THE INVENTION MYTH

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ABSTRACT

Patent law is, at its heart, all about the invention. Determining who qualifies as an inventor defines who controls the exclusory right conferred by the patent. The current law of inventorship, which values mental over physical aspects of the creative process, has remained largely unchanged for over a century. Yet, this approach doesn't work well for a broad swath of inventions—particularly those emerging from experimental fields, complex technologies, and collaborative research. To handle these nonconforming inventions, the patent system relies on fictitious workarounds and mythical, gap-filling doctrines to feign, ignore, or overlook conformity. Fidelity to this paradigm, however, exacerbates a disconnect between patent law and many scientific communities that it serves. This Article offers a new approach to inventorship that better aligns with scientific norms and the realities of the inventive process. It eschews legal fiction and recalibrates the law of invention to allow patent law and science to achieve their shared policy goal of promoting technological progress by rewarding meritorious creators and original, challenging research endeavors.

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INTRODUCTION

Whether an artificial intelligence (AI) software system can qualify as an inventor under the patent statutes has put the law of invention in the national spotlight.[1] In theory, the inventive process has two sequential steps.[2] It begins with conception, where the inventor develops a complete mental picture of the invention.[3] It concludes with reducing that mental picture to practice—either by physically making the invention or describing it in sufficient detail to enable a skilled artisan to physically make it.[4] The law of invention has been propelled into the national spotlight as the Patent Office and the courts wrestle with the proper role of artificial intelligence

1. Saswato R. Das, *An Inventor That Isn't Human*, BOS. GLOBE (Feb. 13, 2022, 12:00 PM), https://www.bostonglobe.com/2022/02/09/opinion/an-inventor-that-isnt-human/ [https://perma.cc/T6S3-5VA4]; Alexandra George & Toby Walsh, Commentary, *Artificial Intelligence is Breaking Patent Law*, 605 NATURE 616 (2022).

2. 1 WILLIAM C. ROBINSON, THE LAW OF PATENTS FOR USEFUL INVENTIONS § 373, at 530 (Boston, Little, Brown & Co. 1890).

3. *See id.* § 376, at 532; *infra* Section I.A.

4. *See infra* Section I.A.

in the process.[5] Even if it's possible for an AI software system to invent, the U.S. Court of Appeals for the Federal Circuit ("Federal Circuit")[6] recently held in *Thaler v. Vidal* that there's "no ambiguity: the Patent Act requires that inventors must be natural persons; that is, human beings."[7]

While *Thaler* answered the AI question, the law of invention remains unsettled and murky. This is because academics, judges, and patent practitioners succumb to legal fiction—a myth—that the inventive process actually follows the two-step sequence described above. Oftentimes it doesn't.[8] The *myth* of invention isn't the *reality* of invention.

To illustrate, consider the following hypothetical. Suppose a DuPont chemist puts *A* and *B* in a furnace, hoping for a chemical reaction that'll produce a new and exciting material. The chemist has no idea what, if anything, will result. Fortuitously, the chemical reaction produces *Y*. Subsequent characterization reveals that *Y* is a crystalline substance that's harder than diamond. Given its potential utility, DuPont files a patent application claiming *Y*. But because *Y*'s creation didn't follow the bipartite paradigm, *Y wasn't invented*—at least not in a formal sense.[9] It wasn't *conceived*.[10] The chemist took a chance and got lucky.[11]

Simultaneously and wholly independent of what's happening at DuPont,[12] suppose a 3M chemist conceives *Y* and formulates a process for making it by placing *A* and *B* in a furnace. It works. Here, *Y* is created by design, not by chance. 3M realizes its potential utility and files a patent application claiming *Y*. Because the 3M chemist followed the traditional two-step sequence, *Y was invented*. Now the normative question: Who's

5. *See generally* David L. Schwartz & Max Rogers, *"Inventorless" Inventions? The Constitutional Conundrum of AI-Produced Inventions*, 35 HARV. J.L. & TECH. 531 (2022); Mimi S. Afshar, *Artificial Intelligence and Inventorship—Does the Patent Inventor Have to be Human*, 13 HASTINGS SCI. & TECH. L.J. 55 (2022).

6. The U.S. Court of Appeals for the Federal Circuit is a twelve-judge Article III court whose jurisdiction includes appeals from the Patent Office and patent suits emerging from the U.S. district courts. *See* 28 U.S.C. §§ 44, 1295(a).

7. Thaler v. Vidal, 43 F.4th 1207, 1210 (Fed. Cir. 2022).

8. *See infra* Part II.

9. In considering DuPont's application, the Patent Office will almost certainly proceed under the *myth* that DuPont's activities followed the two-step sequence. Interestingly, the Patent Office doesn't analyze inventorship except for "the rare situation" where there's a clear inventorship problem. MPEP § 2157 (9th ed. Rev. 1, Nov. 2024).

10. "[A]ccidental discoveries, at least at the moment of the serendipitous event, lack conception." Sean B. Seymore, *Serendipity*, 88 N.C. L. REV. 185, 191 (2009).

11. I call this a *chance discovery*. *See infra* note 82 and accompanying text.

12. There's a strange, curious phenomenon wherein "a handful of geographically dispersed investigators stumble independently onto the very same discovery" at a very specific moment in time. STEVEN JOHNSON, HOW WE GOT TO NOW: SIX INNOVATIONS THAT MADE THE MODERN WORLD 66 (2014); *see also* ROBERT K. MERTON, *Singletons and Multiples in Science*, *in* THE SOCIOLOGY OF SCIENCE 343–70 (Norman W. Storer ed., 1973); Mark A. Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709, 712–33 (2012) (discussing the prevalence of simultaneous invention).

entitled to the patent—DuPont or 3M?[13] The patent statute only allows a *single* patent for an invention.[14]

Entitlement to patent rights depends on the nuts and bolts of the inventive process.[15] It matters who conceives or files first, how the subject matter was invented (for example, by design or by accident), and—if multiple persons are involved in the process—who did what.[16] These issues rarely surface at the Patent Office;[17] examiners are primarily concerned with the statutory patentability requirements—namely, determining if the invention is useful, novel, nonobvious, and directed to eligible subject matter[18] and the patent application adequately describes, enables, and sets forth the best mode for the invention and concludes with definite claims.[19] Inventorship issues typically arise post-issuance when an omitted person wants to be named as a joint or sole inventor[20] or when a named inventor allegedly derived the invention from the true inventor.[21]

The bipartite paradigm exposes a disconnect between patent law and the scientific communities that it serves. Science is generally agnostic about how new things are made;[22] it doesn't matter if the new thing is created by

13. *Cf.* Seymore, *supra* note 10, at 190 ("[W]hen should the patent system consider an accidental discovery 'invented' for the purpose of obtaining patent rights?"); ROBINSON, *supra* note 2, § 370, at 528 ("Where two or more persons, independently of each other, have performed the same complete inventive act, ... the law is forced to choose between the [rivals] and confer the exclusive privilege upon the one who in reason seems best to deserve it."); Peter Lee, *Social Innovation*, 92 WASH U. L. REV. 1, 29 (2014) (observing that "a regime of individual property rights requires assigning rights" to those who invent around the same time, despite the difficulty). Is a planned invention more meritorious of a patent than a chance discovery? *See infra* Part III.

14. Miller v. Eagle Mfg. Co., 151 U.S. 186, 197 (1894) (explaining "the well-settled rule that two valid patents for the same invention cannot be granted either to the same or to a different party"); 35 U.S.C. § 101 (2012) ("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 . . . ." (emphasis added)); ROBINSON, *supra* note 2, § 370, at 528 ("Two patents cannot however be granted for the same invention, because an exclusive privilege cannot subsist in distinct individuals . . . .").

15. *See* Regents of Univ. of N.M. v. Knight, 321 F.3d 1111, 1119 (Fed. Cir. 2003) (observing that "initial ownership of a patent vests in the inventor by operation of law" (citing Beech Aircraft Corp. v. EDO Corp., 990 F.2d 1237, 1248 (Fed. Cir. 1993))); 35 U.S.C. § 154(a)(1) (2012) (conferring the right to exclude to the patent owner); *infra* Part I.

16. *See infra* Section II.C.

17. *See supra* note 9.

18. 35 U.S.C. §§ 101–103.

19. *Id.* § 112(a) & (b).

20. *See infra* Section III.B.4.

21. *See infra* Section III.B.6.

22. While the nuts and bolts of the inventive process matter in patent law, the inventor's identity or technical acumen are largely irrelevant. *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" (quoting Andrews v. Cross, 8 F. 269, 277–78 (C.C.N.D.N.Y. 1881))).

design or by accident.[23] But science also relies on peer review[24] for authenticating research results and allocating credit.[25] This is where patent law and science align: both seek to promote technological progress by emphasizing original, challenging research endeavors;[26] disseminating knowledge of new things,[27] rewarding creators;[28] and ensuring that others can replicate what's been done.[29] There's also hope that others will use what they learn about the new thing to improve upon it or make something else.[30]

Given these shared policy goals, it's time to reformulate the law of invention to better align with scientific norms and realities of the inventive process. This Article attempts to do just that. It begins, in Part I, by exploring the theory, contours, and justifications for the bipartite paradigm. Next, Part II examines inventions that don't conform to the bipartite paradigm—including serendipitous discoveries, newly discovered uses for old things, and jointly-developed inventions. It explores how courts have

23. This was a prevailing view in the early years of U.S. patent law. *See* Earle v. Sawyer, 8 F. Cas. 254, 256, (C.C.D. Mass. 1825) (No. 4,247).

24. Since 1665, the peer-reviewed scientific journal has been the principal medium "through which scientists have chosen to both communicate to their peers" and to archive their "research findings, . . . observations, interpretations, and conclusions." RICHARD D. WALKER, PATENTS AS SCIENTIFIC AND TECHNICAL LITERATURE 1 (1995). Peer review refers to the screening of research results by colleagues in a particular discipline. Peter Hernon & Candy Schwartz, Editorial, *Peer Review Revisited*, 28 LIBR. & INFO. SCI. RSCH. 1, 1 (2006). The mechanics of peer review typically work as follows: First, the researcher submits a manuscript to a journal. Second, the journal editor sends it to one or more reviewers knowledgeable about the problem to judge its merit—uniqueness, methodology, adequacy of research design, and potential contribution to the field. Third, the journal editor makes a publication decision. *See id.*

25. DARYL E. CHUBIN & EDWARD J. HACKETT, PEERLESS SCIENCE: PEER REVIEW AND U.S. SCIENCE POLICY 85 (1990).

26. *See* Michael J. Meurer & Katherine J. Strandburg, *Patent Carrots and Sticks: A Model of Nonobviousness*, 12 LEWIS & CLARK L. REV. 547, 549 (2008) (explaining how the nonobviousness requirement induces inventors to explore challenging endeavors); PAUL BEIJE, TECHNOLOGICAL CHANGE IN THE MODERN ECONOMY 97 (1998) (discussing technological uncertainty and innovation).

27. Rebecca S. Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 YALE L.J. 177, 180 (1987).

28. *See* Graham v. John Deere Co. of Kan. City, 383 U.S. 1, 9 (1966) (describing a patent as "a reward, an inducement, to bring forth new knowledge"); Pennock v. Dialogue, 27 U.S. (2 Pet.) 1, 19 (1829) (recognizing that the patent system seeks to promote the progress of the useful arts and to reward inventors).

29. *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 . . . ."). The U.S. Court of Customs and Patent Appeals (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 U.S. Court of Appeals for 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).

30. Sean B. Seymore, *The Teaching Function of Patents*, 85 NOTRE DAME L. REV. 621, 632, 663 (2010); *see also* Christopher A. Cotropia, *Physicalism and Patent Theory*, 69 VAND. L. REV. 1543, 1560 (2016) ("The reason patent law wants the invention disclosed is so that others can use that information to actually implement the invention and create other inventions."); 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).

created fictitious workarounds to feign, overlook, or ignore conformity. Finally, Part III offers a hybrid approach to invention that eschews legal fiction and, if implemented, would help reconnect patent law with to the scientific and technical communities that it serves.

I. TRADITIONAL INVENTION THEORY

A. The Bipartite Paradigm

Under current patent doctrine, the inventive process consists of two steps.[31] The first step, conception, 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."[32] This means "possession of [a] complete mental picture of the invention."[33] For a rudimentary invention like a dinner fork, this is trivial.[34] For a complex invention like a chemical compound, courts require both knowledge of its structure and "possession of an operative method of making it."[35]

The second step of the inventive process is reduction to practice.[36] This occurs when the inventor either makes a physical embodiment of the invention[37] that works for its intended purpose[38] or files a patent application describing the invention in sufficient detail to teach a person having

31. Note that invention "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, at GL1, Lexis (database updated 2024).

32. Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986) (quoting ROBINSON, *supra* note 2, § 376, at 532). Conception is a legal determination, *id.*, but the legal conclusions "focus on the evidence." *In re* Steed, 802 F.3d 1311, 1316 (Fed. Cir. 2015).

33. Burroughs Wellcome Co. v. Barr Lab'ys, Inc., 40 F.3d 1223, 1228 (Fed. Cir. 1994).

34. Suppose the invention is a stainless-steel dinner fork with five tines. The inventor probably contemporaneously recognizes and appreciates that it grabs food. *Cf.* Sean B. Seymore, *The Presumption of Patentability*, 97 MINN. L. REV. 990, 1024 (2013).

35. Oka v. Youssefyeh, 849 F.2d 581, 583 (Fed. Cir. 1988); *accord* 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.").

36. The general rule is that "[r]eduction to practice follows conception." Mahurkar v. C.R. Bard, Inc., 79 F.3d 1572, 1578 (Fed. Cir. 1996).

37. An "embodiment" is a concrete, physical form of an invention described in a patent application or patent. ROBERT PATRICK MERGES & JOHN FITZGERALD DUFFY, PATENT LAW AND POLICY 34 (8th ed. 2021).

38. Cooper v. Goldfarb, 154 F.3d 1321, 1327 (Fed. Cir. 1998). Evaluating an invention's intended purpose is a legal conclusion. z4 Techs., Inc. v. Microsoft Corp., 507 F.3d 1340, 1352 (Fed. Cir. 2007). Although the patent is the most important and persuasive evidence of the intended purpose, it's "appropriate to consider extrinsic evidence, particularly when it does not contradict the patent[]." Medtronic, Inc. v. Teleflex Innovations S.À.R.L., 68 F.4th 1298, 1304 (Fed. Cir. 2023).

ordinary skill in the art (PHOSITA)[39] how to practice it.[40] That a PHOSITA can rely on a patent document to practice a yet-unmade invention is based in legal fiction.[41] For reduction to practice to be complete, the inventor must contemporaneously recognize and appreciate what's been made.[42]

B. Mental Over Physical

Unlike the norms of science which focus on how the new thing is physically made, a bedrock principle of patent law is that an inventor need not engage in actual experimentation before obtaining a patent.[43] According to the Supreme Court, "[t]he primary meaning of the word 'invention' in the Patent Act unquestionably refers to the inventor's conception rather than

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39. The person having ordinary skill in the art (PHOSITA) is a hypothetical construct of patent law akin to the reasonably prudent person in torts. Panduit Corp. v. Dennison Mfg. Co., 810 F.2d 1561, 1566 (Fed. Cir. 1987). Factors relevant to constructing the PHOSITA in a particular field include its level of sophistication, "the educational level of the inventor," "the educational level of active workers in the field," the "type of problems encountered in the art," "prior art solutions to those problems," and the "rapidity with which innovations are made." Env't Designs, Ltd. v. Union Oil Co. of Cal., 713 F.2d 693, 696 (Fed. Cir. 1983).

40. Hybritech, Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986); Pfaff v. Wells Elecs., Inc., 525 U.S. 55, 61–63 (1998) (citing The Telephone Cases, 126 U.S. 1, 535–36 (1888)) (explaining that Alexander Graham Bell obtained a patent without building his invention, but that a skilled artisan can use the patent document to construct and practice what's claimed). The term "practice" refers to the how-to-make and how-to-use prongs of the enablement requirement of § 112(a). *In re* Swartz, 232 F.3d 862, 863 (Fed. Cir. 2000) (per curiam). It mandates that a patent application disclose an invention in sufficient detail to "enable a [PHOSITA] to make and use the invention without undue experimentation." *In re* Wands, 858 F.2d 731, 735 (Fed. Cir. 1988); *see also* Space Sys./Loral, Inc. v. Lockheed Martin Corp., 271 F.3d 1076, 1080–81 (Fed. Cir. 2001) (holding that enablement discussed in *Pfaff* is the statutory enablement requirement of § 112).

41. *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). As explained by Dan Burk and Mark Lemley:

> [T]he inventor is in some sense speculating or guessing about the features of an invention not yet built. But even [so], the underlying assumption in patent law is that the inventor "has" the invention mentally, and so can give a sufficiently detailed description of that inventive conception—physically creating the invention is straightforward.

Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1174 n.77 (2002); *see also* William Macomber, *Reduction to Practice of Patentable Inventions*, 63 U. PA. L. REV. 353, 356 (1915) (arguing that "a very large number of patented inventions go from the mind of the inventor . . . direct to the Patent Office. . . . but are absolutely incapable of [actual] reduction [to practice]"). However, this fiction "is well-placed, *if* the inventor meets the requirements of § 112 . . . . The underlying theory is that, if the inventor writes a truly enabling disclosure, the [patent document] should be just as useful . . . as [the] completed invention." MERGES & DUFFY, *supra* note 37, at 240.

