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Alan L. Durham

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TWO MODELS OF UNPATENTABLE SUBJECT MATTER

Alan L. Durham[†]

Patentable subject matter has become one of the most controversial areas of patent law. Efforts to articulate a lucid and productive theory of patentable subject matter must acknowledge that there are two competing models of unpatentable subject matter. One posits that natural laws, natural phenomena, and abstract ideas are themselves ineligible for patenting, and that each example of a natural law, natural phenomenon, or abstract idea further defines a class of inventions that cannot be patented because they lack an additional element of ingenuity—or "inventive concept"—that sufficiently distinguishes those inventions from their natural counterparts. This "penumbral" model of unpatentable subject matter mirrors the statutory structure of anticipation and obviousness. The competing "binary" model of unpatentable subject matter posits that one must only apply a natural law, natural phenomenon, or abstract idea in a useful manner in order to have a patent-eligible invention. Potential versus application is an either/or proposition. Recent attempts to achieve synthesis have adopted the penumbral model. However, the shadows and degrees of the penumbral model are an uncomfortable fit for the subject-matter inquiry. Particularly in the case of natural laws, treating newly discovered principles as a given (or as a baseline to which one must add a further "inventive concept") threatens to overlook the true nature of invention, as well as valuable contributions to the technological arts. Here, at least, the binary model is in need of revival and reaffirmation.

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INTRODUCTION

The controversy that surrounds the doctrine of patentable subject matter, which a series of Supreme Court decisions failed to resolve, is the product of, in part, two competing and irreconcilable models of *un*patentable subject matter; the *penumbral model* and the *binary model*.

Courts interpreting § 101 of the Patent Act have held that one cannot patent an invention if it constitutes a natural law, a natural phenomenon, or an abstract idea. Some decisions further suggest that patent-ineligible subject matter casts a shadow larger than itself—in other words, that for each natural law, natural phenomenon, or abstract idea, one can identify a class of inventions that cannot be patented because they are *too similar* to their ineligible counterparts.[1] To escape this shadow, an inventor must add something substantial to differentiate the invention—an "inventive concept" in the form of significant physical differences, unconventional steps, or meaningful

1. *See, e.g.*, Alice Corp. v. CLS Bank Int'l, 134 S. Ct. 2347, 2357 (2014); Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1298 (2012).

limitations.[2] Such distinctions, like those that determine obviousness of a claimed invention in comparison to the prior art, are a matter of degree.

Other decisions hold that any process, apparatus, or composition of matter that *usefully applies* the latent potential of nature or an abstract idea is an invention eligible for patenting.[3] When one focuses on potential and application, patentable subject matter is no longer a matter of shadows and degrees; it is a binary either/or proposition. As expressed in one opinion of the Federal Circuit Court of Appeals, "either the subject matter falls within Section 101 or it does not."[4]

In their search for a consistent and intelligible approach to unpatentable subject matter, courts have treated principles of nature, natural phenomena, and abstract ideas as similar building blocks of technological advancement. With that goal in mind, the penumbral model of unpatentable subject matter has recently been advanced as the model to apply in cases involving natural laws (e.g., the correlation between certain metabolite levels and an effective dosage of medicine),[5] natural phenomena (e.g., the DNA found in human genes),[6] and abstract ideas (e.g., the precaution of putting assets in the hands of a trusted intermediary before completing a trade).[7] Yet there are problems in applying the same penumbral model of unpatentable subject matter to each of the three off-limits categories—asking whether, in each case, the claimed invention adds significantly more.

First, this approach fails to acknowledge, much less resolve, the long-standing tension between the binary model of unpatentable subject matter, based solely on the introduction of new utility through human effort, and the penumbral model, which demands an additional measure of ingenuity. Second, although they regularly deny it, courts applying the penumbral model have introduced obviousness as a consideration in the analysis of patentable subject matter. This contradicts the fundamental structure of the Patent Act, in which obviousness matters only in relation to human-made prior art. Finally, when applied to natural laws, the penumbral model of unpatentable subject matter treats nature, like human-made prior art, as a baseline or starting point for invention. Invention often consists of a new

2. *Alice*, 134 S. Ct. at 2357; *Mayo*, 132 S. Ct. at 1294.

3. *See, e.g.*, Diamond v. Diehr, 450 U.S. 175, 187 (1981).

4. Animal Legal Def. Fund v. Quigg, 932 F.2d 920, 930 (Fed. Cir. 1991).

5. *Mayo*, 132 S. Ct. at 1294.

6. Ass'n for Molecular Pathology v. US Patent & Trademark Office, 689 F.3d 1303, 1355 (Bryson, J., concurring).

7. *Alice*, 134 S.Ct. at 2357.

understanding of what nature can do. If that new understanding is dismissed, like prior art, as a given, we are missing the point, and useful advances worthy of the patent incentive receive inadequate reward. In this area at least, the binary potential/application model of unpatentable subject matter is in need of revival and reaffirmation.

