Misunderstood Function of Disclosure in Patent Law*, 23 HARV. J.L. & TECH. 401, 403 (2010) (explaining how the information disclosed in many patent documents is inadequate); Mark A. Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709, 746 (2012) ("[T]he fact that many of those patents obfuscate the technology at issue, deliberately or because we lack a clear language for communicating some types of inventions, means that the payoff from reading those applications is often dubious.").

148. Note, *supra* note 46, at 2025-26.

149. *See supra* note 144; *Pfaff*, 525 U.S. at 60–61 ("[T]he word 'invention' in the Patent Act unquestionably refers to the inventor's conception rather than to a physical embodiment of that idea.").

150. *See* Hyatt v. Boone, 146 F.3d 1348, 1352 (Fed. Cir. 1998) ("[T]he inventor need not provide evidence of either conception or actual reduction to practice when relying on the content of the patent application."). These departures from the norms of science may exist because patent law is more concerned with the "thing" and less with the path to the "thing" or the acumen of the person who made it. *See* Eames v. Andrews, 122 U.S. 40, 56 (1887) (explaining that an inventor's ignorance of the scientific principles is immaterial as

examples, that is, specific illustrations of the invention that have not, in fact, been carried out."[151] This regime (which surprises many scientists unfamiliar with the patent system)[152] lies in stark contrast to scientific norms, which "require actual performance of every experimental detail"[153] as a prerequisite for publication.[154] Figuring out how or why an invention works requires actual experimentation and, as a result, yields a more technically-robust and credible patent document.[155] Such heightened disclosures help bridge the disconnect between patent law and the norms of science which, hopefully will lead more innovators to turn to patents for substantive technical information.[156]

V. CONCLUSION

Disclosure is often touted as a principal benefit of the patent system, giving the public access to knowledge that can be used to stimulate ideas and promote technological progress. Yet the disclosure function falls short in achieving these goals because patent law only requires minimal disclosure from the inventor. It is surprising that an inventor can obtain a patent without any idea how or why an invention works. The resulting disclosure has limited technical value because follow-on researchers must figure out the omitted information through their own experimentation. This problem has become more acute as inventions have become more complex over time. This Essay argues that encouraging inventors to fill this knowledge void will produce meaningful, technically-robust patent documents that will allow follow-on innovators to more easily and quickly improve on current technologies and will foster the diffusion of knowledge and more creative innovation within and across disciplines. Including this

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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.").

151. 3A CHISUM, *supra* note 62, at § 10.05[1].

152. Ouellette, *supra* note 146, at 549.

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

154. "Indeed, in scientific publishing, the author-scientist must demonstrate an understanding of the underlying science and support alleged discoveries with actual results, that are often confirmed through replicate experiments." Seymore, *Teaching Function*, *supra* note 19, at 654–55. "Ultimately, the scientific community polices both the understanding and the alleged discoveries through peer review." *Id.* at 655.

155. Credibility in science "is the degree of belief scientists attach to a research claim and to the facts presented to support it." Seymore, *supra* note 7, at 1508 (citing JOHN ZIMAN, REAL SCIENCE 222 (2002)).

156. *Cf.* Seymore, *Teaching Function*, *supra* note 19, at 654–56 (making a similar argument for a proposed heightened enablement standard).

additional information in patent documents will also bridge the gap between the patent laws and the norms of scientific research and sharpen the debate over the disclosure function and its role in stimulating innovation.