SERENDIPITY[*]

SEAN B. SEYMORE[**]

Serendipity, the process of finding something of value initially unsought, has played a prominent role in modern science and technology. These "happy accidents" have spawned new fields of science, broken intellectual and technological barriers, and furnished countless products that have altered the course of human history. In the realm of patent law, one curious aspect of accidental discoveries that has received little attention in the academic literature and the courts is how they mesh with the substantive law of invention. This Essay shows that applying conventional doctrines to accidental inventions is theoretically untenable and, in certain circumstances, may result in unfortunate outcomes for the inventor. As a result, this Essay offers an alternative approach that is better suited to deal with accidental inventions. Finally, this Essay reflects on how adoption of this alternative approach is appropriate considering the fact that accidental inventions benefit the patent system and the public, especially their potential to spur significant follow-on innovation.

** Assistant Professor and Alumni Faculty Fellow, Washington & Lee University School of Law; J.D., University of Notre Dame, 2006; Ph.D. (Chemistry), University of Notre Dame, 2001; M.S.Chem., Georgia Institute of Technology, 1996; B.S., University of Tennessee, 1993. I thank those who have supported and provided valuable feedback on various aspects of this project, including Timothy Holbrook and Craig Nard. I also thank the Frances Lewis Law Center at Washington & Lee for its support of this project through a research grant. E-mail: seymores@wlu.edu.

INTRODUCTION

The dramatic increase in patent applications emerging from the biotech, nanotech, and pharmaceutical industries over the past decade has rekindled debates about the patent system's ability to adapt to new sciences and emerging technologies.[1] Several commentators and other legal actors contend that making structural reforms to the examination process,[2] creating specialized patent courts with technically trained judges,[3] or moving toward a technology-specific application of the patent statute[4] would bridge the divide between patent law and science. But the heart of the problem arguably lies with the judiciary's production of "an isolated and sterile

1. *See, e.g.*, Qin Shi, *Patent System Meets New Sciences: Is the Law Responsive to Changing Technologies and Industries?*, 61 N.Y.U. ANN. SURV. AM. L. 317, 344 (2005) ("To promote continued innovation and efficient commercialization in these areas, it is clear that courts and the [U.S. Patent and Trademark Office], in applying patent rules and standards, ought to make special efforts to stay informed of technology advances and their commercial implications.").

2. *See, e.g.*, Joseph Farrell & Robert P. Merges, *Incentives to Challenge and Defend Patents: Why Litigation Won't Reliably Fix Patent Office Errors and Why Administrative Patent Review Might Help*, 19 BERKELEY TECH. L.J. 943, 960–68 (2004) (exploring various Patent and Trademark Office ("PTO") measures to improve patent quality, including giving the applicant an incentive to search for and reveal relevant information); Mark A. Lemley & Kimberly A. Moore, *Ending Abuse of Patent Continuations*, 84 B.U. L. REV. 63, 93–118 (2004) (exploring the elimination of patent continuation applications and alternatives like limiting the amount of time that an applicant can spend before the Patent Office); Beth Simone Noveck, *"Peer to Patent": Collective Intelligence, Open Review, and Patent Reform*, 20 HARV. J.L. & TECH. 123, 125–27 (2006) (proposing peer review for certain elements of patent examination).

3. *See, e.g.*, Kimberly A. Moore, *Forum Shopping in Patent Cases: Does Geographic Choice Affect Innovation?*, 79 N.C. L. REV. 889, 932–34 (2001) (suggesting that specialized patent trial courts would develop expertise in patent law and increase accuracy in resolving patent disputes); Arti K. Rai, *Specialized Trial Courts: Concentrating Expertise on Fact*, 17 BERKELEY TECH. L.J. 877, 889–95 (2002) (arguing for the creation of a specialized trial court to which the U.S. Court of Appeals for the Federal Circuit would feel compelled to defer on questions of fact).

4. *See* DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 95–141 (2009) (arguing that courts should tailor patent law, through interpretations and applications, to suit the needs of various types of businesses); Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1630–38 (2003) (exploring the pros and cons of a technology-specific system).

jurisprudence that is increasingly disconnected from the technological communities affected by patent law."[5]

In the case of the experimental sciences,[6] a tangible disconnect exists between the judicial bench and laboratory bench, which has grown as inventions have evolved from mechanical and electrical to predominately chemical in nature.[7] Yet, explaining the source of the disconnect goes beyond the judiciary's (lack of) scientific expertise. One commentator asserts that the judiciary's interest in discouraging the patenting of "quack" pharmaceuticals and ethical objections to medical patents in the nineteenth century created an engineering bias that favored inventions in the applied technologies over those in the experimental sciences.[8] Although attitudes have evolved, vestiges of the bias remain.[9]

An artifact of this bias is that the patent system often ignores, and deliberately omits, any significant consideration of the fact that the pathway to invention in unpredictable fields like chemistry[10] is

5. Craig Allen Nard & John F. Duffy, *Rethinking Patent Law's Uniformity Principle*, 101 NW. U. L. REV. 1619, 1620–21 (2007). Criticisms of the Federal Circuit's insular and nuanced jurisprudence have led the Supreme Court and Congress to pursue judicial and legislative patent reform, respectively. *See, e.g.*, KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 415 (2007) (rejecting the Federal Circuit's rigid test for nonobviousness because it was inconsistent with the "expansive and flexible" approach set forth in prior Supreme Court precedent); Patent Reform Act of 2009, H.R. 1260, 111th Cong. (2009); Patent Reform Act of 2009, S. 515, 111th Cong. (2009); Patent Reform Act of 2007, H.R. 1908, 110th Cong. (2007) (as passed by House, Sept. 7, 2007); Patent Reform Act of 2007, S. 1145, 110th Cong. (2007) (as introduced in the Senate, Apr. 18, 2007) (stalled due to an impasse over patent damages). In response to these reform efforts, the Federal Circuit is now eager to revisit old issues and "mak[e] desirable adjustments in a fine-tuned way." Nate Raymond, *A Full-Court Press for Patent Credibility*, LEGAL TIMES (Wash., D.C.), Mar. 16, 2009, at 12 (quoting Chief Judge Paul Michel).

6. *See infra* note 10.

7. *See* John Hoxie, *A Patent Attorney's View*, 47 J. PAT. OFF. SOC'Y 630, 636 (1965) (contending the judiciary's interpretation of the patent statute did not change even when chemical inventions became more frequent); Jackie Hutter, Note, *A Definite and Permanent Idea? Invention in the Pharmaceutical and Chemical Sciences and the Determination of Conception in Patent Law*, 28 J. MARSHALL L. REV. 687, 713–25 (1995) (exploring the disconnect between judges and scientists and arguing that chemical and biochemical inventions are inherently different from those in applied technologies).

8. William D. Noonan, *Patenting Medical Technology*, 11 J. LEGAL MED. 263, 264–69 (1990).

9. *See* Paul H. Eggert, *Uses, New Uses and Chemical Patents—A Proposal*, 51 J. PAT. OFF. SOC'Y 768, 783 (1969) ("The law of chemical patents is a child (or orphan) of mechanical patent law."); Hoxie, *supra* note 7, at 636 (explaining how the judiciary tries to fit chemical inventions into the "mold" of mechanical-electrical inventions).

10. The courts refer to the chemistry, biochemistry, and related experimental fields as "unpredictable" because skilled artisans in these fields often cannot predict whether a reaction protocol that works for one embodiment will work for others. On the other hand, applied technologies like electrical and mechanical engineering are often regarded as

fundamentally different than that in predictable fields like mechanical and electrical engineering.[11] Indeed, in contrast to the foreseeability and coherency that pervade inventions emerging from applied technologies, accidental discovery is a common and widely acknowledged path to invention in unpredictable fields.[12] Known more popularly as "serendipity," accidental discovery refers to the process of finding something of value initially unsought.[13] Teflon,[14]

"predictable" arts because they are rooted in well-defined, predictable factors. For a deeper exploration of the predictable-unpredictable dichotomy, see Sean B. Seymore, *The Enablement Pendulum Swings Back*, 6 NW. J. TECH. & INTELL. PROP. 278, 282–84 (2008) [hereinafter Seymore, *Enablement Pendulum*]; Sean B. Seymore, *Heightened Enablement in the Unpredictable Arts*, 56 UCLA L. REV. 127, 136–39 (2008) [hereinafter Seymore, *Heightened Enablement*].

11. One possible explanation is that patent law is more concerned with the "thing" to be patented and less with the path to the "thing" or the acumen of the person who made it. *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); Life Techs., Inc. v. Clontech Labs., Inc., 224 F.3d 1320, 1325 (Fed. Cir. 2000) ("Patentability shall not be negatived by the manner in which the invention was made." (citing 35 U.S.C. § 103(a) (2006)); 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."); *cf.* Earle v. Sawyer, 8 F. Cas. 254, 256 (C.C.D. 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. The law looks to the fact, and not to the process by which it is accomplished.").

12. *See supra* note 10. Perhaps this is a bit surprising in light of the scale and scope of systematic research. *See* ROBERT K. MERTON, SOCIAL THEORY AND SOCIAL STRUCTURE 104 (rev. & enlarged ed. 1957) ("The serendipity pattern refers to the fairly common experience of observing an *unanticipated*, *anomalous*, and *strategic* datum which becomes the occasion for developing a new theory or for extending an existing theory."); Robert Friedel, *Serendipity Is No Accident*, THE KENYON REV., Spring 2001, at 36, 36.

13. The eminent sociologist Robert K. Merton traces the term to the great eighteenth century author Horace Walpole, who, in reference to the fairy tale *The Three Princes of Serendip*, wrote to a friend that these princes were "always making discoveries, by accidents and sagacity, of things which they were not in quest of . . . ." ROBERT K. MERTON & ELINOR BARBER, THE TRAVELS AND ADVENTURES OF SERENDIPITY: A STUDY IN SOCIOLOGICAL SEMANTICS AND THE SOCIOLOGY OF SCIENCE 2 (2004).