42. Invitrogen Corp. v. Clontech Lab'ys, Inc., 429 F.3d 1052, 1064 (Fed. Cir. 2005) ("[A] reduction to practice at time A necessarily requires the inventor to possess the knowledge about the invention to show a conception."); *accord* MPEP, *supra* note 9, at § 2138.05(IV) ("The invention must be recognized and appreciated for a reduction to practice to occur." (citing Cooper v. Goldfarb, 154 F.3d 1321, 1331 (Fed. Cir. 1998))).

43. *See* Computing Scale Co. v. Standard Computing Scale Co., 195 F. 508, 511 (6th Cir. 1912) (recognizing the "established rule" that a constructive reduction to practice by filing a patent application is "the equivalent of the actual building" of the invention); John F. Duffy, *Reviving the Paper Patent Doctrine*, 98 CORNELL L. REV. 1359, 1371 (2013) (same).

to a physical embodiment of that idea."[44] This reinforces a fundamental rule of the bipartite paradigm that "[c]onception is the touchstone of inventorship, the completion of the mental part of invention."[45] The creative aspect of the inventive process purportedly ends at conception.[46]

A corollary of this rule is that only a person who conceives qualifies as an inventor. As Dan Burk has explained:

> [P]atent law elevate[s] mental effort over physical effort, conceptual production over material 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 . . . attribute[s] the entirety of creative production to a particular, discrete act of creative vision.[47]

Thus, unpacking the mental and physical steps of the inventive process is crucial in inventorship disputes and in fights between rival inventors.

C. Invention Timing and Patent Rights

Entitlement to patent rights depends on the timing of various inventive acts. For most of the history of U.S. patent law, the first person to invent was entitled to a patent.[48] The patent application's filing date was taken as the presumptive invention date.[49] This presumption could be rebutted when the inventor needed to establish an earlier date—most often to overcome or

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44. *Pfaff*, 525 U.S. at 60.

45. Burroughs Wellcome Co. v. Barr Lab'ys, Inc., 40 F.3d 1223, 1227–28 (Fed. Cir. 1994).

46. ROBINSON, *supra* note 2, § 376, at 532 (explaining that all that remains after conception to perfect the invention is "construction, not creation").

47. Dan L. Burk, *Feminism and Dualism in Intellectual Property*, 15 AM. U. J. GENDER, SOC. POL'Y & L. 183, 192–93 (2007); *see also* Dan L. Burk, *Causation and Conception in American Inventorship*, 20 DUKE L. & TECH. REV. 116, 122 (2021–2022) ("[T]he act of invention is entirely mental work, dubbed 'conception,' which is bifurcated from the invention's 'reduction to practice' as a material object.").

48. *See* 35 U.S.C. § 102(g) (2006) (repealed 2011) (giving the first inventor superior rights over others so long as the inventor hasn't "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.").

49. Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc., 796 F.2d 443, 449 (Fed. Cir. 1986); *accord* Brown v. Barbacid, 276 F.3d 1327, 1333 (Fed. Cir. 2002) (setting forth the rebuttable presumption that the filing date is the invention date); MPEP, *supra* note 9, § 2158 ("Under pre-AIA examination practice, the Office uses the effective filing date as a proxy for the invention date, unless there is evidence of record to establish an earlier date of invention.").

exclude a prior art reference[50] (to evaluate novelty and nonobviousness)[51] during examination, to avoid a potentially invalidating prior art reference in litigation,[52] or to defeat a rival party's claim to the invention.[53] With adequate proof, the inventor could establish an invention date as far back as the conception date if the inventor was reasonably diligent in reducing the invention to practice.[54] Thus, the timing of inventive acts in this previous regime was critically important.[55]

The America Invents Act of 2011 (AIA) converted the U.S. patent system from a first-to-invent regime to a first-inventor-to-file regime.[56] Now, assessing patentability for novelty and nonobviousness[57] is based on

50. Prior art includes products, devices, practices, uses, and activities already in the public domain. *See* Kimberly-Clark Corp. v. Johnson & Johnson, 745 F.2d 1437, 1453 (Fed. Cir. 1984) (citing Graham v. John Deere Co. of Kan. City, 383 U.S. 1, 6 (1966)). Documents like issued patents and printed publications are common sources of prior art. *See* 35 U.S.C. § 102 (defining what may be considered prior art); Timothy R. Holbrook, *Patent Prior Art and Possession*, 60 WM. & MARY L. REV. 123, 148–83 (2018) (comprehensively discussing categories of prior art). A specific document, product, device, use, etc., asserted against the claimed invention is called a prior art reference. JANICE M. MUELLER, PATENT LAW 410 (6th ed. 2020).

51. Novelty is the statutory requirement that an invention be new. 35 U.S.C. § 101 ("Whoever invents or discovers any *new* and useful process, machine, manufacture, or composition of matter . . . may obtain a patent . . . ." (emphasis added)). Nonobviousness is the statutory requirement that bars a patent if the claimed invention is a technologically trivial extension of what is already known. *Id.* § 103; *see also* John F. Duffy, *Inventing Invention: A Case Study of Legal Innovation*, 86 TEX. L. REV. 1, 11–17 (2007) (explaining the rationale for denying patents for technologically trivial inventions).

52. *See* Mahurkar v. C.R. Bard, Inc., 79 F.3d 1572, 1576–77 (Fed. Cir. 1996) (explaining that once the alleged infringer has presented potentially patent-defeating prior art, the patentee must prove invention of the subject matter before the publication date of the prior art reference).

53. Under the first-to-invent system, patent rights are awarded to the first inventor. 35 U.S.C. § 102(g) (2006) (repealed 2011). When two parties claim the same invention, the Patent Office institutes an "interference" proceeding to determine priority (i.e., which party is entitled to a patent). *Id.* The first party "to reduce the invention to practice" usually wins; however, 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 v. Goldfarb, 240 F.3d 1378, 1382 (Fed. Cir. 2001).

54. *Mahurkar*, 79 F.3d at 1577 (quoting Christie v. Seybold, 55 F. 69, 76 (6th Cir. 1893)). What constitutes "reasonable diligence" depends on the facts of the case. *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).

55. The America Invents Act of 2011 applies to patent applications (and patents issuing therefrom) filed on or after Mar. 16, 2013. *See* Leahy-Smith America Invents Act, Pub L. No. 112-29, § 3(n)(1), 125 Stat. 284, 293 (2011) (stating that the first-to-file provision takes effect eighteen months after the bill's passage on Sept. 16, 2011; other provisions took effect one year after the bill's passage, on Sept. 16, 2012). Thus, patent applications pending or issued patents existing before that date are still governed by the first-to-invent regime. *See* MUELLER, *supra* note 50, at 6–7. This means that U.S. patent law will operate under dual regimes for decades. *Id.*

56. *See* Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 3(b), 125 Stat. 284, 285–87 (2011) (amending 35 U.S.C. § 102(a) and repealing § 102(g)).

57. *See supra* note 51 and accompanying text.

the patent application's filing date,[58] so proof of pre-filing inventive activities (conception and reduction to practice) can't be used to overcome or exclude prior art references[59] or resolve contests between independent rival inventors.[60] Thus, the AIA "radically transforms some of the most basic rules in the U.S. patent system."[61]

II. NONCONFORMING INVENTIONS

Patent law is dynamic: it evolves as technology evolves.[62] This dynamism allows the patent system "to adapt flexibly to both old and new technologies, encompassing 'anything under the sun that is made by man.'"[63] However, patent law functions as a one-size-fits-all system—every invention, irrespective of technical field, is subject to the same statutory patentability requirements.[64] But this unitary approach doesn't work well for inventorship.[65] Many inventions *don't* conform to the bipartite paradigm.[66] Sometimes the conception step, the reduction step, or both steps are lacking. Yet, nonconformity is ignored, overlooked, or handled with

58. *See* 35 U.S.C. § 102(a)(1) (denying patentability if "the claimed invention was patented . . . before the effective filing date of the claimed invention"); *id.* § 102(a)(2) (denying patentability if "the claimed invention was described in a patent . . . [which] names another inventor and was effectively filed before the effective filing date of the claimed invention"); *id.* § 103 (denying patentability if "the claimed invention . . . would have been obvious before the effective filing date of the claimed invention").

59. MUELLER, *supra* note 50, at 353–55; MPEP, *supra* note 9, § 715 (explaining that the provisions of 37 C.F.R. § 1.131(a) which permit an applicant to submit an affidavit to prove an earlier date of invention to avoid prior art doesn't apply to patent applications filed under the AIA).

60. MUELLER, *supra* note 50, at 343 n.403. Such contests "will now be determined almost exclusively by looking to when each of the rivals filed their patent application." Robert P. Merges, *Priority and Novelty Under the AIA*, 27 BERKELEY TECH. L.J. 1023, 1024 (2012).

61. Merges, *supra* note 60, at 1023.

62. This responsiveness isn't 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).

63. Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1576 (2003) (quoting Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980)).

64. *See supra* notes 18–19 and accompanying text. As a signatory to a multilateral intellectual property agreement, the United States agrees that patent rights shall be "enjoyable without discrimination as to . . . the field of technology" subject only to a few enumerated exceptions. Agreement on Trade-Related Aspects of Intellectual Property Rights art. 27(1), Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 108 Stat. 4809, 1869 U.N.T.S. 299, http://www.wto.org/english/docs_e/legal_e/27-trips.pdf [https://perma.cc/PRQ8-DBLY].

65. *See* 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").

66. One explanation is that patent law can't evolve fast enough to keep pace with technological advances. *See infra* note 334 and accompanying text.

fictitious workarounds.[67] One reason is because many nonconforming inventions emerge from "unpredictable" fields like chemistry, biotechnology, and pharmacology (as opposed to "predictable" fields like mechanical engineering and other applied technologies).[68] This Part explores nonconforming inventions and the role of unpredictability.

A. Serendipitous Discovery

The patent system often ignores, or consciously omits, that the inventive process varies substantially across technologies. Specifically, the coherency and foreseeability that pervade invention in predictable fields like mechanical engineering is often absent in unpredictable fields like chemistry.[69] As one commentator explains, "[i]t is not surprising that . . . there continue to be so many fortunate and 'accidental' discoveries in [chemistry]. Mechanical invention, on the other hand, is not so likely to be favoured by accident," because it "has to be thought of from the beginning as a system, and designed as a whole."[70] This makes sense. In chemistry, results are often uncertain and unexpected because chemical properties often must be discerned through trial and error.[71]

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67. *Cf.* Sean B. Seymore, *Atypical Inventions*, 86 NOTRE DAME L. REV. 2057, 2062 (2011) (defining "atypical inventions" as "those in which either (1) a technical aspect of the invention or the inventive process does not conform to an established legal standard in patent law or (2) the technical underpinnings of the invention depart from well-established scientific paradigms").

68. Courts have long recognized the differences between a mechanical device and a chemical compound. *See* 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 . . . be borne in mind . . . that reasoning by analogy in a complex field like chemistry is very much more restricted than in a simple field like mechanics."). Applied technologies like electrical and mechanical engineering are called "predictable" because behavior can be predicted by resort to known, well-defined scientific laws. *In re* Fisher, 427 F.2d 833, 839 (C.C.P.A. 1970). Experimental fields like chemistry and biotechnology are called "unpredictable" because reactions often lead to unpredictable results or failure. *Id.* For a deeper exploration of the predictable-unpredictable dichotomy, see Sean B. Seymore, *Heightened Enablement in the Unpredictable Arts*, 56 UCLA L. REV. 127, 136–39 (2008).

69. *See supra* note 68 and accompanying text. The predictable-unpredictable dichotomy is a tool; it doesn't mean that electrical and mechanical fields lack unpredictable features or that chemical and biotechnological fields lack predictable factors. *See In re* Bowen, 492 F.2d 859, 861–62 (C.C.P.A. 1974) (criticizing a rigid dichotomy).

70. JOHN JEWKES, DAVID SAWERS & RICHARD STILLERMAN, THE SOURCES OF INVENTION 63 (2d ed. 1969).

71. *See id.*; sources cited *supra* note 68.

Serendipity—making a new thing that was initially unsought[72]—is a common pathway to invention in unpredictable fields.[73] Nylon,[74] Teflon,[75] and SuperGlue[76] are famous examples of patented chemical inventions that emerged from serendipitous discoveries in the laboratory.[77] This Section will focus on chemical inventions given their pervasiveness in serendipitous discovery and importance in the development of patent jurisprudence over the past seventy years.

Even within chemistry, there are various types of unexpected discoveries that could be deemed serendipitous.[78] Two will be considered here. First,

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72. Sociologist Robert K. Merton traces the term to the eighteenth-century author Horace Walpole, who, in reference to the fairy tale *The Travels and Adventures of Three Princes of Serendip*, wrote 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 1–2 (2004) (quoting Letter from Horace Walpole to Sir Horace Mann (Jan. 28, 1754), *in* 20 THE YALE EDITION OF HORACE WALPOLE'S CORRESPONDENCE 407 (W.S. Lewis ed., 1960), https://libsvcs-1.its.yale.edu/hwcorrespondence/ [https://perma.cc/727W-KPE9]).

73. This might seem surprising because research projects are often planned and performed with a systematic approach. ROBERT K. MERTON, SOCIAL THEORY AND SOCIAL STRUCTURE 103–04 (rev. & enlarged ed. 1957).

74. Diamine-Dicarboxylic Acid Salts & Process of Preparing Same, U.S. Patent No. 2,130,947 (filed July 1, 1936); Linear Polyamides & Their Prod., U.S. Patent No. 2,130,523 (filed Jan. 2, 1935); Synthetic Fiber, U.S. Patent No. 2,130,948 (filed Apr. 9, 1937).

75. Tetrafluoroethylene Polymers, U.S. Patent No. 2,230,654 (filed July 1, 1939). Roy J. Plunkett accidentally made the substance at DuPont in 1938. FRAN CAPO, IT HAPPENED IN NEW JERSEY 161–62 (2004). Plunkett's original target was a new Freon compound made from tetrafluoroethylene gas. ALAN G. ROBINSON & SAM STERN, CORPORATE CREATIVITY: HOW INNOVATION AND IMPROVEMENT ACTUALLY HAPPEN 176 (1997). Rather, the tetrafluoroethylene gas spontaneously polymerized, which, until then, had been thought impossible. *Id.* at 176–77.

76. Alcohol-Catalyzed a-Cyanoacrylate Adhesive Compositions, U.S. Patent No. 2,768,109 (filed June 2, 1954). Eastman Kodak scientist Harry Coover synthesized cyanoacrylate with the aim of making a clear plastic for precision gunsights. He discovered that the new substance was too sticky and "stuck to everything, almost instantly." Harry W. Coover, *IRI Achievement Award Address: Discovery of Superglue Shows Power of Pursuing the Unexplained*, RES. TECH. MGMT., Sept.–Oct. 2000, at 36, 36.

77. Even horseplay can lead to discovery:

> [T]he discovery of cold drawing fibers was more or less accidental. . . . Nylon had been made and seemed not to have any especially useful properties *and put aside on the shelf without patenting*. . . . [A]nd . . . 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. CHEM. EDUC. 535, 536 (1981) (emphasis added). The accidental discovery of the cold drawing process "led to the most important product Du Pont ever put on the market." ROYSTON M. ROBERTS, SERENDIPITY: ACCIDENTAL DISCOVERIES IN SCIENCE 173 (1989). For more examples, see GILBERT SHAPIRO, A SKELETON IN THE DARKROOM: STORIES OF SERENDIPITY IN SCIENCE, at vii–xiii (1986); 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).

78. For instance, a researcher might discover a new use for a previously known drug. This pathway to invention is explored *infra* Section II.B.

consider a scenario where a planned reaction ($A+B$) yields an unexpected product (X) rather than the expected product (C):

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

This pathway to invention will be called an *accidental discovery*.[79]

Second, consider a scenario where a researcher mixes several chemicals together ($A+B$) just to see what happens.[80] This "opportunistic process[] of scientific creation" is known as *tinkering*:[81]

$$A + B \rightarrow ?$$

If tinkering yields a new and useful product (X), this pathway to invention will be called a *chance discovery*.[82]

Both accident and chance have something in common: at the time of its creation, X's discovery often appeared scientifically inconceivable, theoretically implausible, or synthetically impossible.[83] After the initial bewilderment, the discovery spawns two types of follow-on inquiry: *basic research*, which seeks to understand what happened and expand human knowledge; and *applied research*, which opens new frontiers for exploration by solving practical problems.[84]

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79. *See* STUART FIRESTEIN, FAILURE: WHY SCIENCE IS SO SUCCESSFUL 44–45 (2016) (explaining that many serendipitous discoveries occur due to failure). The accident can occur not because of misconception about *C*, but because of poor experimental conditions. Indeed, several Nobel Prize-winning accidental discoveries occurred because of the presence of impurities in a reaction vessel. Notable examples include the synthetic dye indigo (1905 Nobel Prize in Chemistry) and crown ethers (1987 Nobel Prize in Chemistry). *See* Frank Steinmüller, *Adolf von Baeyer*, *in* NOBEL LAUREATES IN CHEMISTRY, 1901–1992, at 30, 30–35 (Laylin K. James ed., 1993); Herman E. Schroeder, *Charles J. Pedersen*, *in* NOBEL LAUREATES IN CHEMISTRY, *supra*, at 722, 722–28.

80. J. Piirto, *Talent and Creativity*, *in* 2 ENCYCLOPEDIA OF CREATIVITY 427, 432 (Mark A. Runco & Steven R. Pritzker eds., 2d ed. 2011).

81. AHARON KANTOROVICH, SCIENTIFIC DISCOVERY: LOGIC AND TINKERING 223 (1993).

82. *See id.* A variation is when a researcher walks into the laboratory and find a mysterious, unknown substance sitting at the bottom of a flask full of chemical waste (and the mysterious, unknown substance turns out to be new and useful).

83. Serendipitous discoveries promote technological progress particularly well because scientific principles that were seemingly well understood or settled are suddenly challenged, "thereby enabl[ing] science to advance into domains of understanding that were not previously imagined." JOHN ZIMAN, REAL SCIENCE: WHAT IT IS AND WHAT IT MEANS 217 (2000). A famous example is the accidental discovery of buckminsterfullerene, a remarkably stable, inconceivable cluster of sixty carbon atoms resembling a geodesic dome. *See* H.W. Kroto, J.R. Heath, S.C. O'Brien, R.F. Curl & R.E. Smalley, *C_{60}: Buckminsterfullerene*, 318 NATURE 162, 162–63 (1985). This discovery won the 1996 Nobel Prize in Chemistry.

84. Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1017 n.3 (1989). Basic research is "[e]xperimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view." NAT'L SCI. BD., NAT'L SCI. FOUND., NSB-2022-1, SCIENCE AND ENGINEERING INDICATORS 2022: THE STATE OF U.S. SCIENCE AND ENGINEERING, at 31 (2022). Applied research is "[o]riginal investigation undertaken to acquire new knowledge; directed primarily, however, toward a specific, practical aim or objective." *Id.*

The bipartite paradigm is ill-equipped to handle serendipitous discoveries. Clearly, it's impossible to *conceive* the accidental discovery of *X*—at least at the time of the serendipitous event.[85] *X*'s identity only becomes known through subsequent analysis. Applying the bipartite paradigm, *X* can't be *invented* until that later point in time.

Likewise, a reduction to practice doesn't occur at the time of the serendipitous event even though a physical substance is produced. At that moment, the researcher didn't contemporaneously recognize and appreciate *X*'s structure or identity.[86] The courts address this scenario with a fictitious exception to the bipartite paradigm known as the doctrine of simultaneous conception and reduction to practice (SCRTP).[87] It arises when an inventor can't form a complete picture of the invention until reducing the invention to practice through successful experimentation.[88] For example, in *Amgen, Inc. v. Chugai Pharmaceutical Co.*, the Federal Circuit held that, for an invention claiming a purified DNA sequence for encoding a protein, conception didn't occur until *after* the fragment had been isolated and characterized.[89] The court later explained that

> a product is not conceived until one can define it other than by its . . . activity or function. The difficulty that would arise if we were to hold that a conception occurs when one has only the idea of a compound . . . is that would-be inventors would file patent applications before they had made their inventions and before they could describe them. That is not consistent with the statute or the policy behind the statute, which is to promote disclosure of inventions, not of research plans. . . . [O]ne . . . need[s] to be able to describe that invention with particularity.[90]

In sum, SCRTP arises when actual experimentation (sufficient to fulfill the requirements of reduction to practice) is necessary to supply the

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85. *See supra* note 72 and accompanying text.

86. *See supra* note 42 and accompanying text.

87. As explained in a venerable patent treatise:

> In many [cases] the work of conception and reduction goes forward almost simultaneously, so nearly so that no date can be fixed as that before which the conception was complete and after which the reduction to practice was begun. This is true in nearly all inventions which are the result of experiment . . . . [A]t no instant before the experiment succeeds can it be said that the conception of the invention exists in the inventor's mind. . . . [T]he same act which reduces it to practice gives to the conception its definite and final form.

ROBINSON, *supra* note 2, § 381, at 537–38; *cf.* MERGES & DUFFY, *supra* note 37, at 239 ("[W]here the claimant is unable . . . to produce sufficient evidence on the subject of conception, the conception date is 'collapsed' into the reduction to practice date . . . ."). For a case recognizing the doctrine, see also *Smith v. Bousquet*, 111 F.2d 157, 159 (C.C.P.A. 1940).

88. Burroughs Wellcome Co. v. Barr Lab'ys, Inc., 40 F.3d 1223, 1229 (Fed. Cir. 1994).

89. Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1206 (Fed. Cir. 1991).

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

knowledge to complete conception.[91] As applied to serendipitous discoveries, SCRTP doesn't occur until *X*'s identity is elucidated.

Even if *X*'s serendipitous creation doesn't fit the bipartite paradigm, this may not affect patentability. The Patent Office doesn't inquire into the nuts and bolts of invention unless it has a reason.[92] Indeed, the inventor-applicant has little incentive to reveal how *X* was created. This might be due to strategy[93] or a desire to conceal serendipity's role in discovery.[94] Despite its ubiquity, serendipity offends scientific rationality. While some scientists find joy in this mode of scientific investigation, others obscure its role in their own research out of fear that it'll cast a negative light on their skills or on the underlying science itself.[95]

Yet, there are times when an inventor must prove an earlier date of invention for a serendipitous discovery to obtain, enforce, or preserve patent rights. This applies to patents subject to the first-to-invent regime[96] (which will coexist with the AIA's first-inventor-to-file regime[97] until at least Mar. 15, 2034).[98] To illustrate, consider the following hypothetical.[99] Inventor made a new material by accident on May 30, 2011. Subsequent analysis and characterization allowed Inventor to identify the new material as *X* on June 2, 2011. Inventor files a patent application claiming *X* on June 30, 2011, and a patent eventually issues. Inventor subsequently sues Competitor for patent infringement. Competitor asserts that the patent is invalid for a lack of novelty because *X* was disclosed in the journal *Rapid Chemical Communications* with a publication date of June 1, 2011.[100] For the

91. 2 R. CARL MOY, MOY'S WALKER ON PATENTS § 8:54 (4th ed.), Westlaw (database updated Nov. 2023).

92. Recall that the Patent Office presumes that the invention date is the filing date. *See supra* note 49 and accompanying text.

93. *See* Timothy R. Holbrook, *Patents, Presumptions, and Public Notice*, 86 IND. L.J. 779, 818 (2011) (exploring an applicant's incentives to strategically withhold certain information from the Patent Office).

94. MERTON & BARBER, *supra* note 72, at 159.

95. *See* MERTON & BARBER, *supra* note 72, 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 [scientists] from making full disclosure."); Richard P. Feynman, The Development of the Space-Time View of Quantum Electrodynamics (Dec. 11, 1965), *in* NOBEL LECTURES: PHYSICS 1963–1970, at 155, 155 (1972) ("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 . . . .").

96. *See supra* Section I.C.

97. *See supra* Section I.C.

98. *See supra* note 55 and accompanying text.

99. The underlying facts are very loosely based on *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572 (Fed. Cir. 1996).

100. *See* 35 U.S.C. § 102(a) (2006) (amended 2011) ("A person shall be entitled to a patent unless . . . the invention was . . . described in a printed publication . . . before the invention thereof by the applicant for patent . . . .").

publication to serve as patent-defeating prior art,[101] it must have been published before Inventor's invention date.[102] Once Competitor offers the publication into evidence disclosing *X*, Inventor must "offer evidence showing [it] invented the subject matter of [the] patent before the publication date of the document."[103] Because the party "who first conceives . . . [under the bipartite paradigm] first invents,"[104] Inventor can prevail by proving a conception date before June 1, 2011 combined with reasonable diligence to reduction to practice.[105] Recall that conception requires that Inventor must've formed "a definite and permanent idea of the complete and operative invention,"[106] which must be "clearly defined in the inventor's mind" of *X*.[107] This didn't happen until June 2, 2011, when Inventor characterized *X*. Because Inventor can't adduce the requisite evidence, the journal publication becomes novelty-defeating prior art because Inventor's invention date defaults to the patent's filing date of June 30, 2011.[108] Accordingly, Inventor's patent is rendered invalid for a lack of novelty.[109] This outcome reflects a structural bias in the bipartite paradigm against serendipitous inventions.

B. New Uses for Old Things

A bedrock principle of patent law is that old things can't be patented.[110] Inventions must be novel.[111] And newly-discovered uses for old things don't render the old thing novel.[112] However, the new use itself *might* be patentable.[113] The quintessential example is aspirin, an invention that fell

101. *See supra* note 50.
102. *Mahurkar*, 79 F.3d at 1576.
103. *Id.* at 1576–77.
104. Christie v. Seybold, 55 F. 69, 76 (6th Cir. 1893).
105. *Mahurkar*, 79 F.3d at 1577 (quoting Price v. Symsek, 988 F.2d 1187, 1190 (Fed. Cir. 1993)).
106. Burroughs Wellcome Co. v. Barr Lab'ys, Inc., 40 F.3d 1223, 1228 (Fed. Cir. 1994) (quoting Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986)).
107. *Id.* (citing Sewall v. Walters, 21 F.3d 411, 415 (Fed. Cir. 1994)).
108. *Mahurkar*, 79 F.3d at 1577.
109. *See supra* note 100.
110. WILLARD PHILLIPS, THE LAW OF PATENTS FOR INVENTIONS 150 (Bos., Am. Stationers' Co., N.Y.C., Gould, Banks & Co. 1837) ("It is an essential requisite that the invention shall be *new*.").
111. *See supra* note 51.
112. *See In re* Schreiber, 128 F.3d 1473, 1477 (Fed. Cir. 1997) ("It is well settled that the recitation of a new intended use for an old product does not make a claim to that old product patentable."); *In re* Zierden, 411 F.2d 1325, 1328 (C.C.P.A. 1969) ("[M]ere statement of a new use for an otherwise old . . . composition cannot render a claim to the composition patentable.").
113. *See* 35 U.S.C. § 100(b) (defining "process" in § 101 to "include[ ] a new use of a known process, machine, manufacture, composition of matter, or material"); 35 U.S.C. § 101 (identifying as patentable "any new and useful improvement" of a "process, machine, manufacture," etc.); Perricone v. Medicis Pharm. Corp., 432 F.3d 1368, 1378 (Fed. Cir. 2005) ("New uses of old products or processes are indeed patentable subject matter."); P.J. Federico, *Commentary on the New Patent Act*, 75 J. PAT. &

into the public domain[114] when the patent expired in 1917.[115] Although aspirin itself is no longer patentable, new uses for aspirin *are* patentable.[116]

Indeed, finding new uses for old things is the type of creative activity that the patent system encourages.[117] The Patent Act of 1952[118] explicitly renders repurposed inventions patent eligible.[119] In theory, anything can be repurposed and the new use patented if it satisfies the statutory patentability requirements.[120]

Of course, inventors who tinker with old things—and *all* inventors for that matter—want the broadest patent protection possible.[121] This means "obtain[ing] very broad claims for which a colorable argument can be made for patentability."[122] Claims define the "technological territory" that the inventor claims is his or hers to control[123] and "provide[] the metes and bounds of the right which the patent confers on the patentee to exclude others from making, using, or selling the protected invention."[124] For an invention like a drug whose active ingredient is chemical compound *X*, a product claim covering *X* itself affords the broadest protection[125] because it

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TRADEMARK OFF. SOC'Y 161, 177 (1993) (explaining that a method claiming a new use for a known device, product, or composition of matter may be patentable if the conditions of patentability are satisfied).

114. As the Supreme Court has explained, "[O]n the expiration of a patent the monopoly created by it ceases to exist, and the right to make the thing formerly covered by the patent becomes public property. It is upon this condition that the patent is granted." Singer Mfg. Co. v. June Mfg. Co., 163 U.S. 169, 185 (1896).

115. *See* Acetyl Salicylic Acid, U.S. Patent No. 644,077 (filed Aug. 1, 1898) (issued Feb. 27, 1900).

116. *See, e.g.*, Novel Method of Administering Aspirin & Dosage Forms Containing Same, U.S. Patent No. 4,885,287 (filed Aug. 9, 1988); Pharm. Chewing Gum Containing Acetylsalicylic Acid, U.S. Patent No. 5,922,347 (filed Jan. 29, 1993); Aspirin-Triggered Lipid Mediators, U.S. Patent No. 7,053,230 (filed Sept. 12, 2003).

117. *See* Dawson Chem. Co. v. Rohm & Haas Co., 448 U.S. 176, 221 (1980) (reviewing a patent covering a new use for a known product and explaining that the "[d]evelopment of new uses for existing chemicals is . . . a major component of practical chemical research"); United States v. Adams, 383 U.S. 39, 52 (1966) (discussing the merit in "find[ing] new uses for old inventions").

118. The 1793 Patent Act restricted patent-eligible subject matter to any new and useful "art, machine, manufacture, or composition of matter." Patent Act of 1793, ch. 11, § 1, 1 Stat. 318, 319 (repealed 1836). This language "appeared to clearly restrict patentability of machines to only those that were new, and said nothing about authorizing patentability of a new use of a known machine." Edward C. Walterscheid, *Novelty & the* Hotchkiss *Standard*, 20 FED. CIR. BAR J. 219, 247 n.184 (2010). The 1952 Act replaced "art" with "process" in § 101. *Id.*

119. *See* sources cited *supra* note 113.

120. *See supra* note 113. For the statutory patentability requirements, see *supra* notes 18–19 and accompanying text.

121. Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 840 (1990).

122. ANTHONY L. MIELE, PATENT STRATEGY 98 (2000).

123. Merges & Nelson, *supra* note 121, at 844.

124. Corning Glass Works v. Sumitomo Elec. U.S.A., Inc., 868 F.2d 1251, 1257 (Fed. Cir. 1989).

125. *In re* Papesch, 315 F.2d 381, 391 (C.C.P.A. 1963) (discussing the "well-recognized advantages" of product claims); TONY ELLERY & NEAL HANSEN, PHARMACEUTICAL LIFECYCLE MANAGEMENT 93 (2012) (noting that a product patent is the "strongest" type of patent).

"dominates every method of making that compound and every single use of that compound, every single mixture of different components that includes that compound, and every end use composition inclusive of the compound."[126]

So an inventor *always* prefers a product claim to *X*.[127] But sometimes a product claim is unavailable. *X* might be covered by an existing patent or already reside in the public domain.[128] Either way, a subsequent inventor can't (re)patent *X*[129] but can possibly obtain a method-of-use claim for *X*.[130] Admittedly, a method claim is "often viewed as [a] second-best form[] of protection," particularly in the chemical and pharmaceutical industries.[131]

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126. HAROLD C. WEGNER, PATENT LAW IN BIOTECHNOLOGY, CHEMICALS, & PHARMACEUTICALS 177 (1992); *see also* Merges & Nelson, *supra* note 121, at 912 (providing examples that demonstrate the broad scope of protection). An inventor must assert a utility for a new product in the patent application. 35 U.S.C. § 101; Brenner v. Manson, 383 U.S. 519, 534–35 (1966); *In re* Fisher, 421 F.3d 1365, 1371–72 (Fed. Cir. 2005). The resulting patent covers the full scope of the product, including all uses. *In re* Thuau, 135 F.2d 344, 347 (C.C.P.A. 1943).

127. MARTIN A. VOET, THE GENERIC CHALLENGE: UNDERSTANDING PATENTS, FDA AND PHARMACEUTICAL LIFE-CYCLE MANAGEMENT 71–74 (5th ed. 2016) (describing the "hierarchy" of patent claims and noting that product patents are the best for pharmaceuticals).

128. A famous example involves cisplatin, a widely used anticancer drug. Its biological properties were discovered serendipitously when the compound was accidentally made during a chemical experiment. JIE JACK LI, LAUGHING GAS, VIAGRA, AND LIPITOR: THE HUMAN STORIES BEHIND THE DRUGS WE USE 10–11 (2006). Characterization of the compound revealed that it was first made in 1845 and even contributed to the 1913 Nobel Prize in Chemistry. Rebecca A. Alderden, Matthew D. Hall & Trevor W. Hambley, *The Discovery and Development of Cisplatin*, 83 J. CHEM. EDUC. 728, 728 (2006). A method-of-use patent for cisplatin was issued in 1979. *See* Anti-Animal Tumor Method, U.S. Patent No. 4,177,263 (filed Dec. 27, 1976) (claiming methods for treating tumors with the compound).

129. *See supra* notes 110–11 and accompanying text; *In re* Spada, 911 F.2d 705, 708 (Fed. Cir. 1990) (citing Titanium Metals Corp. v. Banner, 778 F.2d 775, 780, 782 (Fed. Cir. 1985)) (holding that the discovery of a new property of an old compound doesn't make claims to that compound patentable). I'm putting aside the repurposing strategy known as patent evergreening—where a drug firm will effectively extend the life of a soon-to-expire product patent by obtaining closely-related follow-on patents for new formulations, preparations, and delivery profiles for the original drug. Dmitry Karshtedt, *The More Things Change: Improvement Patents, Drug Modifications, and the FDA*, 104 IOWA L. REV. 1129, 1215 n.491 (2019); Kate S. Gaudry, *Evergreening: A Common Practice to Protect New Drugs*, 29 NATURE BIOTECH. 876 (2011); C. Scott Hemphill & Bhaven N. Sampat, *Evergreening, Patent Challenges, and Effective Market Life in Pharmaceuticals*, 31 J. HEALTH ECON. 327, 327–28 (2012). While drug firms contend that these follow-on patents are legitimate innovations, critics argue that they're merely trivial modifications of old drugs undeserving of patent protection. *See* JOHN R. THOMAS, CONG. RSCH. SERV., R40917, PATENT "EVERGREENING": ISSUES IN INNOVATION AND COMPETITION 7–10 (2009) (exploring the debate); Janice M. Mueller & Donald S. Chisum, *Enabling Patent Law's Inherent Anticipation Doctrine*, 45 HOUS. L. REV. 1101, 1106 n.12 (2008) (noting that drawing the line between legitimate innovation and evergreening is a "broad and difficult problem in patent law").