14. Tetrafluoroethylene Polymers, U.S. Patent No. 2,230,654 (filed July 1, 1939). Roy J. Plunkett accidentally made the substance at DuPont in 1938. *See* FRAN CAPO, IT HAPPENED IN NEW JERSEY 161–62 (2004). While trying to make a new Freon compound, Plunkett realized that the reaction vessel, a gas cylinder, did not discharge when he opened the valve. While preparing to discard the "faulty" cylinder, Plunkett's assistant noticed that it was too heavy to be empty. *Id.* at 163. Plunkett removed the valve, turned the cylinder upside down, and discovered a waxy white powder. *See* ALAN G. ROBINSON & SAM STERN, CORPORATE CREATIVITY: HOW INNOVATION AND IMPROVEMENT ACTUALLY HAPPEN 176 (1997). The tetrafluoroethylene gas had spontaneously polymerized, which, until then, had been thought impossible. *Id.* at 176–77.

nylon,[15] SuperGlue,[16] and mauve[17] are just a few examples of substances that emerged from accidental or unexpected findings in the laboratory.[18] The most striking example is the field of organic

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15. Diamine-Dicarboxylic Acid Salts and Process of Preparing Same, U.S. Patent No. 2,130,947 (filed July 1, 1936); Linear Polyamides and Their Production, U.S. Patent No. 2,130,523 (filed Jan. 2, 1935); Synthetic Fiber, U.S. Patent No. 2,130,948 (filed Apr. 9, 1937). The story of nylon reveals that even horseplay can lead to discovery.

> It is interesting to note that the discovery of cold drawing fibers was more or less accidental. Yet it was a most important part of synthetic fiber development. Nylon had been made and seemed not to have any especially useful properties *and put aside on the shelf without patenting* . . . . [Yet one day] Hill and his cohorts tried to see how far they could stretch [a] sample[] and took a little ball on a stirring rod and ran down the hall and stretched [it] out into a string. It was in doing this that they noticed the very silky appearance of the extended molecules and they realized that they were orienting the polymer molecules and increasing the strength of the product.

C. S. Marvel, *The Development of Polymer Chemistry in America—The Early Days*, 58 J. CHEMICAL EDUC. 535, 536 (1981) (emphasis added). The accidental discovery of the cold drawing process "led to the most important product DuPont ever put on the market." ROYSTON M. ROBERTS, SERENDIPITY: ACCIDENTAL DISCOVERIES IN SCIENCE 173 (1989).

16. Alcohol-Catalyzed α-Cyanoacrylate Adhesive Compositions, U.S. Patent No. 2,768,109 (filed June 2, 1954). Harry Coover, a scientist at Eastman Kodak Research Laboratories during World War II, synthesized cyanoacrylate with the aim of making optically-clear plastic for precision gunsights. Harry W. Coover, *Discovery of Superglue Shows Power in Pursuing the Unexplained*, RES. TECH. MGMT., Sept.–Oct. 2000, at 36, 36. Unfortunately, Coover abandoned the project because cyanoacrylate was too sticky. *Id.* Later, a co-worker smeared the material between two glass plates to take an optical measurement but could not separate the plates after doing so. *Id.* Coover explained what happened next:

> [I] began gluing everything I could lay my hands on—glass plates, rubber stoppers, metal spatulas, wood, paper, plastic—in all combinations. Everything stuck to everything, almost instantly, and with bonds I could not break apart. In that one afternoon, cyanoacrylate adhesives were conceived purely as the result of serendipity.

Id.

17. A New Coloring Matter for Dyeing with a Lilac or Purple Color Stuffs of Silk, Cotton, Wool, or Other Materials, Brit. Patent No. 1,984 (filed Aug. 26, 1856). Mauve was the first synthetic dye. *See generally* SIMON GARFIELD, MAUVE: HOW ONE MAN INVENTED A COLOR THAT CHANGED THE WORLD (2002) (describing the history of mauve). Sir William Henry Perkin explained the accident:

> "I was in the laboratory of the German chemist [August Wilhelm von Hofmann] when I discovered mauve. I was then eighteen. While in an experiment to find quinine I failed, and was about to throw a certain black residue away when I thought it might be interesting. The solution of it resulted in a strangely beautiful color. You know the rest."

Sir W. Perkin Tells of His Great Discovery, N.Y. TIMES, Oct. 1, 1906, at 7.

18. For more examples of accidental discoveries, see GILBERT SHAPIRO, A SKELETON IN THE DARKROOM: STORIES OF SERENDIPITY IN SCIENCE vii–xiii (1986);

chemistry, which became an area of systematic study in 1828 only after Friedrich Wöhler accidentally synthesized urea from mixing two inorganic salts.[19] This serendipitous event, heralded as the first organic synthesis, shattered the prevailing belief that man could never make any substance extracted from living things.[20] So the history of science shows that it grows by plan *and* by accident.[21]

While accidental discoveries may raise questions about merit and legitimacy within the scientific community,[22] indisputably, they are worthy of patent protection as long as the discoveries satisfy the statutory tests for patentability.[23] In fact, it is well settled that "the path that leads an inventor to the invention is expressly made irrelevant to *patentability* by statute."[24] But a more curious aspect of accidental discoveries is how they mesh with the substantive law of patents. In particular, when should the patent system consider an accidental discovery "invented" for the purpose of obtaining patent rights?

As described in more detail below, it is a bedrock principle of patent law that the inventive process has two elements: conception and reduction to practice.[25] Conception occurs when the inventor

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Pek Van Andel, *Anatomy of the Unsought Finding. Serendipity: Origin, History, Domains, Traditions, Appearances, Patterns and Programmability*, 45 BRIT. J. FOR PHIL. SCI. 631, 631–48 (1994).

19. *See* AARON J. IHDE, THE DEVELOPMENT OF MODERN CHEMISTRY 163–65 (1964); ROBERTS, *supra* note 15, at 42. Soon after the discovery, Wöhler wrote a letter to his former research mentor exclaiming, with a sense of humor atypical for German chemists, that "I must tell you that I can make urea without the use of kidneys, either man or dog. Ammonium cyanate is urea." IHDE, *supra*, at 165 n.1 (quoting Wöhler's letter to Berzelius dated Feb. 22, 1828).

20. *See* IHDE, *supra* note 19, at 163–64 (discussing vitalism). Articles and books praising Wöhler's synthesis have persisted from his time to the present. *See, e.g.*, George B. Kauffman & Steven H. Chooljian, *Friedrich Wöhler (1800–1882), on the Bicentennial of His Birth*, 6 CHEMICAL EDUCATOR 121, 128–29 (2001).

21. MERTON & BARBER, *supra* note 13, at 186.

22. *See id.* at 170–95.

23. Title 35 of the U.S. Code contains the conditions for patentability. The claimed invention must be useful (§ 101), novel (§ 102), nonobvious (§ 103), and directed to patentable subject matter (§ 101). In addition, § 112 ¶ 1 requires that the disclosure adequately describe, enable, and set forth the best mode of carrying out the invention, and § 112 ¶ 2 requires that the claims set forth the subject matter that the applicant regards as his invention and that the claims particularly point out and distinctly define the invention.

24. Life Techs., Inc. v. Clontech Labs., Inc., 224 F.3d 1320, 1325 (Fed. Cir. 2000) (emphasis added). Congress inserted this language into § 103 of the 1952 Patent Act to put to rest the "flash of genius" theory of patentability. *Cf.* Cuno Eng'g Corp. v. Automatic Devices Corp., 314 U.S. 84, 91 (1941) ("[T]he new device, however useful it may be, must reveal the flash of creative genius, not merely the skill of the calling.").

25. *See* 1 WILLIAM C. ROBINSON, THE LAW OF PATENTS FOR USEFUL INVENTIONS 116 (Boston, Little, Brown, & Co. 1890) ("[T]he inventive act in reality consists of two

formulates a complete idea of the invention.[26] For example, in the case of a chemical compound, conception does not occur until the inventor has a mental picture of its structure or can sufficiently distinguish it.[27] It follows then that accidental discoveries, at least at the moment of the serendipitous event, lack conception. Considering the importance of conception (and timing) in establishing patent rights, scientists who make serendipitous discoveries may be unjustly deprived of patents.

This Essay focuses attention on the treatment of serendipitous discoveries, which, until now, has received little consideration either in the courts or the academic literature.[28] It joins a larger project exploring the extent to which the patent laws should conform to the norms and realities of science.[29] After Part I lays a framework for this Essay, Part II begins with a hypothetical example tracing the steps of an accidental discovery. The example shows that, under the traditional conception-focused framework, accidents can only ripen into inventions at some point *after* the serendipitous event. This unfortunate outcome reveals a structural bias in patent law against accidental discoveries. To eliminate this bias this Essay contends that an accidental discovery should become an "invention" at the moment of the serendipitous event. Finally, this Essay reflects on how

acts; one mental, the conception of an idea; the other manual, the reduction of that idea to practice.").

26. *See infra* Part II.A.

27. *See infra* Part II.A.