130. *See* 35 U.S.C. § 100(b) (defining a patentable "process" to "include[] a new use of a known . . . composition of matter, or material"); Merck & Co., Inc. v. Teva Pharms. USA, Inc., 347 F.3d 1367, 1372 (Fed. Cir. 2003) (explaining that a new use for a known compound can be patented with a "method" claim).

131. Timothy R. Holbrook, *Method Patent Exceptionalism*, 102 IOWA L. REV. 1001, 1010 (2017). Recall that new-use patent claims are narrow in scope, meaning that they're often avoided. The patentee only has the right to exclude others from using the product in the *exact* manner that's been claimed. MUELLER, *supra* note 50, at 525–27. Thus, a new-use patent might be too narrow to cover other uses

The claim is written in the form "the [method] of applying Old Product *X* to New [Use] *Y*."[132]

Nowhere is repurposing more important than in the pharmaceutical industry: drug firms recognize that developing new uses for old drugs[133] is cheaper than de novo drug design.[134] The cost savings[135] comes from risk reduction[136] and faster drug development due to "the existing knowledge of the known drug in terms of safety profile, clinical use, and manufacture."[137] Some drug repurposing successes are legendary. Viagra (sildenafil) was

for the product that arise during the patent's lifespan or prevent others from using the product for other purposes. Rebecca S. Eisenberg, *The Problem of New Uses*, 5 YALE J. HEALTH POL'Y, L. & ETHICS 717, 724–25 (2005); Rebecca S. Eisenberg, *The Role of the FDA in Innovation Policy*, 13 MICH. TELECOMMS. & TECH. L. REV. 345, 351 (2007).

132. Merges & Nelson, *supra* note 121, at 852. A method patent can provide strong protection in certain situations. *See, e.g.*, Lorie Ann Morgan & Jeffrey Tidwell, *Patents: United States Perspective*, *in* 4 ENCYCLOPEDIA OF PHARMACEUTICAL TECHNOLOGY 2616, 2617 (James Swarbrick ed., 3d ed. 2007) (explaining that method-of-use claims can afford important protection for pharmaceuticals because FDA approval is linked to specific therapeutic uses).

133. The National Institutes of Health (NIH) defines "repurposing" as "[d]iscovering new uses for approved drugs to provide the quickest possible transition from bench to bedside." *Repurposing Drugs*, NAT'L CTR. FOR ADVANCING TRANSLATIONAL SCI. (July 25, 2019), https://perma.cc/D444-32ZK.

134. *See* Francis S. Collins, Commentary, *Mining for Therapeutic Gold*, 10 NATURE REVS. DRUG DISCOVERY 397, 397 (2011); John Arrowsmith & Richard Harrison, *Drug Repositioning: The Business Case and Current Strategies to Repurpose Shelved Candidates and Marketed Drugs*, *in* DRUG REPOSITIONING: BRINGING NEW LIFE TO SHELVED ASSETS AND EXISTING DRUGS 9 (Michael J. Barratt & Donald E. Frail eds., 2012). "De novo" refers to traditional drug discovery, which begins with identifying new compounds suitable for medical use. Varnavas D. Mouchlis et al., *Advances in De Novo Drug Design: From Conventional to Machine Learning Methods*, INT'L. J. MOLECULAR SCIS., Feb. 2021, at 1, 2; Ted T. Ashburn & Karl B. Thor, *Drug Repositioning: Identifying and Developing New Uses for Existing Drugs*, 3 NATURE REVS. DRUG DISCOVERY 673, 673–74 (2004). Taking a new drug from the conception stage through FDA approval costs billions of dollars. *See* TUFTS CTR. FOR THE STUDY OF DRUG DEV., COST TO DEVELOP AND WIN MARKETING APPROVAL FOR A NEW DRUG IS $2.6 BILLION (2014), https://f.hubspotusercontent10.net/hubfs/9468915/TuftsCSDD_June2021/pdf/pr-coststudy.pdf [https://perma.cc/AZR8-QTWS]; Alexander Schuhmacher, Markus Hinder, Alexander von Stegmann und Stein, Dominik Hartl & Oliver Gassmann, *Analysis of Pharma R&D Productivity—A New Perspective Needed*, DRUG DISCOVERY TODAY, Oct. 2023, at 1, 5 (estimating $6.16 billion total R&D expenditures per new drug).

135. Repurposing previously approved drugs can lower the cost to only $300 million. Sudeep Pushpakom et al., *Drug Repurposing: Progress, Challenges and Recommendations*, 18 NATURE REVS. DRUG DISCOVERY 41, 41 (2019).

136. Most de novo candidates fail. A drug company may screen hundreds of thousands of chemical compounds as likely candidates, but "[f]or approximately every 10,000 compounds that are evaluated in animal studies, 10 will make it to human clinical trials in order to get 1 compound on the market." RICHARD B. SILVERMAN, THE ORGANIC CHEMISTRY OF DRUG DESIGN AND DRUG ACTION 8 (2d ed. 2004); *see also* Steve Morgan, Paul Grootendorst, Joel Lexchin, Colleen Cunningham & Devon Greyson, *The Cost of Drug Development: A Systematic Review*, 100 HEALTH POL'Y 4, 9 (2011) (noting estimates of success rates for new drugs entering clinical trials ranging from eleven to twenty-four percent); *A Higher Purpose*, THE ECONOMIST, Mar. 2–8, 2019, at 52 (noting that forty-five percent of new drug candidates fail clinical trials).

137. Carmen Gil & Ana Martinez, *Is Drug Repurposing Really the Future of Drug Discovery or Is New Innovation Truly the Way Forward?*, 16 EXPERT OP. ON DRUG DISCOVERY 829, 829 (2021).

originally purposed for angina;[138] it's been repurposed for erectile dysfunction.[139] Rogaine (minoxidil) was originally purposed for hypertension;[140] it's been repurposed for baldness.[141] Interest in drug repurposing continues to increase as the number of successes grows.[142]

The pathway to discovering new uses for known drugs is particularly important for present purposes. Ideas for repurposing come through various discovery methods—including targeted screening, big data analysis, and serendipity.[143] The first two discovery methods aren't particularly remarkable; they conform to the bipartite paradigm. To illustrate, suppose an inventor's computational (virtual) screening of drug libraries/compound databases[144] suggests that known drug *X*, currently used to treat cystic fibrosis, might effectively target the protein SPLUNC1.[145] Realizing that SPLUNC1 is associated with asthma,[146] the inventor hypothesizes that *X* might effectively treat asthma. The inventor's limited human clinical trials show efficacy and lead to the preparation of a patent application. This pathway to invention isn't atypical; it aligns with sequential conception and reduction to practice in the bipartite paradigm.

However, the story is quite different for repurposed drugs discovered through serendipity.[147] It's played a long role in drug discovery.[148] Early drug repurposing successes primarily came from the serendipitous

138. *See* Pyrazolopyrimidinone Antianginal Agents, U.S. Patent No. 5,250,534 (filed May 14, 1992).

139. *See* Pyrazolopyrimidinones for the Treatment of Impotence, U.S. Patent No. 6,469,012 (filed May 13, 1994).

140. *See* 6-Amino-4-(Substituted Amino)-1,2-Dihydro-1-Hydroxy-2-Iminopyrimidines, U.S. Patent No. 3,461,461 (filed Nov. 1, 1965).

141. *See* 6-Amino-4-(Substituted Amino)-1,2-Dihydro-1-Hydroxy-2-Iminopyrimidine, Topical Compositions & Process for Hair Growth, U.S. Patent No. 4,139,619 (filed Aug. 19, 1977).

142. Ashburn & Thor, *supra* note 134, at 673; *see also* Pushpakom et al., *supra* note 135, at 41–58.

143. Ashburn & Thor, *supra* note 134, at 674–76; Joel T. Dudley, Tarangini Deshpande & Atul J. Butte, *Exploiting Drug-Disease Relationships for Computational Drug Repositioning*, 12 BRIEFINGS BIOINFORMATICS 303, 304 (2011); Sean Ekins, Antony J. Williams, Matthew D. Krasowski & Joel S. Freundlich, In Silico *Repositioning of Approved Drugs for Rare and Neglected Diseases*, 16 DRUG DISCOVERY TODAY 298, 300 tbl.1, 301 tbl.2 (2011).

144. Mithun Rudrapal, Shubham J. Khairnar & Anil G. Jadhav, *Drug Repurposing (DR): An Emerging Approach in Drug Discovery*, *in* DRUG REPURPOSING—HYPOTHESIS, MOLECULAR ASPECTS AND THERAPEUTIC APPLICATIONS 1, 6–9 (Farid A. Badria ed., 2020) (discussing approaches to drug repurposing).

145. *Cf.* Sara Khanal et al., *SPLUNC1: A Novel Marker of Cystic Fibrosis Exacerbations*, EUR. RESPIRATORY J., Nov. 2021, at 1.

146. *See* Tongde Wu et al., *Identification of BPIFA1/SPLUNC1 as an Epithelium-Derived Smooth Muscle Relaxing Factor*, NATURE COMMC'NS., Feb. 2017, at 1.

147. The first repurposed drugs were serendipitous discoveries. Jean-Pierre Jourdan, Ronan Bureau, Christophe Rochais & Patrick Dallemagne, *Drug Repositioning: A Brief Overview*, 72 J. PHARMACY & PHARMACOLOGY 1145, 1145–49 (2020); *see also* Thomas A. Ban, *The Role of Serendipity in Drug Discovery*, 8 DIALOGUES CLINICAL NEUROSCIENCE 335, 335–36 (2006).

148. *See* WALTER SNEADER, DRUG DISCOVERY: A HISTORY 432–45 (2005) (describing drugs discovered through serendipity).

observation of side effects after treatment according to the (original) purpose on the drug label.[149] Perhaps the most famous example is sildenafil (Viagra), which was originally purposed for angina.[150] An important question is if sildenafil's repurposed use to treat erectile dysfunction[151]—a side effect—was actually *conceived*. This question is intertwined with novelty,[152] the statutory requirement that an invention "be *new*, that is, bestowed for the *first time upon the public* by the patentee."[153] "The conception stage, representing the genesis of the inventive process, entails coming up with a viable idea for a *new* invention."[154] Patients taking sildenafil for angina who also suffered from erectile dysfunction were concomitantly, inevitably, and necessarily treated for *that* condition—even if no one knew it at the time. Put differently, the side effect wasn't *conceived* because it already existed.[155]

Here it's necessary to briefly explain the law of inherency. A patent claim lacks novelty (and is "anticipated")[156] if the relevant property is "necessarily present in"[157] or "inevitably flows from"[158] a prior disclosure or activity.[159] Prior knowledge of the inherent property is unnecessary;[160] and a subsequent inventor's recent discovery (and public disclosure) of such knowledge doesn't confer novelty.[161] However, the public must've

149. Gil & Martinez, *supra* note 137, at 829.

150. *See supra* note 138 and accompanying text.

151. *See supra* note 139 and accompanying text.

152. *See supra* note 51 and accompanying text.

153. ROBINSON, *supra* note 2, § 221, at 305 (second emphasis added).

154. Oren Bar-Gill & Gideon Parchomovsky, Essay, *A Marketplace for Ideas?*, 84 TEX. L. REV. 395, 398 (2005) (emphasis added).

155. Sean B. Seymore, *Patenting New Uses for Old Inventions*, 73 VAND. L. REV. 479, 507–09 (2020) (arguing that if a drug's indication is an "inherent characteristic," then the purported new use isn't new because the drug is doing what it's always done, even if that characteristic was previously unknown).

156. "A rejection for 'anticipation' means that the invention is not new." *In re* Skvorecz, 580 F.3d 1262, 1266 (Fed. Cir. 2009). "Thus, anticipation is the converse of novelty: if an invention lacks novelty, it is anticipated." Timothy R. Holbrook, *Patent Anticipation and Obviousness as Possession*, 65 EMORY L.J. 987, 993 (2016).

157. Cont'l Can Co. USA v. Monsanto Co., 948 F.2d 1264, 1268 (Fed. Cir. 1991).

158. *In re* Montgomery, 677 F.3d 1375, 1381 (Fed. Cir. 2012).

159. If the feature isn't inevitably present as "the natural result flowing from the operation [of the prior art] as taught," then it's not inherent. *In re* Oelrich, 666 F.2d 578, 581 (C.C.P.A. 1981) (quoting Hansgirg v. Kemmer, 102 F.2d 212, 214 (C.C.P.A. 1939)); *see also* Transclean Corp. v. Bridgewood Servs., Inc., 290 F.3d 1364, 1373 (Fed. Cir. 2002) ("[A]nticipation by inherent disclosure is appropriate only when the reference discloses prior art that must *necessarily* include the unstated limitation." (citing *Cont'l Can Co. USA*, 948 F.2d at 1268–69)).

160. Schering Corp. v. Geneva Pharms., Inc., 339 F.3d 1373, 1377 (Fed. Cir. 2003); *see also* SmithKline Beecham Corp. v. Apotex Corp., 403 F.3d 1331, 1343 (Fed. Cir. 2005) ("[I]nherent anticipation does not require a [skilled artisan] to recognize the inherent disclosure in the prior art at the time the prior art is created." (citing *Schering Corp.*, 339 F.3d at 1377)).

161. Titanium Metals Corp. of Am. v. Banner, 778 F.2d 775, 782 (Fed. Cir. 1985) ("Congress has not seen fit to permit the patenting of an old alloy, known to others through a printed publication, by one who has discovered its corrosion resistance or other useful properties . . . .").

benefitted from the prior disclosure or activity involving the inherent property,[162] even if unwitting.[163]

A famous inherency case is *In re Cruciferous Sprout Litigation*, where the patent involved the cancer-preventative effects of cruciferous sprouts like broccoli and cauliflower.[164] The Federal Circuit affirmed the district court's finding that the claimed methods of using these sprouts to reduce cancer risk were inherently anticipated[165] because the public was already eating the sprouts and receiving the cancer-preventative benefits despite being unaware.[166] Again, recent realization of a necessarily present but heretofore unknown benefit doesn't confer novelty.[167] Upholding the patent would've made eating broccoli or cauliflower a potential act of infringement.[168] That's not allowed: "[I]f granting patent protection . . . would allow the patentee to exclude the public from practicing [what it's freely done], then that claim is anticipated."[169] Also, if the cancer-preventive properties of cruciferous sprouts are viewed as a side

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162. *See* Dan L. Burk & Mark A. Lemley, *Inherency*, 47 WM. & MARY L. REV. 371, 374 (2005) ("[T]he inherency cases are all ultimately about whether the public already gets the *benefit* of the claimed element or invention."). To illustrate, consider *In re Seaborg*, 328 F.2d 996 (C.C.P.A. 1964), where Glenn Seaborg sought to claim "element 95," a man-made element. The Patent Office asserted that the claim was inherently anticipated because trace amounts of element 95 were inevitably produced as a byproduct by operation of Fermi's nuclear reactor. *Id.* at 997. The court held that Seaborg was entitled to the claim, reasoning that the public didn't benefit from the Fermi reactor's production of element 95, as it was "completely undetectable, since it would have been diluted with the 40 tons of intensely radioactive uranium fuel which made up the reactor." *Id.* at 999; *see also* Jeanne C. Fromer, *A Psychology of Intellectual Property*, 104 NW. U. L. REV. 1441, 1487 (2010) (observing that "unless American society actually seems to have a reasonably good chance of benefiting from a preexisting solution to a problem, it is as if the solution does not exist" for novelty purposes).

163. "If the public already benefits from the invention, even if they don't know why, the invention is inherent in the prior art." Burk & Lemley, *supra* note 162, at 374.

164. 301 F.3d 1343, 1345 (Fed. Cir. 2002); *cf.* Vitamin Technologists, Inc. v. Wis. Alumni Rsch. Found., 146 F.2d 941, 948 (9th Cir. 1945) (invalidating a patent claiming a method of increasing the Vitamin D content of food by irradiating it with ultraviolet light for a lack of novelty because the identical Vitamin D-producing process has occurred in nature whenever the sun's ultraviolet rays hit the sap of cut hay or the meat of a coconut).

165. *See supra* note 156 and accompanying text.

166. *See Cruciferous Sprout*, 301 F.3d at 1351 ("[The inventor] cannot credibly maintain that no one has heretofore grown and eaten one of the many suitable cultivars identified by its patents. It is unnecessary for purposes of anticipation for the persons sprouting these particular cultivars to have realized that they were sprouting something [with cancer-preventative effects].").

167. *See id.* at 1346 (agreeing with the district court's conclusion that "broccoli sprouts . . . [can't] be patented merely on the basis of a recent realization that the plant has always had some heretofore unknown but naturally occurring beneficial feature" (quoting *In re* Cruciferous Sprout Pat. Litig., 168 F. Supp. 2d 534, 537 (D. Md. 2001))); Atlas Powder Co. v. Ireco Inc., 190 F.3d 1342, 1348 (Fed. Cir. 1999) ("The public remains free to make, use, or sell prior art compositions or processes, regardless of whether or not they understand their complete makeup or the underlying scientific principles which allow them to operate.").