28. *See, e.g.*, Hoxie, *supra* note 7, at 638 (criticizing the fact that courts have ignored the role of unpredictability in modern chemistry); Brian P. O'Shaughnessy, *The False Inventive Genus: Developing a New Approach for Analyzing the Sufficiency of Patent Disclosure Within the Unpredictable Arts*, 7 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 147, 152 n.14 (1996) (stating that there is no analysis of the number of patents from the unpredictable arts that are rejected for insufficient disclosures). The treatment of serendipitous discoveries has received scant attention because of several characteristics of the patent application process make it difficult to gather information about them. First, the patent examination process is ex parte and hidden from the public unless and until a patent application publishes (and before 2000, everything was kept in secret unless and until a patent issued). ALAN L. DURHAM, PATENT LAW ESSENTIALS: A CONCISE GUIDE § 5.1, at 32–33 (2d ed. 2004). Second, if an inventor (like a serendipper) abandons an application, the public never learns about the prosecution history. *Id.* § 5.1, at 34. Third, until recently, most prosecution histories were not readily accessible to the public. In 2004, the Patent Office began providing access to most prosecution histories online through the Public Patent Application Retrieval System ("Public PAIR"). *See* Press Release, U.S. Patent and Trademark Office, Internet Access to Patent Application Files Now Available (Aug. 2, 2004), *available at* http://www.uspto.gov/news/pr/2004/04-13.jsp.

29. *See* Seymore, *Heightened Enablement*, *supra* note 10; Sean B. Seymore, *The Teaching Function of Patents*, 85 NOTRE DAME L. REV. (forthcoming 2010) [hereinafter Seymore, *Teaching Function*] (proposing a new disclosure framework which will transform the patents into readable, technically robust documents).

accidental inventions benefit the patent system and the public, especially with their potential to spur significant follow-on innovation.

I. UNDERSTANDING AN ACCIDENTAL DISCOVERY

A. *Chance Favors the Prepared Mind*[30]

Despite its ubiquity, "the role of accident in [scientific] discovery has not been placed in perspective," or "given its due."[31] In some ways, this lack of respect is understandable because accident does not fit nicely into the realm of scientific rationality. While some scientists find joy in this mode of scientific investigation, others obscure or minimize the role of accident in their own research out of fear that it will cast a negative light on their skills or on the underlying science itself.[32]

But to associate an unexpected finding with irrationality is improper. As the great chemist and microbiologist Louis Pasteur recognized in 1854, "chance favors only those minds which are prepared."[33] In other words, accidental discoveries do not just happen as a result of apparently random circumstances.[34] Rather, astute knowledge, alertness, and flexibility are essential prerequisites.[35]

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30. *See* Louis Pasteur, Dean of the Faculty of Science at the University of Lille, Chance Favors Only Those Minds Which are Prepared (Dec. 7, 1854), *in* A TREASURY OF THE WORLD'S GREAT SPEECHES 469, 473 (Houston Peterson ed., 1954).

31. MERTON & BARBER, *supra* note 13, at 159.

32. *See id.* at 159 (explaining that some scientists engage in "retrospective falsification" to conceal accidents, which only come to light in memoirs or through informal talks); MORTON A. MEYERS, HAPPY ACCIDENTS: SERENDIPITY IN MODERN MEDICAL BREAKTHROUGHS 24 (2007) ("Embarrassment and fear of loss of stature may inhibit [most scientists] from making full disclosure."); Richard Feynman, The Development of the Space-Time View of Quantum Electrodynamics (Dec. 11, 1965), *in* NOBEL LECTURES: PHYSICS (1963–1970), at 155, 155 (1998) ("We have a habit in writing articles . . . to cover all the tracks, to not . . . describe how you had the wrong idea first, and so on. So there isn't any place to publish, in a dignified manner, what you actually did . . . .").

33. Pasteur, *supra* note 30, at 473. Pasteur was also a serendipper. The term "serendipper" refers to one who invents by accident. *See* Thomas A. Ban, *The Role of Serendipity in Drug Discovery*, 8 DIALOGUES IN CLINICAL NEUROSCIENCE 335, 335 (2006). His accidental discoveries include the use of vaccination for disease prevention and the chirality (right- and left-handedness) of molecules. *See* ROBERTS, *supra* note 15, at 59–65.

34. The story of artificial indigo shows that even a serendipitous mishap in the laboratory is more than "an unexpected gift from heaven." H. Brunck, *History of the Commercial Manufacture of Artificial Indigo*, CHEMICAL NEWS & J. PHYSICAL SCI., Oct. 31, 1902, at 211, 213. In 1865, the illustrious and future Nobel Laureate Adolf von Baeyer, a German chemist, began working on a synthetic method for making the highly prized dye.

> [S]erendipity does not, of itself, produce discoveries: it produces opportunities for making discoveries. Accidental events have no scientific meaning in themselves: they only acquire significance when they catch the attention and interest of someone capable of putting them into a scientific context. Even then, the perception of an anomaly is fruitless unless it can be made the subject of deliberate research.[36]

In sum, the serendipper must be "primed to appreciate [the] significance" of the accident when it happens.[37]

To illustrate this point, if *X* refers to an unexpected discovery, a scientist would not even recognize *X* as something of value unless it could be "describe[d] and place[d] within an existing body of

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ROBERTS, *supra* note 15, at 72, 76. After twenty years, he developed a process, but its cost and complexity made it unsuitable for commercial development. *Id.* at 72. But, in 1896, an "insignificant worker" at BASF carrying out the synthesis accidentally broke a mercury thermometer in the reaction mixture. WALTER GRATZER, EUREKAS AND EUPHORIAS: THE OXFORD BOOK OF SCIENTIFIC ANECDOTES 38 (2002) (suggesting that the worker was in fact stirring the mixture with the thermometer contrary to standard laboratory practice). The mercury catalyzed a new, cheap, and rapid route to the dye which, after commercialization, caused the natural indigo industry to quickly collapse. *Id.* at 38; ROBERTS, *supra*, at 72. While it is true that the discovery would not have arisen but for the broken thermometer, a managing director at BASF explained that the conditions for the practical synthesis "were furnished by the results of a long scientific research" and "the knowledge, the zeal, the energy, and the spirit of duty which animated [the] chemists." Brunck, *supra*, at 213; *see* Dietrich Stoltzenberg, *Scientist and Industrial Manager: Emil Fischer & Carl Duisberg*, *in* THE GERMAN CHEMICAL INDUSTRY IN THE TWENTIETH CENTURY 57, 60 (John E. Lesch ed., 2000) (explaining Brunck was a managing director at BASF).

35. "A central point about serendipity that emerges from the sociological literature . . . is that while research does involve the unexpected happening or chance event, what happens as a result is not fortuitous, but depends, for many reasons, upon what the investigator brings to the occurrence of serendipity." JUDITH P. SWAZEY & KAREN REEDS, TODAY'S MEDICINE, TOMORROW'S SCIENCE: ESSAYS ON PATHS OF DISCOVERY IN THE BIOMEDICAL SCIENCES 7 (1978). Similarly, Ernst Mach, the Austrian physicist and great philosopher of science, said that

> it does not follow that accident alone is sufficient to produce an invention. The part which man plays is by no means a passive one . . . . In all such cases, the inventor is obliged *to take note* of the new fact, he must discover and grasp its advantageous feature, . . . *isolate* the new feature, . . . unite and interweave it with the rest of his thought; in short, he must possess the capacity to *profit by experience*.

Ernst Mach, The Part Played by Accident in Invention and Discovery (Oct. 21, 1895), *in* POPULAR SCIENTIFIC LECTURES 259, 266 (Thomas J. McCormack trans., Chicago, Open Court Publ'g Co. 3d ed. 1898).

36. JOHN ZIMAN, REAL SCIENCE: WHAT IT IS, AND WHAT IT MEANS 217 (2002).

37. *Id.*

knowledge."[38] As one chemist has explained, "it is not enough to have accidents, everyone has those, but we must also be ready and in the right state of preparedness to profit from the happy accident or it may just be washed down the sink like many failed experiments and reaction mixtures."[39]

B. Serendipity in "Unpredictable" Technologies

While serendipity occurs across all technical disciplines, it is more common in some fields than others. For example, one commentator described why the role of accident is more prevalent in chemistry than in mechanical fields thusly:

> It is not surprising that . . . there continues to be so many fortunate and "accidental" discoveries in this field. Mechanical invention, on the other hand, is not so likely to be favored by accident [because it] has to be thought of from the beginning as a system, and designed as a whole . . . .[40]

This analysis makes sense because it is in chemical arts where results are often uncertain and unexpected because unknown properties of compounds can only be uncovered through actual

38. MALCOLM WILLIAMS, SCIENCE AND SOCIAL SCIENCE: AN INTRODUCTION 30 (2000).

39. Peter E. Childs, *Chemistry and Chance: Part 1*, CHEMISTRY IN ACTION!, Oct. 1, 1997, http://www.ul.ie/~childsp/CinA/issue50/chance.html. Similarly, Nobel Laureate Irving Langmuir famously stated, "[i]f you can't predict ideas, you can't plan things in a laboratory. But you can organize a laboratory so as to increase the probabilities that useful things will happen there." *What General Electric People are Saying*, SCIENCE, Feb. 22, 1952, at 2. The story of polyethylene shows how misjudgment can lead a scientist to miss a happy accident. In 1930, two chemists at the University of Illinois reported that an experiment with high-pressure ethylene produced a white solid byproduct (which was polyethylene). *See* M. E. P. Friedrich & C. S. Marvel, *The Reaction Between Alkali Metal Alkyls and Quaternary Arsonium Compounds*, 52 J. AM. CHEMICAL SOC'Y 376, 376–84 (1930). The chemists did not explore the substance because they doubted its usefulness. *See* ROBERTS, *supra* note 15, at 181 (referring to this as a "classic example of misjudgment"). Three years later, a group of British scientists made polyethylene by accident while attempting to react ethylene with benzaldehyde. *See* ANDREW J. PEACOCK, HANDBOOK OF POLYETHYLENE 28 (2000) (explaining that the scientists recovered unreacted benzaldehyde and a white substance that turned out to be polyethylene). Although the scientists immediately recognized that polyethylene was a useful material, its preparation was irreproducible (and often explosive). *Id.*; DAVID M. TEEGARDEN, POLYMER CHEMISTRY 63 (2004). It was not until 1935 that the group recognized the key to reproducibility was the accidental leakage of oxygen into the reaction vessel. PEACOCK, *supra*, at 28. Patents soon followed. *See, e.g.*, Interpolymerization of Ethylene, U.S. Patent No. 2,200,429 (filed Apr. 21, 1938); Improvements in or Relating to the Polymerization of Ethylene, Brit. Patent No. 471,590 (filed Feb. 4, 1936). Polyethylene is the most widely used mass-produced plastic. *See* TEEGARDEN, *supra*, at 63.