168. Anticipation and infringement are two sides of the same coin: that which anticipates earlier in time would infringe later in time. Peters v. Active Mfg. Co., 129 U.S. 530, 537 (1889); *see also supra* note 156 and accompanying text.

169. Schering Corp. v. Geneva Pharms., Inc., 339 F.3d 1373, 1379 (Fed. Cir. 2003) (quoting *Atlas Powder*, 190 F.3d at 1346).

effect of consumption, there's also no conception because the property already existed.[170]

But there's a caveat: Whether conception and novelty exist for a repurposed drug can depend on its route of administration. To illustrate, suppose the prior art teaches that oral administration of aspirin has anti-inflammatory properties.[171] Now suppose an inventor seeks to claim a method of treating acne by topical administration of aspirin.[172] There are two reasons why conception and novelty exist for this repurposed use. First, the claim explicitly requires *topical* administration of aspirin, which isn't taught in the prior art.[173] It's possible that once upon a time an acne patient *might've* applied aspirin to the skin to achieve the claimed result. But recall that an alleged inherent property must *necessarily and inevitably result* from a prior use; that it can *possibly* result from a given set of circumstances won't anticipate.[174] By contrast, when a patient ingests aspirin, its (inherent) anti-inflammatory properties are necessarily and inevitably present.[175] Second, acne patients didn't benefit from either the prior art disclosure of aspirin or its *oral* consumption.[176]

Despite the well-settled law of inherency, no one has questioned whether repurposing a drug based on a side effect *a priori* raises novelty or inventorship concerns.[177] Nonetheless, the patent system operates under the *myth* that these repurposed uses are novel and inventive. Fully engaging in that doctrinal or policy debate is beyond the scope of this Article. It suffices to say that these activities don't conform to the bipartite paradigm.

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170. *See supra* note 166 and accompanying text.

171. *See, e.g.*, DIARMUID JEFFREYS, ASPIRIN: THE REMARKABLE STORY OF A WONDER DRUG 229 (2004).

172. *Cf.* LUCY BEALE & ANGELA JENSEN, THE COMPLETE IDIOT'S GUIDE TO BETTER SKIN 133 (2004) ("Here's a simple home remedy for healing a pimple. Take a regular uncoated aspirin. Dip in water, then rub the pimple with the aspirin. Leave on overnight and the next morning, your pimple may be totally gone.").

173. *See* Perricone v. Medicis Pharm. Corp., 432 F.3d 1368, 1378–79 (Fed. Cir. 2005) (reversing a district court's finding of inherent anticipation because the prior art use didn't teach "topical application" required by the claimed new use).

174. *See supra* notes 157–58 and accompanying text.

175. *Cf.* Schering Corp. v. Geneva Pharms., Inc., 339 F.3d 1373, 1376–77, 1380 (Fed. Cir. 2003) (discussing how ingestion of a drug necessarily forms a metabolite whose production inherently anticipates a subsequent patent claim to the metabolite).

176. *See supra* notes 162 and 166 and accompanying text.

177. One could also argue that a purported new use of this type is patent ineligible because the side effect isn't manmade—rather, it's a product of nature. *See* Gottschalk v. Benson, 409 U.S. 63, 67 (1972) ("Phenomena of nature, though just discovered . . . are not patentable . . . ."). So "a new mineral discovered in the earth or a new plant found in the wild is not patentable subject matter. . . . Such discoveries are 'manifestations of . . . nature, free to all men and reserved exclusively to none.'" Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (quoting Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948)).

C. Joint Invention

More than 90% of research conducted in science and engineering fields is collaborative.[178] This results in publications listing multiple authors,[179] comprising anyone whose physical or mental efforts contributed to the research project.[180] Most patents list more than one inventor;[181] however, patent law narrowly defines who qualifies as an inventor. A person whose physical or mental efforts contribute to the patented invention may *not* be an inventor—even if the person is listed as a co-author on the corresponding journal publication.[182]

The patent system contemplates that multiple persons can act together to produce an invention.[183] Joint invention is "the product of a collaboration between two or more persons working together to solve the problem addressed."[184] Because the bipartite paradigm values mental activity over physical activity,[185] elucidating who qualifies as a joint inventor might appear straightforward. The Federal Circuit thinks so, stating that "[d]etermining 'inventorship' is nothing more than determining who conceived the subject matter at issue."[186] However, this view grossly oversimplifies the issues involved.[187] The "exact parameters of what

178. BARRY BOZEMAN & CRAIG BOARDMAN, RESEARCH COLLABORATION AND TEAM SCIENCE 1 (2014) (citation omitted).

179. *See* Stefan Wuchty, Benjamin F. Jones & Brian Uzzi, *The Increasing Dominance of Teams in Production of Knowledge*, 316 SCIENCE 1036, 1036–37 (2007) (showing empirically that the number of authors per paper has increased from 1.9 to 3.5 from 1955–2000).

180. *See* Editorial, *Games People Play with Authors' Names*, 387 NATURE 831, 831 (1997) (discussing the low threshold for authorship in academic science).

181. *See* Wuchty et al., *supra* note 179, at 1037 (showing empirically that the number of inventors per patent has increased from 1.7 to 2.3 from 1975–2000); Justin Hughes, *The Philosophy of Intellectual Property*, 77 GEO. L.J. 287, 301 (1988) (explaining that rarity of "autonomous inventor[s]").

182. *In re* Katz, 687 F.2d 450, 455–56 (C.C.P.A. 1982). In *Katz*, a professor filed a patent application listing himself as the sole inventor. *Id.* at 452. However, several months earlier, the professor published a corresponding journal article describing the invention which listed two graduate students as co-authors. *Id.* The patent examiner rejected the patent application in part because "[w]here a reference is from a collection of authors, it must be assumed that all authors contributed . . . [to the invention]." *Id.* at 453. On appeal, the C.C.P.A. criticized the assumption, holding that "authorship of an article by itself does not raise a presumption of inventorship with respect to the subject matter disclosed in the article." *Id.* at 455 (emphasis omitted).

183. *See* ROBINSON, *supra* note 2, § 392, at 561 (defining "[c]o-operating [i]nventors"); *id.* § 396, at 566 (defining "joint inventors"). The patent statute states that "[w]hen an invention is made by two or more persons jointly, they shall apply for patent jointly . . . ." 35 U.S.C. § 116(a).

184. Falana v. Kent State Univ., 669 F.3d 1349, 1357 (Fed. Cir. 2012) (quoting Burroughs Wellcome Co. v. Barr Lab'ys, Inc., 40 F.3d 1223, 1227 (Fed. Cir. 1994)).

185. *See supra* Section I.B.

186. *In re* VerHoef, 888 F.3d 1362, 1365 (Fed. Cir. 2018) (alteration in original) (quoting Sewall v. Walters, 21 F.3d 411, 415 (Fed. Cir. 1994)).

187. The Patent Office recognizes the complexities:

> Difficulties arise in separating members of a team effort, where each member of the team has contributed something, into those members that actually contributed to the conception of the

constitutes joint inventorship are quite difficult to define";[188] making it "one of the muddiest concepts in the muddy metaphysics of the patent law."[189]

Involvement with conception of the subject matter of one patent claim is enough to confer joint inventorship.[190] To qualify, the collaborator must've

> (1) contributed in some significant manner to the conception of the invention; (2) made a contribution to the claimed invention that is not insignificant in quality, when that contribution is measured against the dimension of the full invention; and (3) did more than merely explain to the real inventors well-known concepts and/or the current state of the art.[191]

For predictable fields of technology, the analysis is straightforward. To illustrate, suppose Inventors 1 and 2 collaborate on a new dinner fork. Inventor 1 conceives of a stainless-steel dinner fork with five tines. Inventor 2 conceives of an embodiment with a straight-line, tapered handle. If the resulting patent includes a claim to the basic fork and a claim to the fork with the tapered handle, Inventors 1 and 2 are joint inventors.[192] This aligns with the bipartite paradigm.

However, the story is quite different in unpredictable fields like chemistry. Recall the rule that "[c]onception of a chemical compound 'requires knowledge of both the specific chemical structure of the compound and an operative method of making it.'"[193] Consider a research project involving the synthesis of *Z*, which has promising use as a pharmaceutical. The research is conducted in a university laboratory where P is the professor and G is a graduate student. Here are five plausible pathways for inventing *Z*:

> invention, such as the physical structure or operative steps, from those members that merely acted under the direction and supervision of the conceivers.

MPEP, *supra* note 9, § 2109(III).

188. Mueller Brass Co. v. Reading Indus., Inc., 352 F. Supp. 1357, 1372 (E.D. Pa. 1972) (quoted in *VerHoef*, 888 F.3d at 1365).

189. *Id.*; *see also* Liza Vertinsky, *Boundary-Spanning Collaboration and the Limits of Joint Inventorship Doctrine*, 55 HOUS. L. REV. 401, 443 (2017) ("The current approach to joint inventorship . . . leads to problems of uncertainty about inventorship and to problems of over-inclusiveness and under-inclusiveness in determinations of who shares in the benefits from collaboration.").

190. Falana v. Kent State Univ., 669 F.3d 1349, 1357 (Fed. Cir. 2012) (quoting Ethicon, Inc. v. U.S. Surgical Corp., 135 F.3d 1456, 1460 (Fed. Cir. 1998)).

191. HIP, Inc. v. Hormel Foods Corp., 66 F.4th 1346, 1350 (Fed. Cir. 2023) (citing Pannu v. Iolab Corp., 155 F.3d 1344, 1351 (Fed. Cir. 1998)).

192. For joint invention, "[i]t is not necessary that the same idea should occur simultaneously to each. . . . [and] it is immaterial who first conceives any particular . . . plan of the invention, or in what order the development of its subordinate ideas proceeds." ROBINSON, *supra* note 2, § 398, at 567.

193. *Falana*, 669 F.3d at 1357 (quoting Fina Oil & Chem. Co. v. Ewen, 123 F.3d 1466, 1473 (Fed. Cir. 1997)).

Scenario 1. P forms a mental picture of *Z* and a process for making it by mixing *A* and *B* in ethanol. P instructs G, "Try to make *Z* by mixing *A* and *B* in ethanol." It works. P is the sole inventor.[194] By only reducing the invention to practice, G is "merely a technician . . . carrying out [P's] instructions."[195]

Scenario 2. G forms a mental picture of *Z* and a process for making it by mixing *A* and *B* in ethanol. G tells P, "I've figured out how to make a new compound, *Z*, by mixing *A* and *B* in ethanol." P says, "Go try it." It works. G is the sole inventor. P took no part in *Z*'s conception.[196]

Scenario 3. P forms a mental picture of Z and a process for making it by mixing A and B in ethanol. P instructs G, "Try to make Z by mixing A and B in ethanol." It fails.[197] G reevaluates the protocol[198] and decides to mix A and C in water. It works. G is the sole inventor. P took no part in Z's conception.[199]

Scenario 4. P forms a mental picture of *Y* and a process for making it by mixing *A* and *B* in ethanol. P instructs G, "Try to make *Y* by mixing *A* and *B* in ethanol." The reaction serendipitously makes *Z*, not *Y*. Neither P nor G invents because neither had "knowledge of both the specific chemical structure of [*Z*] and an operative method of making it."[200]

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194. "Although the law is well settled that a completed invention requires both conception and reduction to practice, there is no requirement that the inventor be the one to reduce the invention to practice so long as the reduction to practice was done on his behalf." *In re* DeBaun, 687 F.2d 459, 463 (C.C.P.A. 1982).

195. Mattor v. Coolegem, 530 F.2d 1391, 1395 (C.C.P.A. 1976); *see also infra* note 234 and accompanying text.

196. One might argue that P and G should be joint inventors because P conceived (or contributed) *Z*'s structure and G figured out how to make it. This can't be right. *Anyone* can draw a chemical structure, including a child or a student in an organic chemistry class. *See* Burroughs Wellcome Co. v. Barr Lab'ys, Inc., 40 F.3d 1223, 1229 (Fed. Cir. 1994) ("Nor do we suggest that a bare idea is all that conception requires."). That's why both the structure and an operative method of making the compound are *both* required for conception. *See* cases cited *supra* note 35.

197. Failure is ubiquitous in scientific research. *See* FIRESTEIN, *supra* note 79, at 41 (explaining that "[f]ailure is the default" in scientific research); *see also* Sonja A. Sharpe, *A Strategy for Successful Research*, *in* THE ELEMENTS OF ACADEMIC RESEARCH 275–77 (Richard H. McCuen ed., 1996) (explaining why experiments fail, including flawed hypotheses).

198. *See* DOROTHY LEONARD-BARTON, WELLSPRINGS OF KNOWLEDGE 119–20 (1995) (presenting stories of "failing forward" from scientific research, which is defined as "creating forward momentum with the learning derived from failures").

199. "[T]o be a joint inventor, an individual must make a contribution to the conception of the claimed invention that is not insignificant in quality, when that contribution is measured against the dimension of the full invention." Fina Oil & Chem. Co. v. Ewen, 123 F.3d 1466, 1473 (Fed. Cir. 1997); Eli Lilly & Co. v. Aradigm Corp., 376 F.3d 1352, 1359 (Fed. Cir. 2004) ("One who merely suggests an idea of a result to be accomplished, rather than means of accomplishing it, is not a joint inventor." (quoting Garrett Corp. v. United States, 422 F.2d 874, 881 (Ct. Cl. 1970))).

200. Falana v. Kent State Univ., 669 F.3d 1349, 1357 (Fed. Cir. 2012) (quoting *Fina Oil & Chem. Co.*, 123 F.3d at 1473).

Scenario 5. In a weekly research meeting, P and G discuss how to make Z. They agree on a basic methodology: mixing A and B in ethanol. G conducts the synthesis. It works. P and G are joint inventors.[201]

Assume that the resulting patent has a single product claim for *Z*.[202] Although only Scenario 5 presents a clear case of joint invention, there are three reasons why *any* resulting patent will likely list either P as the sole inventor or perhaps P and G as joint inventors. First, "'inventorship' can be very confusing for many researchers, since [they're] accustomed to considerations of whether an individual should be listed as 'author' on a journal article, which is very different from whether a person may be an inventor on a patent."[203] Second, professors are total masters of their research: they enjoy a world of unbridled autonomy and individual academic freedom.[204] Professors leading research groups do what they please,[205] including determining inventorship.[206] Third, when a university pursues a patent, most rely on the professor to identify inventors.[207]

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201. "For persons to be joint inventors . . . there must be some element of joint behavior, such as collaboration or working under common direction, one inventor seeing a relevant report and building upon it or hearing another's suggestion at a meeting." *Eli Lilly*, 376 F.3d at 1359 (quoting Kimberly-Clark Corp. v. Proctor & Gamble Distrib. Co., 973 F.2d 911, 917 (Fed. Cir. 1992)).

202. For a discussion of product claims, see *supra* text accompanying notes 121–27.

203. MaryAnne Armstrong & Gerald M. Murphy, Jr., *Inventorship and Ownership Considerations and Pitfalls with Collaborative Research*, 3 ACS MED. CHEMISTRY LETTERS 349, 349 (2012).

204. RICHARD M. REIS, TOMORROW'S PROFESSOR: PREPARING FOR ACADEMIC CAREERS IN SCIENCE AND ENGINEERING 3 (1997) (citations omitted).

205. For example, "professors clearly establish the authorship policy." CORYNNE MCSHERRY, WHO OWNS ACADEMIC WORK? 84 (2001).

206. One researcher explains inventorship determinations involving postdoctoral researchers:

> I think there's rarely more than one inventor. . . . [I]f you wake up and you have an idea, that's the invention. . . . [The postdoctoral researchers] contributed to the work [around the idea], but they didn't do any really innovative work [such as] contributing new concepts, [or] coming up with something that, in my lab, I haven't thought about. It doesn't happen . . . [not because] they aren't innovative people. . . . [T]hey don't have time to think as much [because] they have a lot of manual labor to do.

Id. at 183 (second and fourth alterations in original). A postdoctoral researcher joins a professor's laboratory to gain experience; the goal is to quickly initiate a research project and publish several peer-reviewed papers—all to show competence, productivity, fundability, suitability for permanent employment, and overall professional promise. *See* REIS, *supra* note 204, at 187; DALE F. BLOOM, JONATHAN D. KARP & NICHOLAS COHEN, THE PH.D. PROCESS: A STUDENT'S GUIDE TO GRADUATE SCHOOL IN THE SCIENCES 169 (1998).

207. John J. Okuley, *Resolution of Inventorship Disputes: Avoiding Litigation Through Early Evaluation*, 18 OHIO ST. J. ON DISP. RESOL. 915, 919–20 (2003). It's unlikely that a patent has ever emerged from an academic research laboratory omitting the professor as an inventor. This is related to the conflation of inventorship and authorship in academic science. *See supra* note 203 and accompanying text; P. AARNE VESILIND, SO YOU WANT TO BE A PROFESSOR?: A HANDBOOK FOR GRADUATE STUDENTS 120–21 (2000) (exploring the "sticky" question of authorship credit; including the number of authors and their order of listing).

III. RECONCEPTUALIZING INVENTION

This Article has shown that the bipartite paradigm works for a subset of inventions in predictable fields where the inventor develops a complete and workable mental picture of the invention before physical construction. Many inventions in unpredictable fields don't conform; so the patent system relies on mythical doctrines to feign[208] or overlook conformity.[209] This approach has created a disconnect between patent law and science. To address this problem, this Part offers a hybrid approach to invention.