40. JOHN JEWKES ET AL., THE SOURCES OF INVENTION 63 (2d ed. 1969).

experimentation.[41] As intimated above, this unpredictability has posed significant challenges for the courts over the past half-century.[42] For these reasons, this Essay will focus on chemical inventions.

Of course, there are various types of accidental discoveries within the field of chemistry. For example, a scientist may accidentally discover a new use for a previously known compound (e.g., LSD, nitroglycerin).[43] This Essay will not explore "new use" accidents. Instead, it will focus on the scenario where a reaction (A+B) yields an unknown product (X)[44] rather than the expected product (C):

$$A + B \rightarrow X \text{ (not } C\text{)}$$

For reasons that will become clear later in this Essay, it is worth noting a few features of accidental discoveries of this type.[45] First, and quite important from a technical perspective, the result X is "remarkably easy to reproduce."[46] Second, at a given moment in time, sometimes X can come to light only through serendipity.[47] As one commentator has observed, "[i]f a whole new area of science is to be

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41. *Id.*; *supra* note 10.

42. *See supra* notes 7–9 and accompanying text.

43. *See* Ban, *supra* note 33, at 335–42 (describing in detail the serendipitous discovery of various drugs including LSD); Hugo Kubinyi, *Chance Favors the Prepared Mind—From Serendipity to Rational Drug Design*, 19 J. RECEPTOR & SIGNAL TRANSDUCTION 15, 18–19 (1999) (listing serendipitous discoveries in drug research including LSD and nitroglycerin).

44. In the realm of patent law, as discussed below, X is referred to as a composition of matter.

45. *See infra* Part II.C. In addition to the hypothetical given *infra* in the text accompanying notes 63–69, for examples of discoveries demonstrating these features see *supra* notes 14–19 & 34.

46. SHAPIRO, *supra* note 18, at xii. Perhaps not surprisingly, sometimes X comes about due to an impurity which is present in one of the starting materials (A or B) or in one of the reaction vessels. Key examples include the accidental discoveries of the synthetic dye indigo (1905 Nobel Prize in Chemistry; discussed *supra* note 34), polyethylene (discussed *supra* note 39), and crown ethers (1987 Nobel Prize in Chemistry; discussed *infra* note 69). As one commentator notes, "[i]mpurities have played a major role in important discoveries—so much so, that one wonders whether our modern, highly purified reagents have eliminated one fertile source of new chemistry." Childs, *supra* note 39. Of course, the result (X) did not become reproducible until the scientists recognized the impurity. *Id.*

47. This is often true for several reasons. First, until the moment of the accident, the serendipper and other scientists probably believed that X was theoretically impossible to make or incredibly difficult to prepare. Second, and relatedly, even if a scientist could envision the structure of X, elucidating a synthetic route to make it often led to failed experiments or abandonment of the research project. But as intimated above, once serendipity brings X to the fore, the scientific community realizes that it is often easy to make.

opened up, then by definition the field does not exist before the discovery [of *X*] is made."[48] Third, sometimes the discovery of *X* has a worldwide impact which, at times, leads to a Nobel Prize or other prestigious award.[49] Fourth, the discovery is frequently recognized by a serendipper who, though certainly smart, is often no smarter than others in the field.[50] Yet, these scientists tend to be persistent, driven individuals who enjoy finding new ways to solve problems.[51]

II. ACCIDENTAL INVENTION IN PATENT LAW

A. *When Does an Accident Become an Invention?*

Under current patent doctrine, the inventive process consists of two elements.[52] The first element is conception, which refers to an inventor's mental act of formulating " 'a definite and permanent idea of the complete and operative invention, as it [will] be applied in practice.' "[53] Conception requires that the inventor must also contemporaneously recognize and appreciate the claimed subject matter.[54] In the chemical context, the U.S. Court of Appeals for the

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48. SHAPIRO, *supra* note 18, at vii. A famous example is the accidental discovery in 1985 of buckminsterfullerene, a remarkably stable cluster of sixty carbon atoms resembling a geodesic dome. *See* Harold W. Kroto et al., *C_{60}: Buckminsterfullerene*, 318 NATURE 162, 162–63 (1985). This discovery, which was awarded the 1996 Nobel Prize in Chemistry, spawned the field of fullerene chemistry, itself spawning the subfield of carbon nanotubes. *See* P. M. Ajayan, *Nanotubes from Carbon*, 99 CHEMICAL REV. 1787, 1787–99 (1999); All Nobel Laureates in Chemistry, http://nobelprize.org/nobel_prizes/chemistry /laureates/ (last visited Nov. 19, 2009).

49. A few examples include buckminsterfullerene (1996 Nobel Prize in Chemistry), crown ethers (1987 Nobel Prize in Chemistry), ferrocene (1973 Nobel Prize in Chemistry), and Bakelite (1916 Perkin Medal). *See Perkin Medal Award*, 25 INDUS. & ENGINEERING CHEMISTRY, 229, 229 (1933); All Nobel Laureates in Chemistry, *supra* note 48.

50. SHAPIRO, *supra* note 18, at ix.

51. *Id.*; Robert S. Root-Bernstein, *Who Discovers and Invents*, 32 RES. TECH. MGMT. 43, 44–48 (1989) (identifying characteristics of successful innovators and discoverers).

52. It is important to note that "[i]n patent law the word 'invention' has several different meanings. It may refer to (1) the act of invention, through original conception and reduction to practice; (2) subject matter described and/or claimed in a patent, patent application, or prior art reference (e.g., a product or process) . . . ." 1 DONALD S. CHISUM, CHISUM ON PATENTS, Gl-11 (2009). For an explanation of "prior art," see *infra* note 60.

53. Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986) (quoting 1 WILLIAM C. ROBINSON, THE LAW OF PATENTS FOR USEFUL INVENTIONS § 376 (Boston, Little, Brown, & Co. 1890)). "Conception is a question of law based on underlying facts." Singh v. Brake, 222 F.3d 1362, 1367 (Fed. Cir. 2000) (citing Eaton v. Evans, 204 F.3d 1094, 1097 (Fed. Cir. 2000)).

54. *See* Heard v. Burton, 333 F.2d 239, 243–44 (C.C.P.A. 1964) (holding that even if an applicant produced something that was new and reproducible, his failure to recognize and appreciate what he made was fatal to his case because he never conceived the invention). This requirement also applies to the other component of invention, reduction

Federal Circuit ("Federal Circuit") has held that conception of a chemical compound specifically requires "(1) [an] idea of the structure of the chemical compound and (2) possession of an operative method of making it."[55] The second element is reduction to practice, which the inventor can satisfy (1) actually, by building and testing a physical embodiment of the claimed invention[56] or (2) constructively, by filing a patent application, which contains a disclosure that presumptively enables a skilled artisan to practice the invention.[57]

The intricacies of this framework are important to a potential inventor because in the United States, the first to invent is entitled to a patent.[58] Usually, and consistent with constructive reduction to

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to practice. *See* Estee Lauder Inc. v. L'Oreal, S.A., 129 F.3d 588, 593 (Fed. Cir. 1997) (" 'It is well-settled that conception and reduction to practice cannot be established *nunc pro tunc* [literally now for then, retroactively]. There must be *contemporaneous recognition and appreciation* of the invention . . . .' " (quoting Breen v. Henshaw, 472 F.2d 1398, 1401 (C.C.P.A. 1973))). 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* Federal Courts Improvement Act of 1982, Pub. L. No. 97-164, § 122, 96 Stat. 25, 36 (1982) (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. *See* South Corp. v. United States, 690 F.2d 1368, 1370 (Fed. Cir. 1982) (in banc).

55. Oka v. Youssefyeh, 849 F.2d 581, 583 (Fed. Cir. 1988) (citing Coleman v. Dines, 754 F.2d 353, 359 (Fed. Cir. 1985)); *accord* Invitrogen Corp. v. Clontech Labs., Inc., 429 F.3d 1052, 1063 (Fed. Cir. 2005) ("[For a] claimed chemical compound, conception requires that the inventor 'be able to define' the compound 'so as to distinguish it from other materials, and to describe how to obtain it.' " (quoting Amgen, Inc. v Chugai Pharm. Co., 927 F.2d 1200, 1206 (Fed. Cir. 1991)); Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1206 (Fed. Cir. 1991) ("Conception does not occur unless one has a mental picture of the structure of the chemical, or is able to define it by its method of preparation, its physical or chemical properties, or whatever characteristics sufficiently distinguish it.").

56. Cooper v. Goldfarb, 154 F.3d 1321, 1327 (Fed. Cir. 1998), *aff'd*, 240 F.3d 1378 (Fed. Cir. 2001). An "embodiment" is a physical manifestation of an invention (like a chemical compound or a widget) described in a patent application or patent. ROBERT PATRICK MERGES, PATENT LAW AND POLICY: CASES AND MATERIALS 11 (2d ed. 1992).

57. Kawai v. Metlesics, 480 F.2d 880, 886 (C.C.P.A. 1973).

58. 35 U.S.C. § 102(g) (2006) (giving the first inventor superior rights over others so long as the inventor has not "abandoned, suppressed, or concealed" the invention); Seymour v. Osborne, 78 U.S. (11 Wall.) 516, 552 (1870) ("[F]irst inventors are entitled to the benefit of their inventions if they reduce the same to practice, and seasonably comply with the requirements of the patent law in procuring letters patent for the protection of their exclusive rights."); Paulik v. Rizkalla, 760 F.2d 1270, 1272 (Fed. Cir. 1985) (en banc) ("United States patent law embraces the principle that the patent right is granted to the first inventor rather than the first to file a patent application."). The United States is the only country in the world that maintains a "first-to-invent" system for awarding patent rights, whereas other countries have adopted a "first-to-file" system. *See* Mark A. Lemley & Colleen V. Chien, *Are the U.S. Patent Priority Rules Really Necessary?*, 54 HASTINGS L.J. 1299, 1299 (2003) (comparing the two approaches and exploring patent harmonization

practice, the filing date of the patent application is taken as the date of invention.[59] But sometimes the inventor needs to establish an earlier date—most often to overcome or exclude a prior art reference[60] in patent prosecution,[61] to avoid a potentially invalidating prior art reference in litigation,[62] or to defeat another party's claim to the invention.[63] With adequate proof, the law allows the patentee to

among nations). It is worth noting that first-to-file provisions appear in both the House and Senate versions of the Patent Reform Act of 2009. *See* Patent Reform Act of 2009, H.R. 1260, 111th Cong. § 2 (2009); Patent Reform Act of 2009, S. 515, 111th Cong. § 2 (2009).

59. *See, e.g.*, Bates v. Coe, 98 U.S. 31, 34 (1878); Kopykake Enters., Inc. v. Lucks Co., 264 F.3d 1377, 1383 (Fed. Cir. 2001). "In the United States, the person who first reduces an invention to practice is 'prima facie the first and true inventor.' " Mahurkar v. C.R. Bard, Inc., 79 F.3d 1572, 1577 (Fed. Cir. 1996) (quoting Christie v. Seybold, 55 F. 69, 76 (6th Cir. 1893). As explained below, although filing a U.S. patent application establishes a constructive reduction to practice, a party can obtain an earlier date by proving that the invention was physically made before the filing date. *See* Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986).

60. Prior art is described in § 102 of the Patent Act. *See* § 102(a)–(b), (e)–(g) (2006); OddzOn Prods., Inc. v. Just Toys, Inc., 122 F.3d 1396, 1401–02 (Fed. Cir. 1997) (describing the prior art provisions of § 102). To summarize, "it constitutes documentary sources (patents and publications from anywhere in the world) and non-documentary sources (things known, used or invented in the United States)" that may be used to determine the novelty and nonobviousness of claimed subject matter in a patent application or patent. 1 CHISUM, *supra* note 52, at Gl–8; *see also* Kimberly-Clark Corp. v. Johnson & Johnson, 745 F.2d 1437, 1453 (Fed. Cir. 1984) (explaining that prior art is technology in the public domain that is accessible to the public) (citing Graham v. John Deere Co., 383 U.S. 1, 6 (1996)). A prior art reference must be dated prior to the applicant's date of invention or, in the case of statutory bars, more than one year prior to the filing date of the patent application. *See* § 102 (b); DURHAM, *supra* note 28, § 8.9.2, at 96, § 8.10, at 117.

61. This is usually done by oath or declaration accompanied by a factual record. 37 C.F.R. § 1.131(a) (2008); *see also* In re Clarke, 356 F.2d 987, 990–91 (C.C.P.A. 1966) ("[T]he facts must establish either reduction to practice, or conception coupled with due diligence until a subsequent actual reduction to practice or the filing of the application [in order to prove prior inventorship]."). 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 generally* DURHAM, *supra* note 28, § 5, at 31 (explaining patent prosecution). The application contains essentially the same elements as an issued patent, including a written description, drawings, and claims. *Id.* The patent prosecutor's interaction with the patent examiner is ex parte. *Id.* § 5, at 32.

62. *See Mahurkar*, 79 F.3d at 1576–77 (explaining that once the alleged infringer has presented prior art that anticipates the claims, the patentee has the burden to offer evidence showing he invented the subject matter before the publication date of the prior art document). Patent litigation focuses on issued patents. A patent owner whose rights have been infringed can compel an accused infringer to stop the infringing activity and pay for damages arising from the infringement that has already occurred. *See* DURHAM, *supra* note 28, § 11, at 171.

63. Patent rights are only awarded to the first inventor. § 102(g) (barring issuance of a patent when another inventor has made the invention before the applicant). When two parties claim the same invention, a PTO tribunal known as the Board of Patent Appeals

reach as far back as the date of conception if the patentee was reasonably diligent in reducing the invention to practice " 'so that they are substantially one continuous act.' "[64] Thus, the precise timing of inventive events can be important.

Yet, navigating through this framework can be cumbersome, even for trivial inventions, because fixing the time of completion for each inventive element depends on the nature and timing of various activities.[65] Indeed, for accidental discoveries, the framework's formalistic application is theoretically untenable, unrealistic, and produces results that can be unfavorable or absurd for the serendipper. To help focus the discussion that follows, consider the following hypothetical example, which traces the steps of an accidental invention.[66]

On Day One, a scientist conducts what is expected to be a straightforward synthesis of a known organic compound, *C*. The scientist predicts that mixing *A* (a colorless liquid) with a pinch of *B* (iron chloride, an off-white powder added to speed up the reaction)[67] will yield *C* (also a colorless liquid). Although no one has previously

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and Interferences institutes an interference proceeding to determine priority (i.e., which party is entitled to a patent). *See infra* notes 78–80 and accompanying text.

64. *Mahurkar*, 79 F.3d at 1577 (quoting Christie v. Seybold, 55 F. 69, 76 (6th Cir. 1893)). "Reasonable diligence" is a term of art in patent law. *See* § 102(g); *infra* notes 79–80. Perhaps not surprisingly, what constitutes "reasonable diligence" depends on the facts of a particular case and the surrounding circumstances. *See* Scott v. Koyama, 281 F.3d 1243, 1248 (Fed. Cir. 2002) (explaining that activities showing reasonable diligence can take a "diversity of forms," including ongoing laboratory experimentation); Hull v. Davenport, 90 F.2d 103, 104 (C.C.P.A. 1937) (stating that what constitutes reasonable diligence depends on the facts of each case). Some factors that might be considered include the complexity of the invention and the inventor's involvement with related projects. Christie v. Seybold, 55 F. 69, 77 (6th Cir. 1893); 1 ROBINSON, *supra* note 25, at 548–49.

65. *See supra* notes 53–59 and accompanying text.

66. This hypothetical example is very loosely based on ferrocene, the discovery and characterization of which led to the 1973 Nobel Prize in Chemistry. HELMUT WERNER, LANDMARKS IN ORGANO-TRANSITION METAL CHEMISTRY: A PERSONAL VIEW 162 (John P. Fackler ed., 2009). Ferrocene was discovered by Pauson and Kealy at Duquesne University in 1951. *Id.* at 129–30. As intimated in the text, Pauson and Kealy set out to make an organic compound (a colorless liquid) but instead recovered an orange powder of "remarkable stability." T. J. Kealy & P. L. Pauson, *A New Type of Organo-Iron Compound*, 168 NATURE 1039, 1040 (1951); *see also* Peter L. Pauson, *Ferrocene—How It All Began*, 637–39 J. ORGANOMETALLIC CHEMISTRY 3, 3–6 (2001). Ferrocene is the first and best-known example of a *metallocene* which, in simple terms, describes a metal atom encapsulated between two aromatic rings. Its discovery and characterization spawned the rapid growth of organometallic chemistry in the second half of the twentieth century. *See* WERNER, *supra* at 129–57 (exploring the rapid growth).

67. In the world of chemistry, *B* is called a catalyst. Although catalysts speed up reactions, they are not consumed during the reaction and are often recovered at its completion.

reported preparing *C* by this route, knowledge in the field suggests that it should work. Accordingly, the scientist adds *A* and *B* to a flask and begins stirring the mixture. A few hours later, the scientist returns to the lab and finds that an unexpected bright orange powder, *X*, has settled to the bottom of the flask! The orange color indicates that *X* contains iron. At this point, the scientist immediately begins to isolate and purify *X*, which takes the remainder of the day. On Day Two, the scientist begins structure elucidation. The first test reveals that *X* is an aromatic compound, indicating that it will be unusually stable. Other tests throughout the day support this preliminary structural assignment. Yet, since a metal (iron) is involved, the scientist cannot make a definitive structure determination until obtaining an X-ray analysis of the compound. On Day Three, the X-ray data confirm *X*'s structure: it is indeed an iron-containing aromatic compound. Next, the scientist repeats the synthesis and obtains the same result, *X*, on Day Four. Diligent testing over the next few weeks shows that *X* and its derivatives are useful in polymers, catalysis, and electrochemistry. In light of this utility,[68] the scientist decides to file a patent application.[69]

68. Contrary to popular belief, one cannot obtain a patent on a compound simply because it is novel. It must also be useful. § 101 ("Whoever invents or discovers any new and *useful* process, machine, manufacture, or composition of matter . . . may obtain a patent therefor . . . .") (emphasis added). An applicant must disclose the utility at the time of filing the patent application. Brenner, Comm'r of Patents v. Manson, 383 U.S. 519, 528–29 (1966). But an applicant need not understand or know the invention's utility at the time of conception. *See* Burroughs Wellcome Co. v. Barr Labs., Inc., 40 F.3d 1223, 1228 (Fed. Cir. 1994) ("[A]n inventor need not know that his invention will work for conception to be complete. He need only show that he had the idea . . . ." (citing Applegate v. Scherer, 332 F.2d 571, 573 (C.C.P.A. 1964)) (internal citation omitted). Utility can be confirmed later through the actual or constructive reduction to practice. *Id.*; Timothy R. Holbrook, *The More Things Change, the More They Stay the Same: Implications of* Pfaff v. Wells Electronics, Inc. *and the Quest for Predictability in the On-Sale Bar*, 15 BERKELEY TECH. L.J. 933, 980 (2000).