A. Toward a Hybrid Approach

Conception should no longer be the sine qua non for invention;[210] that is, the primary contribution of the invention need not be the idea itself.[211] I propose that the analysis should focus more on the *thing to be patented* and not solely on mental activities.[212] This hybrid approach takes into account the practical realities of creation in modern science—particularly in unpredictable fields.[213] Drawing more attention to the physical aspects of creation[214] aligns with early American patent law's "materialist" notion of invention[215] that "it is the physical device, *the thing itself*, that is of value to society and hence of interest to the law."[216] Before discussing the theoretical

208. An excellent example is the doctrine of simultaneous conception and reduction to practice. *See* discussion *supra* notes 87–91 and accompanying text.

209. For example, in several cases the Federal Circuit has held that invention doesn't always require conception. *See infra* note 225.

210. *See* Mark A. Lemley, *Ready for Patenting*, 96 B.U. L. REV. 1171, 1176 (2016) (explaining that under the current view of invention, while "[v]arious people can implement the idea once it is disclosed . . . no one [can] do so without the initial mental act—the conception of the idea itself"); *see also supra* Section I.B.

211. *See* Lemley, *supra* note 210, at 1176 (exploring the conception-based view of invention which "treats the mental act as the inventor's paramount contribution").

212. This is for claims to a *thing*—like a product, apparatus, machine, or composition of matter. For claims to a method or process, see discussion *infra* Section III.B.5.

213. *See* discussion *infra* Section III.C.

214. Duffy, *supra* note 43, at 1369 & n.31 (discussing how leading nineteenth century treatise writers interpreted Justice Story's opinion in Earle v. Sawyer, 8 F. Cas. 254 (C.C.D. Mass. 1825) (No. 4,247)). Christopher Cotropia has explored the history of physicalism in patent law, which he defines as "a manifestation of the invention that goes beyond the textual and graphical description that appears in the patent itself." Cotropia, *supra* note 30, at 1547–48. So "an invention is not an 'invention' for patent law purposes unless it exists physically." *Id.* at 1548–49. Cotropia has also argued for an actual reduction to practice requirement—that all applicants "actually implement the invention and observe that it works for its intended purpose . . . before receiving a patent . . . ." Christopher A. Cotropia, *The Folly of Early Filing in Patent Law*, 61 HASTINGS L.J. 65, 120 (2009).

215. Duffy, *supra* note 43, at 1369 n.31; *see also* MERGES & DUFFY, *supra* note 37, at 243–44.

216. Duffy, *supra* note 43, at 1369 (emphasis added) (quoting ROBERT PATRICK MERGES & JOHN FITZGERALD DUFFY, PATENT LAW AND POLICY: CASES AND MATERIALS 456 (4th ed. 2007)).

and policy justifications for the hybrid approach,[217] I first explore its contours.

First, one who physically makes the new thing or constructively makes it (by describing it in sufficient detail to enable a skilled artisan to make it)[218] is the presumptive inventor. Constructively making a new thing might be difficult or impossible for some unpredictable inventions—which might require actual work.[219] The date the new thing comes into existence—either physically or constructively—is the *creation date*.[220] This approach eliminates distinctions between planned and serendipitous inventions[221] and the need for mythical, gap-filling doctrines like simultaneous conception and reduction to practice.[222]

Second, contemporaneous recognition or appreciation of the new thing is irrelevant for establishing inventorship.[223] On the creation date, the presumptive inventor need not understand what's been invented or its

217. *See infra* Part III.

218. Thus, the pragmatic approach retains the notion of "constructive reduction to practice" from the bipartite paradigm. *See supra* notes 39–43 and accompanying text.

219. *Cf.* Seymore, *supra* note 30, at 646–52 (arguing that sometimes an actual reduction to practice is a de facto requirement for unpredictable inventions). For example, several cases suggest that an applicant must supply actual experimental data for inventions in unpredictable fields in the early stages of development or when an applicant purports to invent something that's contrary to well-settled scientific principles. *Id.*

220. I distinguish a *creation date* from an *invention date* because the latter requires conception. Allergan, Inc. v. Apotex Inc., 754 F.3d 952, 967 (Fed. Cir. 2014) (citing Invitrogen Corp. v. Clontech Lab'ys, Inc., 429 F.3d 1052, 1063 (Fed. Cir. 2005)).

221. This aligns with the "materialist" view of invention in early American patent law. *See supra* notes 214–16 and accompanying text. As explained by two commentators:

> [The] emphasis on the fact of invention—the actual artifact produced by the inventor—explains why the law rewards a lucky, serendipitous invention equally as well as one whose conception was arduous and whose execution required painstaking care. It is the invention—the "fact" or "thing"—that matters in the eyes of the law.

MERGES & DUFFY, *supra* note 37, at 244. Antibiotics provide an interesting example of the irrelevance of the path to invention. Given penicillin's success and the potential for antibiotics to generate unprecedented profits, drug companies sought other antibiotics by screening potential antibiotic-producing microorganisms from nature. GRAHAM DUTFIELD, INTELLECTUAL PROPERTY RIGHTS AND THE LIFE SCIENCES INDUSTRIES 141–42 (2d ed. 2009). "But it was uncertain that the patent system including the courts could deliver [the blanket patent protection] they wanted" because the compounds were essentially "gifts of nature" and thus evinced very little inventive creativity. *Id.* at 142. The pharmaceutical industry responded by pressuring Congress to amend the Patent Act. *See* William Kingston, *Removing Some Harm from the World Trade Organization*, 32 OXFORD DEV. STUD. 309, 310 (2004). The basic change was the incorporation of language in the nonobviousness provision of the 1952 Patent Act, *see* Act of July 19, 1952, Pub. L. No. 82-593, § 103, 66 Stat. 792, 798 (codified as amended at 35 U.S.C. § 103) ("Patentability shall not be negatived by the manner in which the invention was made."), tailored to keep the innovation threshold rather low. DUTFIELD, *supra*, at 142.

222. *See supra* notes 87–91 and accompanying text.

223. The bipartite paradigm requires contemporaneous recognition and appreciation. *See supra* text accompanying note 42.

potential utility.[224] This approach aligns the law of invention with the law of novelty.[225]

Third, the presumption that one who physically makes the new thing or constructively makes it is the inventor can be rebutted in certain circumstances. One circumstance is when there's evidence that the presumptive inventor makes the new thing under another's close control and specific direction—meaning that the presumptive inventor exercised no extraordinary skill[226] and merely acts as a "pair of hands" for the true creator.[227] Another circumstance is when the presumptive inventor derived the invention from someone else. Derivation occurs when the presumptive

224. At present, reduction to practice of a new chemical requires making it, recognition of its identity, and recognition of a specific use for it. Estee Lauder Inc. v. L'Oreal, S.A., 129 F.3d 588, 592 (Fed. Cir. 1997) (citing Standard Oil Co. (Ind.) v. Montedison, S.p.A., 494 F. Supp. 370 (D. Del. 1980)). Utility is "satisfied when an inventor has learned enough about the product to justify the conclusion that it is useful for a specific purpose." *Id.* at 593 (quoting *Standard Oil*, 494 F. Supp. at 381). Until the inventor "learns that threshold information, there can be no reduction to practice." *Id.*

225. Novelty and invention are linked. Prior existence of a thing can anticipate (defeat novelty in) a patent claim, even if recognition or appreciation (required for invention) were lacking when the thing was initially made. A famous case is Abbott Lab'ys v. Geneva Pharms., Inc., 182 F.3d 1315 (Fed. Cir. 1999). The Federal Circuit affirmed a summary judgment of invalidity because Abbott's claimed drug, Form IV, was offered for sale more than a year before filing, which constituted anticipation. *See id.* at 1318–19. The parties agreed that a third party had sold Form IV more than a year before Abbott's filing date; but Abbott argued that the sale wasn't anticipatory because the parties didn't know at the time of the sale that the material sold contained Form IV. The court rejected Abbott's contention that there can't be anticipation unless conception of the invention has been proven. *See id.* at 1319 ("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." (first citing Scaltech Inc. v. Retec/Tetra, L.L.C., 178 F.3d 1378, 1384 (Fed. Cir. 1999); and then citing J.A. LaPorte, Inc. v. Norfolk Dredging Co., 787 F.2d 1577, 1582–83 (Fed. Cir. 1986))). According to the court, that Form IV was sold more than a year before the filing date was conclusive on anticipation and obviated any need for inquiry into conception. *See id.* at 1318–19. Thus, "[t]he Federal Circuit held, somewhat quixotically, that the invention had been reduced to practice even though it had yet to be conceived." 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, 958 n.142 (2000). So *Abbott* teaches that if the invention is physically made in the form that's subsequently claimed, that's sufficient to anticipate even if the original creator didn't know the invention's characteristics or have a complete mental picture of it. Scaltech, Inc. v. Retec/Tetra, LLC., 269 F.3d 1321, 1330–31 (Fed. Cir. 2001) (discussing *Abbott*); *cf.* W.L. Gore & Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1548 (Fed. Cir. 1983) (holding that it's irrelevant to the determination of anticipation whether those using the invention appreciated the results because "[w]ere that alone enough to prevent anticipation, it would be possible to obtain a patent for an old and unchanged process" (citing Ansonia Brass & Copper Co. v. Elec. Supply Co., 144 U.S. 11, 18 (1892))).

226. *Cf.* Burroughs Wellcome Co. v. Barr Lab'ys, Inc., 40 F.3d 1223, 1230 (Fed. Cir. 1994). An inventor is presumed to be one of extraordinary skill, which "sets them apart from the workers of ordinary skill." Standard Oil Co. v. Am. Cyanamid Co., 774 F.2d 448, 454 (Fed. Cir. 1985) (emphasis omitted). By contrast, a person of ordinary skill is "presumed to be one who thinks along the line of conventional wisdom in the art and is not one who undertakes to innovate . . . ." *Id.*

227. Mattor v. Coolegem, 530 F.2d 1391, 1393 (C.C.P.A. 1976); *see also infra* text accompanying note 234. This approach aligns with the bipartite paradigm, which "excludes from co-inventorship contributors who functioned only as a 'pair of hands' or assisted in reduction to practice but not conception." Robert P. Merges & Jeffrey M. Kuhn, *An Estoppel Doctrine for Patented Standards*, 97 CALIF. L. REV. 1, 18 n.97 (2009); *see also id.* at 18 ("[T]he contributions of 'minor players' are ignored, and property rights are assigned to those who expend the 'lion's share' of effort.").

inventor obtains the inventive concept from the true creator—perhaps surreptitiously or from an unwitting disclosure. A deriver has no claim to an invention because, by statute, "a patent may only be obtained by the person who engages in the act of inventing."[228]

B. Exemplary Scenarios

1. Rudimentary Inventions

Let's begin with a scenario involving the invention of a simple device in a predictable technology.[229] For example, consider an engineer who devises a new stainless-steel dinner fork with five-tines. Moving forward, the engineer has three options: (personally) make a physical embodiment; provide specific directions to a technician to make a physical embodiment who operates under the engineer's close control and supervision;[230] or prepare a patent application describing the new fork in sufficient detail to enable a skilled artisan to make it.[231] Either way, the engineer is the fork's inventor. The creation date is the date that a physical embodiment of the fork is made (by the engineer or a technician) or the completion date of the patent application.[232]

A few comments about this hybrid approach to invention. First, it primarily focuses on when the new thing comes into existence (actually or constructively).[233] Second, having a technician make the fork doesn't affect the engineer's sole inventorship because the technician is just a "pair of hands."[234] If the technician introduces creativity or ingenuity into the process, then a question of joint inventorship could arise.[235]

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228. Joe Matal, *A Guide to the Legislative History of the America Invents Act: Part I of II*, 21 FED. CIR. BAR J. 435, 451 (2012) (discussing 35 U.S.C. § 101); *cf.* Bd. of Trs. of the Leland Stanford Junior Univ. v. Roche Molecular Sys., Inc., 563 U.S. 776, 780 (2011) ("Since 1790, patent law has operated on the premise that rights in an invention belong to the inventor.").

229. For a discussion of predictable fields, see *supra* note 68 and accompanying text.

230. *See supra* notes 226–27 and accompanying text.

231. *See supra* text accompanying note 218.

232. *See supra* text accompanying note 220.

233. *See supra* note 220 and accompanying text.

234. *See supra* text accompanying notes 226–27. An inventor may even "consider and adopt ideas and materials derived from many sources," including "a suggestion from an employee, or hired consultant . . . [or] a friend" even if that "suggestion proves to be the key that unlocks [the] problem" as long as the inventor "maintains intellectual domination of the work of making the invention." Morse v. Porter, 155 U.S.P.Q. 280, 283 (B.P.A.I. Nov. 19, 1965)); *see also* Technitrol, Inc. v. United States, 440 F.2d 1362, 1369 (Ct. Cl. 1971) (explaining that the invention "is crystallized in all of its essential attributes and . . . so clearly defined . . . [by] the inventor as to be capable of being converted to reality . . . by the inventor or by one skilled in the art").

235. *Cf.* Falana v. Kent State Univ., 669 F.3d 1349, 1358 (Fed. Cir. 2012) (explaining that when making the new thing requires "nothing more than the use of ordinary skill," this contribution "would not normally be a sufficient contribution to amount to an act of joint inventorship" (citing Fina Oil & Chem. Co. v. Ewen, 123 F.3d 1466, 1473 (Fed. Cir. 1997))).

2. Serendipitous Discoveries

Next, I apply the hybrid approach to serendipitous discovery, which is prevalent in unpredictable fields like chemistry.[236] Recall that two types of unexpected discovery can be deemed serendipitous—accidental discovery and chance discovery.[237]

Accidental discovery[238] occurs when a planned reaction ($A+B$) yields an unexpected product (X) rather than the expected product (C):

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

Consider the following hypothetical.[239] On Day One, a scientist devises a seemingly straightforward synthesis of a known compound, *C*. The scientist expects that mixing *A* (a colorless liquid) with a pinch of *B* (iron chloride, an off-white powder added to speed up the reaction)[240] will yield *C* (also a colorless liquid). So the scientist adds *A* and *B* to a flask and stirs the mixture. A few minutes later, the scientist observes unexpectedly that a bright orange powder has settled to the bottom of the flask! The orange color indicates that it contains iron.[241] The scientist immediately isolates and purifies the powder, which takes the remainder of the day. On Day Two, the scientist identifies the orange powder as *X*: it's an unusually stable organometallic compound.[242] Testing reveals that *X* is useful in polymers, catalysis, and electrochemistry.[243] Given this utility, the scientist files a patent application.[244]

236. *See supra* Section II.A.

237. *See supra* Section II.A.

238. *See supra* note 79 and accompanying text.

239. This hypothetical is loosely based on ferrocene, whose discovery and characterization led to the 1973 Nobel Prize in Chemistry. The researchers planned 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 (2001). Ferrocene is the first and best-known example of a metallocene—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.

240. *B* is a catalyst—a substance that speeds up a chemical reaction but isn't consumed in the reaction. *See* ENCYCLOPEDIA OF SCIENCE AND TECHNOLOGY 90 (James Trefil ed., 2001).

241. *See* ROB JANES & ELAINE MOORE, METAL-LIGAND BONDING 2 (2004) (noting that metal compounds exhibit a wide range of colors). Most organic compounds (without metals) are colorless. *See* DANA W. MAYO, RONALD M. PIKE & DAVID C. FORBES, MICROSCALE ORGANIC LABORATORY 651 (7th ed. 2023).

242. *See* sources cited *supra* note 239.

243. *See* Katja Heinze & Heinrich Lang, *Ferrocene—Beauty and Function*, 32 ORGANOMETALLICS 5623, 5623–25 (2013) (exploring various uses of ferrocene).

244. One can't obtain a patent on a compound merely because it's novel; it must also have utility. *See supra* note 126.

Chance discovery[245] occurs when several chemicals are mixed (*A*+*B*) just to see what happens:

$$A + B \rightarrow ?$$

Often nothing happens[246] but sometimes the result is a new and useful product (*X*). To illustrate, let's modify the previous hypothetical. On Day One, a scientist mixes *A* (a colorless liquid) with a pinch of *B* (iron chloride, an off-white powder) in a flask just to see what happens. A bright orange powder collects on the bottom of the flask. The orange color indicates that it contains iron.[247] The scientist immediately isolates and purifies the powder, which takes the remainder of the day. On Day Two, the scientist identifies the powder as *X*: it's an unusually stable organometallic compound. Testing reveals that *X* is useful in polymers, catalysis, and electrochemistry. Given this utility, the scientist files a patent application.[248]

A few comments. First, whether *X* is made by accident or by chance, Day One is the creation date because that's when *X* came into existence.[249] Clearly *X* wasn't conceived since it was made serendipitously—but that's irrelevant under the hybrid approach.[250]

Second, it's also irrelevant that the scientist couldn't characterize *X* by structure or understand its properties until a future date.[251] The focus is on the creation date—when the new thing comes into existence.[252] Again, this approach aligns the law of invention with the law of novelty.[253] If another inventor independently makes *X* later in time, the scientist's activities on Day One would qualify as novelty-defeating prior art against the subsequent inventor—despite the scientist not knowing *X*'s identity or utility on Day One.[254]

3. Simultaneous Creation

Quite often scientists working independently arrive at the (same) invention simultaneously.[255] Both scientists might create through planned experiments; or one might create serendipitously. If there's a dispute about

245. *See supra* notes 80–82 and accompanying text.
246. Most chemical reactions fail. *See supra* note 197.
247. *See* JANES & MOORE, *supra* note 241 (noting that metal compounds exhibit a wide range of colors). Most organic compounds (without metals) are colorless. *See* MAYO ET AL., *supra* note 241.
248. *See supra* note 126.
249. *See supra* note 220 and accompanying text.
250. *See supra* text accompanying note 222.
251. *See supra* text accompanying notes 223–24.
252. *See supra* text accompanying note 220.
253. *See supra* note 225 and accompanying text.
254. *See* cases cited *supra* note 225.
255. *See supra* note 12.

which simultaneous inventor is entitled to a patent,[256] one might ask if the path to invention—planned or serendipitous—should matter.