69. The early patenting history of ferrocene is interesting. Believing that Pauson had not grasped the significance of the compound, Herman E. Schroeder, a DuPont scientist, invited Pauson to the company to discuss the invention and to help Pauson file a patent application. *See* Herman E. Schroeder & Charles J. Pedersen, *The Productive Scientific Career of Charles J. Pedersen Supplemented by an Account of the Discovery of "Crown Ethers*,*"* 60 PURE & APPLIED CHEMISTRY 445, 446 (1988) (telling the story). Pauson filed the patent application a few months later with DuPont as the assignee. *See* Dicyclopentadienyliron and Process of Making the Same, U.S. Patent No. 2,680,756 (filed June 3, 1952) (issued June 8, 1954). Pedersen later discovered that ferrocene was a useful additive in gasoline and rocket fuel, paving the way for a host of follow-on patents. *See* Schroeder & Pedersen, *supra*, at 447. But in addition to this groundbreaking ferrocene research, Pedersen later won the 1987 Nobel Prize in Chemistry for his accidental discovery of crown ethers. *Id.* at 445 n.450; *see also* Charles J. Pedersen, *Macrocyclic*

1. Pinpointing Conception

Current patent law is ill equipped to handle this example because it is impossible to "conceive" the accidental discovery of *X*—at least at the moment of the serendipitous event. Technically, the traditional rule dictates that *X* cannot be "invented" until later.[70] But on which day did conception occur?

Answering this question is somewhat tricky because pinpointing conception is a technical inquiry.[71] It appears that the earliest date that the scientist had an idea of *X*'s structure was on Day Two. By this point, the scientist clearly had a complete mental picture of *X* and could define *X* by its method of preparation as well as by its physical and chemical properties.[72] Thus, on Day Two, the scientist could sufficiently distinguish *X* from other compounds.[73] Although one could argue that this idea did not become "definite and permanent" until the X-ray data arrived on Day Three, these data did not alter the specificity of the scientist's idea.[74] In sum, under the current law, it appears that Day Two is the earliest possible date of conception.

2. Pinpointing Reduction to Practice

Putting aside conception for a moment, it appears that under the present framework an actual reduction to practice probably did not occur until Day Four, even though *X* was physically isolated on Day One, which is always the case for accidental discoveries of this type. Indeed, current law dictates that the initial accident on Day One cannot serve as a reduction to practice because at that time the

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Polyethers for Complexing Metals, 4 ALDRICHIMICA ACTA 1, 1–4 (1971) (recounting the discovery).

70. For a rare exception, see *infra* note 76 (discussing the doctrine of simultaneous conception and reduction to practice).

71. *See* Douglas Lichtman et al., *Strategic Disclosure in the Patent System*, 53 VAND. L. REV. 2175, 2186 (2000) (referring to conception as "a technical concept"); *see also* Technitrol, Inc. v. United States, 440 F.2d 1362, 1369 (Ct. Cl. 1971) (describing conception as "a pivotal if somewhat nebulous notion in patent law").

72. *Cf. Burroughs Wellcome*, 40 F.3d at 1228 ("The conception analysis necessarily turns on the inventor's ability to describe his invention with particularity. Until he can do so, he cannot prove possession of the complete mental picture of the invention."); Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1206 (Fed. Cir. 1991) ("[I]t is well established in our law that conception of a chemical compound requires that the inventor be able to define it so as to distinguish it from other materials, and to describe how to obtain it." (citing Oka v. Youssefyeh, 849 F.2d 581, 583 (Fed. Cir. 1988))).

73. *See Amgen*, 927 F.2d at 1206.

74. *See Burroughs Wellcome*, 40 F.3d at 1229 ("A conception is not complete if the subsequent course of experimentation . . . reveals uncertainty that so undermines the specificity of the inventor's idea that it is not yet a definite and permanent reflection of the complete invention as it will be used in practice.").

scientist did not contemporaneously recognize and appreciate *X*'s structure.[75] As discussed above, this did not happen until at least Day Two. Thus, it appears that the actual reduction to practice occurred on Day Four when the experiment was repeated.[76] If this is indeed true, it is absurd because it suggests that unexpected discoveries require at least two sets of experiments to establish an actual reduction to practice: the initial accident that leads to conception and a following experiment to reduce the conceived idea to practice. Indeed, one would think that making the compound once in the form that is subsequently claimed should be sufficient to establish an actual reduction to practice. Now, of course, an actual reduction to practice is not required to file a patent application.[77] Nonetheless, a party can obtain an earlier date of invention by proving that the invention was physically made before the filing date.[78]

3. Priority Issues

Having determined that while the accident occurs on Day One, conception occurs on Day Two at the earliest, and actual reduction to

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75. *See* Estee Lauder Inc. v. L'Oreal, S.A., 129 F.3d 588, 593 (Fed. Cir. 1997) (" 'It is well-settled that conception and reduction to practice cannot be established *nunc pro tunc* [literally now for then, retroactively]. There must be *contemporaneous recognition and appreciation* of the invention . . . .' " (quoting Breen v. Henshaw, 472 F.2d 1398, 1401 (C.C.P.A. 1973))).

76. This reasoning is in accord with the general rule under the conception–reduction to practice framework that "[r]eduction to practice follows conception." Mahurkar v. C.R. Bard, Inc., 79 F.3d 1572, 1578 (Fed. Cir. 1996). However, the courts have created a narrow exception that is known as the doctrine of simultaneous conception and reduction to practice ("SCRTP"). *See* Smith v. Bousquet, 111 F.2d 157, 159 (C.C.P.A. 1940) (establishing the doctrine). As the Federal Circuit has explained, SCRTP arises in the rare instance where an inventor cannot formulate a complete picture of the invention until "reduc[ing] the invention to practice through a successful experiment." *Burroughs Wellcome*, 40 F.3d at 1229; *cf.* Alpert v. Slatin, 305 F.2d 891, 894 (C.C.P.A. 1962) (" 'This doctrine [SCRTP] . . . is but rarely applied to a residuum of cases where results at each step do not follow as anticipated, but are achieved empirically by what amounts to trial and error.' " (quoting Bd. of Patent Interferences, Interference No. 87,154)). For an example of the doctrine's application, see *Amgen*, 927 F.2d at 1206, which held that for an invention claiming a purified DNA sequence for encoding a protein, conception did not occur until after the fragment had been isolated and characterized. In sum, SCRTP arises when actual experimentation (which is also sufficient to fulfill the requirements of reduction to practice) is necessary to supply the knowledge to complete conception. 2 R. CARL MOY, MOY'S WALKER ON PATENTS § 8:54 (4th ed. 2008). Turning to the hypothetical example used in the text, since it is clear that one *could have* formulated a mental picture of *X* before engaging in experimentation, SCRTP need not apply. *See supra* notes 72–74 and accompanying text.

77. Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986). *See supra* note 56 and accompanying text.

78. Cooper v. Goldfarb, 240 F.3d 1378, 1382 (Fed. Cir. 2001).

practice on Day Four, one might ask how this time lag might affect the scientist's patent rights. As discussed above, this time lag can be determinative if another party competes with the scientist over the priority of invention rights for *X*. Although a detailed analysis of the applicable law is beyond the scope of this Essay, a short illustration will help make the point. Assume that while the scientist's patent application for *X* is pending in the U.S. Patent and Trademark Office ("PTO"), the examiner receives an application from another party who also claims *X*. To determine priority, the examiner declares an interference.[79] During the proceeding, the other party submits evidence that establishes its conception of *X* on Day One followed by reasonable diligence toward a constructive reduction to practice that culminated on its filing date.[80] Thus, the other party wins even though it filed its application last and never actually reduced *X* to practice! As discussed above, this unfortunate outcome reflects a structural bias in current patent doctrine against accidental inventions.[81]

B. When Should an Accident Become an Invention?

Because the traditional conception-focused framework cannot easily be applied to accidental inventions, it is time for the patent system to adopt a paradigm that distinguishes inventions made with intention from those that occur serendipitously.[82] At the very least,

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79. *See* 35 U.S.C. § 135 (2006). As discussed above, the PTO Board of Patent Appeals and Interferences determines which party is entitled to a patent. *See supra* note 63. The party that first reduced the invention to practice usually wins; however, as stated above, a party that was "first to conceive the invention but last to reduce it to practice" (either actively or constructively) will win if that party "demonstrates reasonable diligence [toward] reduction to practice." *Cooper*, 240 F.3d at 1382 (citing 35 U.S.C.A. § 102(g) (West Supp. 2000)).

80. *See* Hull v. Davenport, 90 F.2d 103, 105 (C.C.P.A. 1937) (articulating rule); Sletzinger v. Lincoln, 410 F.2d 808, 810 (C.C.P.A. 1969) (presenting a chemical example). An inventor's or attorney's preparation of the patent application can count as reasonable diligence toward a constructive reduction to practice. *See* Bey v. Kollonitsch, 806 F.2d 1024, 1027–28 (Fed. Cir. 1986).

81. *See supra* notes 8–9 and accompanying text.

82. *Cf.* 1 ENCYCLOPEDIA OF CREATIVITY 566 (Mark A. Runco & Steven R. Pritzker eds., 1999) ("In general, scientists usually argue that inventions are made with intention, whereas discoveries occur serendipitously."); Root-Bernstein, *supra* note 51, at 44 ("[W]e invent with intention; we discover by surprise."). There is little doubt that the current patent laws value mental activity over physical activity. *See, e.g.*, Pfaff v. Wells Electronics, 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."); Burroughs Wellcome Co. v. Barr Labs., Inc., 40 F.3d 1223, 1227 (Fed. Cir. 1994) ("Conception is the touchstone of inventorship."); Dan L. Burk, *Feminism and Dualism in Intellectual Property*, 15 AM. U. J. GENDER SOC. POL'Y & L. 183, 192–93 (2007) ("[P]atent law elevate[s] mental effort over physical effort, conceptual production over material

every invention need not begin with conception. Rather, as explained below, the isolation of the substance coupled with reasonable diligence toward elucidating its structure should be sufficient to establish priority to the invention as of the moment of the serendipitous event.[83] Returning to the hypothetical, this would mean that *X* became a patentable invention on Day One because the serendipper began reasonable diligence toward structure elucidation immediately after isolation and purification of the compound. Although this alternative approach to invention may appear to be a departure from basic patent law principles, the theoretical underpinnings for it already exist in case law.

The relevant cases wrestle with the extent to which an invention must be developed before pre-filing commercialization activity bars its patentability. The on-sale provision of § 102(b) of the Patent Act bars patentability if the invention was on sale more than a year before filing.[84] It serves to strike a balance between an inventor's need for adequate time after the sales activity to assess the value of a potential patent and the needs of the public, who may have come to believe that the invention is now in the public domain or otherwise "up for grabs."[85] A key question is when does an invention reach the stage at which the on-sale bar attaches. The Supreme Court resolved this question more than a decade ago in *Pfaff v. Wells Electronics, Inc.*,[86] when it decided whether a written purchase order for mechanical sockets not physically made before the critical date was sufficient to have placed the invention "on-sale."[87] The Court held that the

production, thus tying . . . rewards to participation in an idealized, romantic vision of creative production. Participants in the [physical] portions of the creative process are excluded, invisible, [and] unrecognized. This version of creative effort effectively . . . attribute[s] the entirety of creative production to a particular, discrete act of creative vision.").

83. *See infra* notes 100–01 and accompanying text.

84. § 102(b) (explaining that a patent is invalid if the invention was on sale in the United States more than one year before the date of the application for a U.S. patent).

85. DURHAM, *supra* note 28, at 118; *see also* King Instrument Corp. v. Otari Corp., 767 F.2d 853, 860 (Fed. Cir. 1985) (discussing the underlying policies of the on-sale bar); 1 CHISUM, *supra* note 52, § 601 ("The general purpose behind all the [§ 102] bars is to require inventors to assert with due diligence their right to a patent through the filing and prosecution of a patent application.").

86. 525 U.S. 55 (1998).

87. *Id.* at 57–60. The "critical date" is "the date one year prior to the date on which the patent application was filed." Monon Corp. v. Stoughton Trailers, Inc., 239 F.3d 1253, 1257 (Fed. Cir. 2001). So, for example, if an inventor filed an application on April 19, 1982, the critical date for § 102(b) purposes is April 19, 1981. If a triggering event occurred before the earlier date, the inventor has lost his right to a patent. *Pfaff*, 525 U.S. at 57–58.

invention must be "ready for patenting"[88] to trigger the one-year clock, a condition that is satisfied "by proof of reduction to practice before the critical date or by proof that prior to the critical date the inventor had prepared drawings or other descriptions of the invention that were sufficiently specific to enable a person skilled in the art to practice [it]."[89]

What is more important, for purposes of this Essay, is that after *Pfaff*, the Federal Circuit held that proof of conception is not required for an invention to be "ready for patenting" if it is physically made and sold in its claimed form.[90] The key case on point is *Abbott Laboratories v. Geneva Pharmaceuticals, Inc.*,[91] in which the Federal Circuit affirmed a summary judgment of invalidity because Abbott's claimed drug was offered for sale more than a year before filing.[92] The parties did not dispute that a third party had sold the specifically claimed "Form IV" of the drug more than a year before Abbott's filing date.[93] Yet, Abbott argued that the sale was not for the patented invention because the parties did not know at the time of the sale that the material sold contained Form IV.[94] In rejecting Abbott's contention that there can be no on-sale bar unless conception of the invention has been proven, the Federal Circuit held that there was no requirement that the parties understand the details of what was sold.[95]

88. *Pfaff*, 525 U.S. at 67. The Court explained that § 102(b) does not require reduction to practice before an invention can be patented. *See id*. at 60.

89. *Id.* at 67–68. Applying this condition to the facts, the *Pfaff* Court decided that the patent-at-issue was invalid because the inventor had "prepared detailed engineering drawings that described the design, the dimensions, and the materials to be used in making the socket." *Id.* at 58, 68–69.

90. *See* Abbott Labs. v. Geneva Pharms., Inc., 182 F.3d 1315, 1318 (Fed. Cir. 1999) ("We disagree that proof of conception was required. The fact that the claimed material was sold under circumstances in which no question existed that it was useful means that it was reduced to practice."); Scaltech Inc. v. Retec/Tetra, L.L.C., 178 F.3d 1378, 1383–84 (Fed. Cir. 1999) ("Nor is there a requirement that [the patentee] must have recognized the significance of these limitations at the time of offer. If the [material] offered for sale . . . possessed each of the claim limitations, then [it] was on sale, whether or not the seller recognized that his [material] possessed the claimed characteristics.") (citations omitted).

91. 182 F.3d 1315 (Fed. Cir. 1999).

92. *Id.* at 1318–19.

93. *Id.* at 1317.

94. *Id.* at 1318. After the filing date, Abbott and Geneva separately tested the material that was sold and determined that it contained Form IV. *See id.* at 1317 n.2.

95. "If a product that is offered for sale inherently possesses each of the limitations of the claims, then the invention is on sale, whether or not the parties to the transaction recognize that the product possesses the claimed characteristics." *Id.* at 1319 (citations omitted); *cf.* J.A. LaPorte, Inc. v. Norfolk Dredging Co., 787 F.2d 1577, 1582–83 (Fed. Cir. 1986) ("[T]he question is not whether the sale, even a third party sale, 'discloses' the invention at the time of the sale, but whether the sale relates to a device that *embodies* the invention.") (emphasis added) (citations omitted).

According to the court, the mere fact that the material was sold was conclusive and obviated any need for inquiry into conception.[96] Thus, "[t]he Federal Circuit held . . . that the invention had been reduced to practice even though it had yet to be conceived."[97]

The lesson from *Abbott* is that if the invention sold or offered for sale is physically made and is in the form that is subsequently claimed, it is sufficiently complete and "ready for patenting" for § 102(b) purposes even if the inventor does not know all of its characteristics or have a complete mental picture of it. Although this scenario is unlikely to occur for many "predictable" inventions like the mechanical socket at issue in *Pfaff*,[98] it can arise in chemistry and other unpredictable fields, which are prone to accidental discovery.[99]

Given that conception is not required for § 102(b) purposes, it is hard to understand why it must be required for patent-obtaining purposes. Turning back to the hypothetical, if the substance obtained at the time of the accident, *X*, is the form that will be claimed, the serendipitous event, supported with adequate proof,[100] should be sufficient to establish an invention date for priority purposes even

96. *Abbott*, 182 F.3d at 1318–19. *But see* Holbrook, *supra* note 68, at 958 n.142 (arguing that the court rigidly applied *Pfaff* and adopted a strict interpretation of reduction to practice). But the on-sale bar might not be triggered if additional development of the invention occurs after the offer for sale because it might indicate that the invention was not complete. *See* Pfaff v. Wells Electronics, Inc., 525 U.S. 55, 68 n.14 (1998); Space Systems/Loral, Inc. v. Lockheed Martin Corp., 271 F.3d 1076, 1080–81 (Fed. Cir. 2001) (citing *Pfaff*, 525 U.S. at 68 n.14).

97. Holbrook, *supra* note 68, at 958 n.142.

98. *Pfaff*, 525 U.S. at 57–58. It is also worth noting that for (predictable) inventions of this type, an actual reduction to practice is unnecessary to show how to practice the invention or, relatedly, that it is ready for patenting. *Cf.* Smith v. Place, 84 F.2d 196, 201 (C.C.P.A. 1936) ("The [snap fastener] clearly belongs to that class of inventions which are so simple[,] . . . and the utility of which is so certain, that tests under actual working conditions are unnecessary."). To illustrate, consider a utensil manufacturer who has decided to introduce a new line of chopsticks with pointed tips. The innovation team quickly prepares drawings which provide a detailed description of the chopsticks, including a description of sticks of a given range of sizes, how sticks of appropriate dimensions could be made, and how the sticks would be positioned in the hand. Since chopstick-making is a predictable art, these drawings would be "sufficiently specific to enable a person skilled in the art to practice the invention," even if the chopsticks are never made. *Pfaff*, 525 U.S. at 67–68; *cf.* Karen S. Canady, *The* Wright *Enabling Disclosure for Biotechnology Patents*, 69 WASH. L. REV. 455, 457 (1994) (presenting a form of this example in the § 112 ¶ 1 enablement context). Thus, if these drawings were available at a pre-filing offer for sale, they should be sufficient to trigger the § 102(b) bar. *See Smith*, 84 F.2d at 201.

99. *See supra* Part I.B.

100. A witnessed or signed inventor's notebook, as well as other documentary and physical evidence generated in the laboratory, can serve as sufficient evidence of reduction to practice. *See* Medichem, S.A. v. Rolabo, S.L., 437 F.3d 1157, 1169–70 (Fed. Cir. 2006).

though the inventor's precise knowledge of the structure comes shortly thereafter. Put somewhat differently, when the initial accident is followed by reasonable diligence toward structure elucidation, the events are so connected "that they are substantially one continuous act."[101] Thus, there should be symmetry between invention "completeness" for patent-defeating purposes and for patent-obtaining purposes.[102]

One potential criticism of this approach is that it rewards discovery at the expense of other goals of the patent system. For example, returning to the priority contest presented above, one could argue that awarding priority to the party that first conceived of *X*'s structure (but never actually reduced it to practice) is proper because it fosters rigorous investigation, encourages early disclosure, and promotes efficient investment in innovation.[103]

Yet, the broad ex ante incentives for invention and early disclosure can also thwart innovation.[104] For example, returning to the

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101. *Cf.* Mahurkar v. C.R. Bard, Inc., 79 F.3d 1572, 1577 (Fed. Cir. 1996) ("[T]he person 'who first conceives . . . may date his patentable invention back to the time of its conception, if he connects the conception with its reduction to practice by reasonable diligence on his part, so that they are substantially one continuous act.' " (quoting Christie v. Seybold, 55 F. 69, 76 (6th Cir. 1893))).