The hybrid approach is agnostic to the creation path. The creation date is the date that the new thing comes into existence for each inventor.[257] The creation date isn't particularly relevant for patent applications filed under the AIA[258] because the first inventor to file gets the patent.[259] But what happens in the rare circumstance when simultaneous inventors *file* simultaneously?

To illustrate, consider the hypothetical presented in the Introduction.[260] A DuPont chemist puts *A* and *B* in a furnace, hoping that a chemical reaction will produce a new and exciting material. Fortuitously, the chemical reaction produces *Y*—a crystalline substance that's harder than diamond. This is a chance discovery.[261] Simultaneously, a 3M chemist independently devises a process for making *Y* by placing *A* and *B* in a furnace. This planned invention works.

Suppose DuPont and 3M simultaneously file patent applications. One possibility is that one party—say DuPont—files one day before 3M. Section 102(a)(2) of Title 35 makes DuPont's application prior art against 3M's application because DuPont's application is "effectively filed before the effective filing date of [3M's] claimed invention."[262] Thus, DuPont gets the patent. Importantly, under the hybrid approach, the prior art effect of DuPont's application against 3M doesn't depend on how *Y* was previously made—planned or serendipitously.[263]

Another possibility is that DuPont and 3M file patent applications *on the same day*. Section 102(a)(2) doesn't apply because one application isn't filed before the other.[264] Current law affords no clear-cut answer to this intriguing question.[265] From a policy standpoint, compelling arguments

256. The patent statute only allows a *single* patent for an invention. *See supra* note 14 and accompanying text.

257. *See supra* Section III.A.

258. *See supra* note 56 and accompanying text.

259. 35 U.S.C. § 102(a); *see also* MPEP, *supra* note 9, § 2151 ("The date of invention is not relevant under AIA 35 U.S.C. 102.").

260. *See supra* Introduction.

261. *See supra* notes 81–82 and accompanying text.

262. 35 U.S.C. § 102(a)(2).

263. Although DuPont's application is also prior art against 3M under the current regime, the courts would recognize that DuPont made that compound although it wasn't conceived—thereby making conception irrelevant for novelty purposes. Recall that prior existence of a thing can anticipate (defeat novelty in) a patent claim, even if recognition or appreciation were lacking when it was initially made. *See supra* note 225.

264. *See* 35 U.S.C. § 102(a)(2).

265. Several decades ago, when faced with two inventors (under the bipartite paradigm) who filed on the same day but neither could prove a date of conception, the Patent Office determined that neither party was entitled to a patent. *See* Lassman v. Brossi, No. 94,514, 159 U.S.P.Q. 182, 185–86 (B.P.A.I.

abound for granting the patent to either party.[266] Regardless, the answer shouldn't depend on how *Y* was made.[267]

4. Collaborative Inventions

Most patented inventions involve the efforts of more than one person.[268] Of course, each person involved isn't necessarily an inventor. The hybrid approach focuses more on the new thing and not solely on mental activities.[269] To illustrate, recall a hypothetical research project involving the synthesis of *Z*, which has promising use as a pharmaceutical.[270] The research occurs in a university laboratory where P is the professor and G is a graduate student. Below I explore five plausible collaborative pathways for inventing *Z*.

Scenario 6. P envisions *Z* and develops a process for making it by mixing *A* and *B* in ethanol. P instructs G, "Try to make *Z* by mixing *A* and *B* in ethanol." G relies on intuition, skill, knowledge, and technique to conduct the synthesis. It works. P and G are joint inventors. P provides the basic idea and methodology for the synthesis of *Z* and G actually creates *Z*. Importantly, G has substantial involvement and clearly isn't "merely a technician . . . carrying out [P's] instructions."[271]

Scenario 7. G envisions *Z* and a process for making it by mixing *A* and *B* in ethanol. G tells P, "I've figured out how to make a new compound, *Z*, by mixing *A* and *B* in ethanol." P says, "Go try it." It works. G is presumably the sole inventor because G independently conducts every aspect of creation.[272]

Oct. 26, 1967). *But see* Alton D. Rollins, *PTO Practice: Ties Go to the Runner*, 69 J. PAT. & TRADEMARK OFF. SOC'Y 407, 408 (1987) (arguing that the 1952 Patent Act doesn't prohibit granting a patent to *each* simultaneous inventor); MERGES & DUFFY, *supra* note 37, at 242 (suggesting that since "[a]n application filed simultaneously with another application [under the AIA] is not filed 'before' the other . . . so is arguably not prior art to the other . . . . perhaps issuing two patents makes sense").

266. On one hand, granting the patent to 3M, the planned discoverer, "fosters rigorous investigation, encourages early disclosure, and promotes efficient investment in innovation." Seymore, *supra* note 10, at 207. On the other hand, granting the patent to DuPont, the serendipitous discoverer, "often leads to significant follow-on innovation. . . . This, in turn, will lead innovators to direct research and development efforts toward second-generation products, believing that they will be more effective than [*Y*] itself." *Id.* at 210.

267. *See supra* note 221 and accompanying text.

268. *See supra* note 181 and accompanying text.

269. *See supra* Section III.A.

270. *See supra* Section II.C.

271. Mattor v. Coolegem, 530 F.2d 1391, 1395 (C.C.P.A. 1976).

272. One might argue that P and G should be joint inventors because P conceived (or contributed) *X*'s structure and G figured out how to make it. This can't be right. *Anyone* can draw a chemical structure, including a child or a student in an organic chemistry class. That's why both the structure and an operative method of making the compound are *both* required for conception. *See supra* note 35 and accompanying text.

Scenario 8. P envisions *Z* and a process for making it by mixing *A* and *B* in ethanol. P instructs G, "Try to make *Z* by mixing *A* and *B* in ethanol." G relies on intuition, skill, knowledge, and technique to conduct the synthesis. It fails. G independently decides to mix *A* and *C* in water, based on intuition and knowledge. It works. G is presumably the sole inventor because G independently conducts every aspect of *Z*'s creation. P's basic idea and methodology didn't work.[273]

Scenario 9. P envisions *Y* and a process for making it by mixing *A* and *B* in ethanol. P instructs G, "Try to make *Y* by mixing *A* and *B* in ethanol." G relies on intuition, skill, knowledge, and technique to conduct the synthesis. It serendipitously yields *Z*, not *Y*. Under the hybrid approach, G is an inventor because G actually creates *Z*. Whether P should qualify an a (joint) inventor is tricky. To be sure, P's basic idea and methodology didn't work—as in Scenario 8.[274] However, but for P's basic idea, the serendipitous event wouldn't have occurred. So it could be argued that P took part in some aspect of *Z*'s creation.

Scenario 10. In a weekly research meeting, P and G discuss how to make *Z*. They agree on a basic methodology: mixing *A* and *B* in ethanol. G relies on intuition, skill, knowledge, and technique to conduct the synthesis. It works. P and G are joint inventors. P provides the basic idea and methodology for the synthesis of *Z* and G actually creates *Z*. Importantly, G has substantial involvement and clearly isn't "merely a technician . . . carrying out [P's] instructions."[275]

This hybrid approach to collaborative invention differs a bit from what happens under the bipartite paradigm. In the academic context, it's inconceivable *in any scenario* that G would be deemed a sole inventor or that P would be omitted as a joint inventor.[276] At best, G can expect praise, high marks, or a strong reference letter as consolation for developing a patentable invention.[277] Inventorship decisions are often made unilaterally

273. *See supra* note 199.

274. *See supra* note 199.

275. *Mattor*, 530 F.2d at 1395.

276. *See supra* note 207. Recall *In re Katz*, 687 F.2d 450 (C.C.P.A. 1982), where the court held that two graduate students couldn't be presumed to be co-inventors even if the corresponding journal article describing the research lists the graduate students as co-authors. *See supra* note 182. One commentator argues that the court "would [not] have made the same decision had a graduate student refused to list two professors as co-inventors." MCSHERRY, *supra* note 205, at 183–84.

277. Sandip H. Patel, Note, *Graduate Students' Ownership and Attribution Rights in Intellectual Property*, 71 IND. L.J. 481, 507 (1996).

based on academic norms, status, and structure.[278] If G creates the new thing, G should reap the rewards of their creation.[279]

The hypotheticals illustrate how collaborative research in chemistry and related fields is rife with unpredictability, failure, and serendipity. Under the bipartite paradigm, it's often tedious to accurately discern who's an inventor and who's a (mere) technician.[280] The hybrid approach seeks to achieve accuracy by recognizing *what really happens* in collaborative research.

5. Repurposed Drugs

Finding new uses for old drugs is a safe, speedy, and cost-effective development path for therapeutics.[281] The hybrid approach to invention also works for repurposed drugs—albeit with some nuances.

Unlike a product claim[282] to the drug itself (e.g., *X*), a method claim covers something intangible—a process involving the drug.[283] In determining whether a method of using *X* to treat a disease is novel, the basis of comparison isn't *X*'s prior existence but *X*'s prior *use*.[284] Accordingly, the hybrid approach focuses on the *process to be patented*. For historical and policy reasons, I focus on scenarios where the drug's putative new use is an unexpected side effect discovered through serendipity.[285] To illustrate, consider the following two scenarios.

Scenario 11. Aspirin has been used as a pain reliever and fever reducer since its first preparation in 1897.[286] Suppose a family doctor instructs

278. *See supra* notes 204–06 and accompanying text; MCSHERRY, *supra* note 205, at 183 (discussing the belief among professors "that they alone [are] the originators of the ideas, partly by virtue of their structural position").

279. Patel, *supra* note 277, at 507. In determining that a graduate student had standing to correct inventorship, the Federal Circuit held that the graduate student had a "concrete financial interest" in the patent from royalties and indicated openness to the notion of a reputational interest of a graduate student in recognition of their inventorship. Chou v. Univ. of Chicago, 254 F.3d 1347, 1359 (Fed. Cir. 2001). Designation as an inventor in one's field is "a mark of success" and is "comparable to being an author of an important scientific paper." *Id.*

280. Relatedly, in academic research "in situations of unequal status, researchers . . . want to distinguish between originality and labor." MCSHERRY, *supra* note 205, at 183.

281. *See* discussion *supra* Section II.B.

282. For a discussion of product claims, see *supra* text accompanying notes 121–27.

283. *See* Holbrook, *supra* note 131, at 1010; *In re* Kollar, 286 F.3d 1326, 1332 (Fed. Cir. 2002) (noting that there's a "distinction between a claim to a product, device, or apparatus, all of which are tangible items, and a claim to a process, which consists of a series of acts or steps. . . . [a process] consists of doing something, and therefore has to be carried out or performed").

284. *See* Verdegaal Bros., Inc. v. Union Oil Co. of Cal., 814 F.2d 628, 633 (Fed. Cir. 1987) (explaining that proving anticipation of a method claim is "limited to establishing that [the prior art] disclosed the same process").

285. *See supra* text accompanying notes 147–54.

286. JEFFREYS, *supra* note 171, at 69–70, 72–73.

several patients to take aspirin for post-surgery pain.[287] Observing that the patients struggle to stop bleeding, the doctor posits that aspirin has anticoagulant properties—it's a blood thinner. So the doctor instructs a group of patients with a high risk of heart attack from elevated levels of lipids and cholesterol in their blood to take aspirin as a preventative anticoagulant. Subsequent bloodwork reveals that that their heart attack risk has substantially decreased.[288] The doctor subsequently files a patent application claiming a method for thinning blood [and preventing heart attacks] by administering a therapeutically effective dose of aspirin to a patient.[289]

The doctor isn't an inventor because the doctor didn't create anything.[290] Similar to *Cruciferous Sprout*,[291] patients taking aspirin for the past 125 years have benefitted from its anticoagulant properties despite being unaware.[292] Recent discovery of an inherent property—here, a side effect of a known drug—neither confers inventorship nor novelty—even if the doctor discloses the side effect to the public for the first time.[293] Were the doctor allowed to claim the method, anyone taking aspirin who suffers from elevated levels of lipids and cholesterol could suddenly be liable for infringement.[294] Of course, this outcome is against public policy.[295]

Scenario 12. Vicks VapoRub, a topical ointment comprised of camphor, menthol, and eucalyptus oil, has been used to relieve symptoms of the

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287. This hypothetical is based on the real story of aspirin. *See infra* note 288. The genesis of the discovery "came not from a professor in a high-power research institute but from a practicing physician." LI, *supra* note 128, at 223.

288. The actual story is truly amazing:

> [Lawrence] Craven was a family doctor in Glendale, California. In the 1940s, he noticed that patients who took large doses of [aspirin] for pain after surgery all had difficulty in stopping bleeding. Craven was intrigued by the phenomenon and wondered whether aspirin possessed anticlotting properties. Because many of his affluent middle-aged patients were overweight, he recommended that they take 325–650 mg of aspirin as a preventative anticoagulant. Miraculously, among 1,465 healthy male participants who took aspirin, none suffered coronary occlusion or coronary insufficiency.

Id.

289. This is the typical method claim syntax. *See supra* text accompanying note 132.

290. *Cf. In re* Cruciferous Sprout Litig., 301 F.3d 1343, 1351 (Fed. Cir. 2002) ("While Brassica may have recognized something quite interesting about those sprouts, it simply has not invented anything new.").

291. *Id.* at 1345; *supra* notes 164–70 and accompanying text.

292. *See supra* note 166 and accompanying text.

293. Titanium Metals Corp. of Am. v. Banner, 778 F.2d 775, 782 (Fed. Cir. 1985); *Cruciferous Sprout*, 301 F.3d at 1346, 1350–51.

294. *See supra* notes 168–70 and accompanying text.

295. *See* Graham v. John Deere Co. of Kan. City, 383 U.S. 1, 6 (1966) ("Congress may not authorize the issuance of patents whose effects are to remove existent knowledge from the public domain, or to restrict free access to materials already available."); *supra* note 167 and accompanying text.

common cold[296] since its initial preparation in 1894.[297] The label instructs patients to rub the ointment on the chest or throat for temporary relief of cough symptoms.[298] Suppose a family doctor acquires a bacterial sinus infection that causes a stuffy nose. The doctor places a smear of VapoRub under the nostrils for relief, even though nasal decongestion isn't a listed indication.[299] To the doctor's surprise, within two days both the stuffy nose and infection disappear. Subsequent experimentation reveals that the camphor-menthol-eucalyptus oil mixture is an effective antibiotic against the specific bacteria causing the sinus infection.[300] Because the doctor isn't an active researcher, the doctor doesn't know how or why the mixture works—which is irrelevant for patentability.[301] So the doctor files a patent application claiming a method for treating a bacterial sinus infection by administering a therapeutically effective mixture of camphor, menthol, and eucalyptus oil to a patient.[302]

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296. *See* Delyth Whiteford, Juana Rios, David Hengehold & Sue Aspley, *Multi-Symptom Relief for Cough & Cold: Benefits of Adding Vicks VapoRub to the Treatment Regimen*, 13 OPEN J. RESPIRATORY DISEASES 9, 12–24 (2023) (exploring the relief of common cold symptoms in patients using VapoRub).

297. *See* ASHLEY KAUFMAN, THE LITTLE BLUE JAR: A FAMILY REMEDY 12–18 (2017); Jimmy Tomlin, *The Story of Vicks VapoRub*, OUR ST. (Dec. 2012), https://www.ourstate.com/Lunsford-richardson/ [https://perma.cc/R7WE-8F6V].

298. *FAQs: Vapo*, VICKS, https://vicks.com/en-us/safety-and-faqs/faqs/vicks-vaporub-faq [https://perma.cc/T37D-GR5W].

299. A physician opines on VapoRub's ineffectiveness and contraindication as a nasal decongestant:

> Vicks VapoRub doesn't clear up congestion in the nose. But its strong odor may trick your brain. So you might feel like you're breathing through an unclogged nose.
>
> Vicks VapoRub is an ointment that's rubbed on the throat and chest to relieve a cough.
>
> . . . .
>
> Vicks VapoRub is made of ingredients such as camphor, eucalyptus oil and menthol. . . .
>
> . . . .
>
> . . . [Y]ou should never put VapoRub in or around the nostrils . . . .

Jay L. Hoecker, *Vicks VapoRub: An Effective Nasal Decongestant?*, MAYO CLINIC (Dec. 2, 2023), https://www.mayoclinic.org/diseases-conditions/common-cold/expert-answers/nasal-decongestant/faq-20058569 [https://perma.cc/25WB-VVAU].

300. *Cf.* Ron Eccles, Ingo Fietze & Uwe-Bernd Rose, *Rationale for Treatment of Common Cold and Flu with Multi-Ingredient Combination Products for Multi-Symptom Relief in Adults*, 4 OPEN J. RESPIRATORY DISEASES 73, 76–79 (2014) (exploring the benefits, safety, efficacy, and ease-of-use of multi-ingredient drug therapy for the common cold and flu).