102. In discussing *Abbott* and related cases, Professors Dan Burk and Mark Lemley contend that "the determining factor appears to be that the public has already benefited from the presence of the claimed invention in the prior art, even though it may not have been aware of the invention itself." Dan L. Burk & Mark A. Lemley, *Inherency*, 47 WM. & MARY L. REV. 371, 379 (2005). But they point out that priority cases are distinguishable because (in accord with Federal Circuit jurisprudence) the ability to describe the compound in detail is required to show possession. *Id.* at 394. Accordingly, they argue that an asymmetry makes sense as a policy matter because "an inherent but unappreciated prior use that benefits the public will not qualify for a patent, but it will prevent others from later patenting the invention being used." *Id.* While I agree that public benefit can explain the outcome in *Abbott*, returning to the hypothetical, I do not believe that knowledge of *X*'s structure at the time of the accident should be the *sine qua non* for showing possession on Day One, particularly since structural details are diligently obtained shortly thereafter.

103. *See* Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 267–70 (1977) (arguing that broad patents should be granted for technological "prospects" at an early stage of research and development); John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 472 (2004) ("By allowing a patent to occur before firms commit the bulk of the expenditures necessary to develop the invention, the prospect system reduces wasteful expenditures on duplication and thus makes the process of investing in innovation more efficient."); Dana Rohrabacher & Paul Crilly, *The Case for a Strong Patent System*, 8 HARV. J.L. & TECH. 263, 271 (1995) (arguing that the ability to obtain patent protection at the early stages of the inventive process is necessary to maintain the incentive for the investment of venture capital in research and development).

104. *See* Seymore, *Teaching Function*, *supra* note 29 (explaining how ex ante incentives can discourage ex post improvement activity). *But see supra* note 103 (citing authors who

priority contest discussed above, if the party awarded priority to *X* lacks the capacity or interest in either actually reducing it to practice themselves or licensing the patent to other innovators who might conduct further research (which could lead to a commercial product), then the end result might be a hang-up or holdout.[105] In this case, clearly the party that won the patent race is probably not the best or most efficient user of the technology.[106] By contrast, as discussed in Part II.C below, rewarding the serendipper with the patent to *X* will likely result in a drastically different outcome.

C. *Why Are Accidental Inventions Good for the Patent System?*

An oft-touted justification for the patent system is that society receives some benefit from the invention's disclosure in exchange for the patentee's right to exclude. Yet, as written elsewhere, in far too many cases, the public gets the short end of the stick in this so-called patent bargain.[107] Accidental inventions, however, hold up their end of this so-called patent bargain in two significant ways.

First, since *X* is always physically reduced to practice before a patent application is filed, there is little doubt that the patent document will provide comprehensive technical details about *X*,[108] which, in turn, will substantially contribute to the public storehouse of

support granting patents at the early stages of research). This discussion raises the broader question of whether the purpose of the patent system is to promote innovation or disclosure. *Compare* Paulik v. Rizkalla, 760 F.2d 1270, 1276 (Fed. Cir. 1985) (in banc) ("The obligation to disclose is not the principal reason for a patent system . . . . The reason . . . is to encourage innovation and its fruits: new jobs and new industries, new consumer goods and trade benefits."), *with* Seymore, *Heightened Enablement*, *supra* note 10, at 155–58, 161–64 (arguing that broad claims can thwart innovation and proposing that the inventor's actual experimental details should be used to limit claim scope).

105. Clarisa Long, *Proprietary Rights and Why Initial Allocations Matter*, 49 EMORY L.J. 823, 824–27 (2000). While it is true that the losing party (or other innovators) can obtain an "improvement" patent for a novel and nonobvious variant of *X*, *X′*, the holder of this (narrower) patent cannot practice *X′* without a license from the holder of the (broader) patent to *X*. Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 860–61 (1990). For the sake of completeness, it is also true that the holder of the patent to *X* cannot practice *X′* without a license. *Id.* at 61 n.96.

106. Long, *supra* note 105, at 823.

107. *See, e.g.*, Seymore, *Heightened Enablement*, *supra* note 10, at 143–54 (identifying problems with the current disclosure standard).

108. This will include experimental details about how to make and characterize *X*, which would be akin to the technical information one would find in a research journal. Yet it is possible, as the hypothetical example illustrates, that the scientist will need to engage in additional, post-accident experimentation to satisfy other patentability requirements. *See supra* note 68.

knowledge.[109] Stated another way, while it is true that the patentee can exclude others from practicing the invention until the patent term expires, the technical information relating to *X* that is disclosed in the patent document has potential immediate value to the public,[110] who can use "the information for any purpose which does not infringe the claims."[111] This point is very important because one major criticism of patents is that they "seldom teach enough so that someone can actually go out and actually do the invention without some additional work."[112] And in experimental fields like chemistry where results are often "uncertain, unpredictable, and unexpected,"[113] there is a real danger that claimed embodiments which are inadequately described either cannot be made or may require unduly extensive experimentation.[114]

Yet, the danger of inadequate disclosure is essentially absent for accidental inventions because they are actually made. The resulting patents, often replete with working examples, are technically robust documents which provide specific and useful teaching.[115] Given that disclosure is the principal benefit that the public receives in exchange for the patentee's right to exclude,[116] the knowledge that comes from

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109. *See In re* Argoudelis, 434 F.2d 1390, 1394 (C.C.P.A. 1970) (Baldwin, J., concurring) (explaining 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"); *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 the eventual development of further significant advances in the art); Graham v. John Deere Co., 383 U.S. 1, 6 (1966) (noting that adding to knowledge is required by the Intellectual Property Clause of the Constitution, U.S. CONST. art. 1, § 8); Atlantic Works v. Brady, 107 U.S. 192, 200 (1883) ("The design of the patent laws is to reward those who make some substantial discovery or invention, which adds to our knowledge . . . . It was never the object of those laws to grant a monopoly for every trifling device, every shadow of a shade of an idea . . . .").

110. *See* CRAIG A. NARD, THE LAW OF PATENTS 50 (2008).

111. Kirin-Amgen Inc. v. Hoechst Marion Roussel Ltd. [2004] UKHL 46 ¶ 77 (appeal taken from EWCA (civ.)) (U.K.).

112. Note, *The Disclosure Function of the Patent System (or Lack Thereof)*, 118 HARV. L. REV. 2007, 2024–25 (2005) (citation omitted). This is true, at least in part, because an inventor need not create a working embodiment or engage in any experimentation before obtaining the patent. Rather, an inventor can describe an invention with fictitious, constructed examples (which is entirely consistent with the doctrine of constructive reduction to practice). *See* Seymore, *Heightened Enablement*, *supra* note 10, at 143–45.

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

114. Seymore, *Heightened Enablement*, *supra* note 10, at 138.

115. *See* Seymore, *Teaching Function*, *supra* note 29.

116. The Court often describes disclosure as the quid pro quo for the inventor's right to exclude. *See* Pfaff v. Wells Electronics, 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

an accidental discovery is precisely the type that the patent system should want to fill the shelves of the public storehouse.[117]

Second, the accidental discovery of *X* often leads to significant follow-on innovation. This is not surprising from a societal or technological standpoint. Regarding the former, the subject matter of the discovery often involves "the things that make everyday living more convenient, pleasant, healthy, or interesting."[118] This, in turn, will lead innovators to direct research and development efforts toward second-generation products, believing that they will be more effective than *X* itself.

From a technological perspective, the underlying science surrounding the accident is often new and exciting. Scientific principles and laws that were seemingly well understood and settled are suddenly thrust wide open when *X* is discovered.[119] Indeed, history shows that *X* is often something that the scientific community once thought was theoretically impossible to make or, at the very least, incredibly difficult to prepare.[120] But the accident opens new frontiers for exploration. After the initial bewilderment, the accident tends to spawn two types of inquiry: basic research, which seeks to elucidate mechanistic and structural details; and applied research, which seeks to stretch the boundaries of *X* by tweaking the concept to make improvements that are even more valuable than *X* itself. And, of course, innovators will seek to obtain patent protection for these improvements as well as for the methods of making and using them.

CONCLUSION

Serendipity has played a major role in the production of scientific knowledge. When accidental discoveries are patented, the disclosure of the technical details of the invention and the high likelihood of further innovation advance important goals of the patent system. Yet,

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for a limited period of time."). Essential to the disclosure requirement is enablement, which compels a patent applicant to enable a person having ordinary skill in the art to make and use the full scope of the claimed invention without undue experimentation. *See* 35 U.S.C. § 112 (2006) (describing the enablement requirement); LizardTech, Inc. v. Earth Res. Mapping, Inc., 424 F.3d 1336, 1344 (Fed. Cir. 2005) (describing enablement as the essential aspect of the patent bargain).

117. *See supra* note 109 and accompanying text.

118. ROBERTS, *supra* note 15, at ix.

119. A serendipitous event "involves a wild leap outside the limits of what was until that moment supposed, and thereby enables science to advance into domains of understanding that were not previously imagined." ZIMAN, *supra* note 36, at 217 (citation omitted).

120. For examples, *see supra* note 46.

despite the ubiquity of inventions in unpredictable fields, the patent laws have not evolved to accommodate accidental discoveries. As debates over patent reform continue, this Essay's proposal will help reconcile this lingering gap between patent laws and the realities of scientific research.