301. *See supra* note 22 and accompanying text; Diamond Rubber Co. of N.Y. v. Consol. Rubber Tire Co., 220 U.S. 428, 435–36 (1911) ("A patentee may be baldly empirical, seeing nothing beyond his experiments and the result . . . . It is certainly not necessary that [an inventor] understand or be able to state the scientific principles underlying his invention . . . ."); *In re* Cortright, 165 F.3d 1353, 1359 (Fed. Cir. 1999) ("[A]n inventor [need not] correctly set forth, or even know, how or why the invention works." (quoting Newman v. Quigg, 877 F.2d 1575, 1581 (Fed. Cir. 1989))). Famously, aspirin was used as a pain reliever for 70 years before Sir John elucidated its mechanism of action—a Nobel Prize-winning discovery. *See* J.R. Vane, *Inhibition of Prostaglandin Synthesis as a Mechanism of Action for Aspirin-Like Drugs*, 231 NATURE NEW BIOLOGY 232, 232–35 (1971).

302. This is the typical method claim syntax. *See supra* text accompanying note 132.

Here, the doctor is an inventor. The doctor serendipitously stumbled upon an unknown property of VapoRub from a creative application of the product. It's a chance discovery.[303] Unlike the aspirin scenario, the claimed use doesn't necessarily and inevitably result from applying VapoRub.[304] Rather, it can *possibly* result from an unlikely set of circumstances.[305]

A few comments. Scenario 11 is what I'll call an *inevitable side effect*. Patients who orally take aspirin for *any* indication inevitably and necessarily benefit from its blood thinning properties. This was true when aspirin was first invented in 1897, even if no one knew it.[306] The doctor's claimed use wasn't created because the blood thinning property already existed.[307]

Scenario 12 is what I'll call a *chance side effect*. Although the bipartite paradigm would also allow patentability, it requires the *myth* that the doctor *conceived* the new method of treatment, which clearly isn't true.[308] This discovery is pure chance.[309] The hybrid approach eliminates the need to rely on myths to fill doctrinal gaps between planned and serendipitous inventions.[310]

6. Derived Inventions

Although the AIA converted the U.S. patent system from a first-to-invent regime to a first-inventor-to-file regime,[311] this doesn't mean that the nuts and bolts of the inventive process have become irrelevant.[312] The patent laws (still) require the correct naming of the actual inventor(s); otherwise, the patent is invalid.[313] Improper inventorship can be remedied through

303. *See supra* text accompanying notes 80–82 and 245–48.

304. *See supra* notes 157–58 and accompanying text.

305. Recall that an alleged inherent property must necessarily and inevitably result from practicing the prior art; that it can possibly result from a given set of circumstances can't defeat novelty. *See supra* notes 157–58 and accompanying text.

306. *See supra* note 166 and accompanying text.

307. *See supra* note 284 and accompanying text. The same result should obtain under the bipartite paradigm if *Cruciferous Sprout* is followed. *See* discussion *supra* notes 164–70 and accompanying text.

308. *See* discussion *supra* Section II.A.

309. *See supra* text accompanying notes 80–82 and 245–48.

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

311. *See supra* note 56 and accompanying text.

312. *Cf.* MUELLER, *supra* note 50, at 1121 n.88 ("[T]he AIA does not render irrelevant all aspects of the traditional U.S. first-to-invent priority system. For example, the pre-AIA concept of invention dates (including dates of conception) will likely remain relevant to the post-AIA (i.e., AIA-implemented) derivation proceeding under 35 U.S.C. § 135 . . . .").

313. For patents and patent applications subject to the first-to-invent regime, 35 U.S.C. § 102(f) (2006) (repealed 2011) "makes the naming of the correct inventor or inventors are condition of patentability; failure to name them renders a patent invalid." *In re* VerHoef, 888 F.3d 1362, 1367–68 (Fed. Cir. 2018) (quoting Pannu v. Iolab Corp., 155 F.3d 1344, 1349–50 (Fed. Cir. 1998)) (interpreting § 102(f), which states that "[a person is not entitled to a patent if] he did not himself invent the subject matter sought to be patented"); *accord* Trovan, Ltd. v. Sokymat SA, 299 F.3d 1292, 1301 (Fed. Cir.

inventorship correction[314] or in a derivation proceeding[315] "to ensure that the first person to file the application is actually a true inventor. . . [and] ensure that a person will not be able to obtain a patent for the invention that he did not actually invent."[316] Derivation requires proof of prior conception by the true inventor and communication of that conception to the deriver-patentee.[317]

While the hybrid approach focuses more attention on the thing to be patented, a presumptive inventor who derives the inventive concept from the true creator would also face inventorship correction or a derivation proceeding. To illustrate, consider the following scenario.

Scenario 13.[318] Inventor approaches Automaker about licensing a new radiator specifically designed for use in Automaker's cars. After the pitch to management,[319] Automaker invites Inventor back to show sketches and a three-dimensional model of the invention to a group of Automaker's engineers in a sealed room. At day's end, Automaker tells Inventor that it isn't interested in a license. Automaker's employees surreptitiously obtained photos and video recordings during Inventor's presentation.

2002) ("A patent is invalid if more and less than the true inventors are named." (citing Jamesbury Corp. v. United States, 518 F.2d 1384, 1395 (Ct. Cl. 1975))). Under the AIA, the statutory basis for invalidation can be a failure to comply with 35 U.S.C. § 101 (which only permits "[w]hoever invents" to obtain a patent) or 35 U.S.C. § 115 (only an inventor is allowed to execute the oath or declaration required to file a patent application). *See* MPEP, *supra* note 9, §§ 2109, 2157.

314. The patent statute allows correction for errors involving omitted inventors or naming incorrect inventors. *See* 35 U.S.C. § 116(c) (applicable to patent applications); *id.* § 256(a) (applicable to issued patents). Invalidity can be avoided if inventorship is corrected. *Id.* § 256(b).

315. Before the AIA, when a person believed that he or she was the true inventor of the subject matter in another's patent application or patent, the remedy was to file a patent application claiming that subject matter to "provoke" an interference (with the other application or patent) adjudicated by an intra-office tribunal known as the Board of Patent Appeals and Interferences. *See id.* § 135(a) (2006) (amended 2011). Now a disgruntled party must file a petition to institute a "derivation proceeding" before the Patent Trial and Appeal Board. *See id.* § 135(b). Derivation occurs "when the true inventor discloses her invention to another (the 'deriver'), and the deriver then falsely patents the invention as his own." MUELLER, *supra* note 50, at 386.

316. H.R. REP. NO. 112-98, at 42 (2011), *quoted in* Changes to Implement Derivation Proceedings, 77 Fed. Reg. 7028, 7029 (Feb. 10, 2012).

317. MUELLER, *supra* note 50, at 386 (quoting Creative Compounds, LLC v. Starmark Lab'ys, 651 F.3d 1303, 1313 (Fed. Cir. 2011)); *accord* Price v. Symsek, 988 F.2d 1187, 1190 (Fed. Cir. 1993) ("To prove derivation . . . the person attacking the patent must establish prior conception of the claimed subject matter and communication of the conception to the adverse claimant." (first citing Hedgewick v. Akers, 497 F.2d 905, 908 (C.C.P.A. 1974); and then citing Mead v. McKirnan, 585 F.2d 504, 507 (C.C.P.A. 1978))); *cf.* Catapult Innovations Pty. Ltd. v. Adidas AG, No. DER2014-00002, 2014 WL 5843391, at *2 (P.T.A.B. Oct. 15, 2014) ("[T]he law on derivation require[s] a showing of prior conception and communication of that prior conception.").

318. This hypothetical is inspired by the facts in *Evans Cooling Systems, Inc. v. General Motors Corp.*, 125 F.3d 1448 (Fed. Cir. 1997).

319. An individual or small firm that develops a potentially marketable invention will often pitch it to a manufacturer. *See* RONALD LOUIS DOCIE, SR., THE INVENTOR'S BIBLE: HOW TO MARKET AND LICENSE YOUR BRILLIANT IDEAS 3 (4th ed. 2015); STEPHEN KEY, ONE SIMPLE IDEA 4–5 (2011). Through a license agreement, the inventor will collect royalty payments and the manufacturer will mass produce, advertise, and sell the invention. KEY, *supra*, at 23–24.

Automaker's engineers build a prototype and install it in one of Automaker's cars. Automaker quickly files a patent application that claims a radiator nearly identical to that disclosed in Inventor's presentation. Inventor learns about Automaker's activities when the patent issues and timely files a derivation petition with the Patent Office.[320] It alleges that Automaker, "without authorization, filed an application claiming [a] derived invention"[321] and explains why Automaker's claimed invention is "the same or substantially the same"[322] as the one disclosed by Inventor.

Scenario 13 shows that mental aspects of the inventive process still matter under the hybrid approach. While Automaker is the first to make a physical embodiment of the invention that works for its intended purpose,[323] Inventor can rebut the presumption of Automaker's inventorship with evidence of Inventor's prior conception and communication of the conception to Automaker.[324] Thus, the hybrid approach aligns with the law of derivation and produces a seemingly just outcome.[325]

C. Policy Considerations

Patent law is synonymous with research. A sole inventor tinkering in a garage to build a better mousetrap can be deemed an applied researcher; however, the archetypal inventor is a chemist conducting basic research in a laboratory.[326] The first patent granted in the United States was for an improved method for making potassium carbonate—America's first industrial chemical.[327]

Despite this history, patent law struggles to accommodate inventions from chemistry, biotechnology, pharmacology, and other unpredictable fields.[328] There are at least three reasons why. First, the courts strive for a

320. *See* 35 U.S.C. § 135(a) (2013) (permitting an inventor who isn't the first to file a patent application to file a derivation petition with the Patent Trial and Appeal Board); 37 C.F.R. § 42.403 (2024) ("A petition for a derivation proceeding must be filed within the one-year period beginning on the date of the first publication of a claim to an invention that is the same or substantially the same as the earlier application's claim to the allegedly derived invention.") (implementing 35 U.S.C. § 135(b)).

321. Akin Gump Strauss Hauer & Feld LLP v. Xcential Corp., No. DER2022-00004, 2023 WL 8242035, at *5 (P.T.A.B. Nov. 28, 2023) (citing 35 U.S.C. § 135(a); 37 C.F.R. § 42.405(b)(2) (2022)).

322. *Id.* at *7.

323. *See supra* note 38 and accompanying text.

324. *See supra* note 317 and accompanying text.

325. This outcome is also statutorily required. *See supra* note 228 and accompanying text.

326. *See generally* MICHAEL E. GORMAN, TRANSFORMING NATURE: ETHICS, INVENTION AND DISCOVERY 69 (1998) (examining the processes of invention and discovery and how they are carried out). For definitions of basic and applied research, see *supra* note 84.

327. *See* U.S. Patent No. X000001 (issued July 31, 1790). I thank the late Dmitry Karshtedt for bringing this patent to my attention.

328. Seymore, *supra* note 68, at 139 ("[E]ven though the judiciary recognizes the unique challenges that inventions in the unpredictable arts bring to the patent system, it has struggled to adapt the old doctrinal framework of the patent laws to meet these challenges.").

technology-neutral,[329] one-size-fits-all application of patent doctrines.[330] Some patent doctrines are sufficiently malleable[331] to accommodate unpredictable technologies;[332] however, inventorship isn't one of them.[333] Second, patent law struggles to keep up as science and technology evolve.[334] Third, patent law currently elevates the mental aspects of creation over its physical aspects.[335] To be sure, in times past actual physical implementation was a part of the definition of "invention."[336]

Taken together, the result is *nonconforming inventions*—those emerging from unpredictable fields that don't fit the bipartite paradigm.[337] Yet, the courts have concocted mythical, gap-filling doctrines to feign conformity.[338] I've explored some of them—the *myth* that serendipitous discoveries are conceived;[339] the *myth* that a drug's (inevitable) side effect

329. For an excellent discussion, see Burk & Lemley, *supra* note 63, at 1576–80.

330. *See supra* note 65 and accompanying text.

331. *See* Sean B. Seymore, *Making Patents Useful*, 98 MINN. L. REV. 1046, 1052–53 (2014) ("Malleability is not a foreign concept to patent law—indeed, it is expected. As the nature of the invention landscape changes to reflect advances in science and technology, patent law must respond.").

332. An excellent example is the enablement requirement of 35 U.S.C. § 112(a), which mandates that a patent application disclose an invention in sufficient detail to "enable a [PHOSITA] to make and use the invention without undue experimentation." *In re* Wands, 858 F.2d 731, 735 (Fed. Cir. 1988). A relevant factor for determining whether undue experimentation is required is "the predictability or unpredictability of the art." *Id.* at 737 (citing *Ex Parte* Forman, No. 602-90, 230 U.S.P.Q. 546, 547 (B.P.A.I. Apr. 22, 1986)); *see also* Capon v. Eshhar, 418 F.3d 1349, 1358 (Fed. Cir. 2005) ("It is well recognized that in the 'unpredictable' fields of science, it is appropriate to recognize the variability in the science in determining the scope of the coverage to which the inventor is entitled.").

333. *See* discussion *supra* Parts I.A, I.B. & II; 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, 719–21 (1995) (arguing that the Federal Circuit should adopt an invention standard tailored to meet the needs of unpredictable activities like drug discovery).

334. As explained by one commentator:

> [Law] must run to catch up, and the moment it catches up, it falls behind again. The simple truth is that law evolves through a slow, incremental, and deliberative process . . . . In contrast, technology evolves as quickly as the human mind allows. The result is an increasingly wider "guidance gap"—the space between the new technology and the old law.

EDWARD LEE LAMOUREUX, STEVEN L. BARON & CLAIRE STEWART, INTELLECTUAL PROPERTY LAW AND INTERACTIVE MEDIA 8 (2009); *see also* Carl Shapiro, *Patent System Reform: Economic Analysis and Critique*, 19 BERKELEY TECH. L.J. 1017, 1033 (2004) ("[The Patent Office] lacks sufficient resources to handle the growing number of patents and whose expertise and knowledge . . . can easily lag behind industry in areas where technology is rapidly advancing . . . .").

335. *See supra* Section I.B.

336. *See* Cotropia, *supra* note 30, at 1549. As noted by one commentator:

> Prior to the turn of the century, the courts . . . had rendered decisions in patent cases in which the principle was firmly established that . . . the inventor within the purview of the patent law was the one who first adapted and perfected his invention to use; that is, [actually] reduced it to practice.

Warren H. Willner, *Origin and Development of the Doctrine of Constructive Reduction to Practice*, 34 J. PAT. OFF. SOC'Y 618, 618–19 (1954) (footnote omitted).

337. *See supra* Part II.

338. *See* discussion *supra* Part II.

339. *See supra* Section II.A.

can be invented;[340] and the *myth* that a subordinate in a research laboratory can't be a sole inventor.[341] But these myths come at a cost: They jeopardize the patent rights of a broad swath of inventors.[342]

One solution would be to craft an invention paradigm that completely ignores mental activity and solely focuses on physicality. But supplanting mental with physical is also wrought with problems—and arguably would be no better than the bipartite paradigm.[343] This Article offers a hybrid approach to invention that primarily focuses on the thing to be patented while recognizing that at times inquiry into mental activities might be necessary.[344] This hybrid approach has several upsides for the patent system. First, it's a more realistic approach to invention. Invention is not solely about the mind (bipartite paradigm) or physicality (who makes the thing)—it's more nuanced. With that said, the hybrid approach is simpler than the bipartite paradigm because there's no need to inquire into how the thing came into existence or concoct gap-filling, mythical doctrines. Second, the hybrid approach eliminates the murkiness and structural inequities that pervade the current law of joint inventorship.[345] Third, the hybrid approach works equally well for predictable and unpredictable technologies—thereby achieving patent law's goals of uniformity and technology neutrality.[346] Fourth, tweaking the law of invention to account for the practical realities of basic research—*what really happens* in science—would do much to allow patent law to better serve inventors in unpredictable fields.[347]

CONCLUSION

Patent law is, at its heart, all about the invention—the thing to be patented. Determining who invents the thing lies at the heart of the exclusory right conferred by the patent.[348] Allowing mental aspects of the

340. *See supra* Section II.B.

341. *See supra* Section II.C.

342. *See* Sean B. Seymore, *Rethinking Novelty in Patent Law*, 60 DUKE L.J. 919, 948 (2011) ("[A]lthough a body of 'unpredictable art' jurisprudence [has] slowly developed to bridge the disconnect, several issues remain unsettled.").

343. Solely focusing on physical activity can lead to a seemingly unjust result. For example, if A conceives and figures out how to make new compound *Z*, and instructs B to go into the lab and precisely follow A's instructions to make Z, B isn't an inventor (or joint inventor) but merely a technician who followed A's instructions. *See supra* source cited note 271 and accompanying text.

344. *See supra* Section III.A.

345. *See supra* Section III.B.4.

346. *See supra* notes 64, 329–30 and accompanying text.

347. Sean B. Seymore, *Foresight Bias in Patent Law*, 90 NOTRE DAME L. REV. 1105, 1154 (2015) ("All inventors want to believe that they will get—and are, in fact, entitled to—a fair shot at getting a patent.").

348. *See supra* note 15.

creative process to control inventorship has come at a cost: it doesn't work well for a broad swath of inventions—particularly those emerging from unpredictable fields. Concocting fictitious workarounds to fill doctrinal gaps hasn't solved the problem. Adopting a hybrid approach to invention obviates the need for legal fiction by focusing more on the thing to be patented. This recalibration of the law of inventorship would allow the patent system to better connect to the scientific and technical communities that it serves.