Part I of this article briefly summarizes the statutory conditions for receiving a patent, including patentable subject matter, novelty, nonobviousness, and adequate disclosure. Part II examines the differences between natural laws, natural phenomena, and abstract ideas—the three categories of unpatentable subject matter identified by the courts. Part III discusses principles of nature as unpatentable subject matter, beginning with the cases of the Nineteenth Century and continuing to the present day. The Supreme Court's most recent contribution, *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*,[8] demands that natural laws be "transformed" by the addition of an "inventive concept" that exceeds the "well understood, routine, conventional activity previously engaged in by researchers in the field"[9]—a firm endorsement of a penumbral model of unpatentable subject matter. Part IV discusses phenomena of nature as unpatentable subject matter, culminating with the Supreme Court's 2013 decision in *Association for Molecular Pathology v. Myriad Genetics, Inc.*,[10] concerning the patentability of isolated human DNA. Part V discusses abstract ideas as unpatentable subject matter, including the Supreme Court's 2010 decision in *Bilski v. Kappos*,[11] concerning a system for hedging risk in commodities markets, and its 2014 decision in *Alice Corp. v. CLS Bank International*,[12] concerning the use of a trusted intermediary in financial transactions. Part VI considers the attractions of a unified approach to unpatentable subject matter and the shortcomings of the penumbral model as a candidate for that role.

I. CONDITIONS FOR RECEIVING A PATENT

The United States Constitution allows Congress to "promote the Progress of . . . [the] useful Arts, by securing for limited Times to . . . Inventors the exclusive Right to their . . . Discoveries."[13] The eighteenth-century term "useful arts" is equivalent to what we would

8. 132 S. Ct. 1289 (2012).
9. *Id.* at 1294.
10. 133 S. Ct. 2107 (2013).
11. 561 U.S. 593 (2010).
12. 134 S. Ct. 2347 (2014).
13. U.S. CONST. art. I, § 8, cl. 8.

call "technology."[14] The efforts spurred by exclusive rights are intended to "have a positive effect on society through the introduction of new products and processes of manufacture into the economy, and the emanations by way of increased employment and better lives for our citizens."[15]

A. Section 101 and Its Exceptions

The requirements imposed on an inventor who seeks a patent are, on their face, quite simple. First, § 101 of the Patent Act addresses, categorically, the kinds of discoveries that are eligible for patenting. It states:

> 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, subject to the conditions and requirements of this title.[16]

A patent-eligible invention must qualify as a process, machine, manufacture, or composition of matter.[17] "Process" is the only one of these terms defined in the Patent Act, although in unhelpfully circular terms. Section 100(b) states that "process" refers to a "process, art, or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material."[18] The Supreme Court, abiding by common usage, has defined "composition of matter" as "all compositions of two or more substances and . . . all composite articles,"[19] and "manufacture" as "the production of articles for use from raw or prepared materials by giving to these materials new forms, qualities, properties, or combinations."[20] The use of such expansive terms as "process" and "composition of matter," in conjunction with

14. *See* Karl B. Lutz, *Patents and Science: A Clarification of the Patent Clause of the U.S. Constitution*, 18 GEO. WASH. L. REV. 50, 54 (1949) ("The term 'useful arts,' as used in the Constitution . . . is best represented in modern language by the word 'technology.'").

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

16. 35 U.S.C. § 101 (2013).

17. *See In re* Nuitjen, 500 F.3d 1346, 1353 (Fed. Cir. 2007) (holding that a "signal" is not patentable subject matter because it does not qualify as a process, machine, manufacture, or composition of matter).

18. 35 U.S.C. § 100(b) (2013). In *Cochrane v. Deener*, 94 U.S. 780 (1876), the Supreme Court described a "process" as "a mode of treatment of certain materials to produce a given result," or "an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing." *Id.* at 788. Recently, the Supreme Court observed that while a physical transformation is an "important clue" it is not indispensable to a patent-eligible process. Bilski v. Kappos, 561 U.S. 593, 594 (2010).

19. Diamond v. Chakrabarty, 447 U.S. 303, 308 (1980) (quoting Shell Dev. Co. v. Watson, 149 F.Supp. 279, 280 (D.D.C 1957), *aff'd*, 252 F.2d 861 (D.C. Cir. 1958)).

20. *Id.* (quoting Am. Fruit Growers, Inc. v. Brogdex Co., 283 U.S. 1, 11 (1931)).

the all-embracing "any," demonstrates Congress's intention to define patentable subject matter broadly[21]—extending, in the words of often-quoted legislative history, to "anything under the sun that is made by man."[22] This ensures that technological advancement will receive the "liberal encouragement" envisioned by Thomas Jefferson, the original architect of our patent system.[23]

Yet courts have long held that natural laws, natural phenomena, and abstract ideas are not patentable subject matter.[24] For example, Newton's laws of gravity could not be patented even if they were described as the process by which one mass attracts another.[25] Similarly, one could not patent table salt (sodium chloride), although it is unquestionably a "composition of matter" consisting of a molecular union of sodium and chlorine atoms. Even if they were previously unknown, these are not the kinds of discoveries that one can patent. Natural laws and phenomena, together with abstract ideas, are said to be building blocks of technological advancement that must remain unencumbered by exclusive rights.[26] They are "manifestations of . . . nature, free to all men and reserved exclusively to none."[27] Hence, a thing made in the laboratory can be patented, but a similar thing found in nature cannot,[28] even though society finds the discoveries equally beneficial, and the discoverer of each would be encouraged to explore by an award of exclusive rights.

It is curious that a distinction so fundamental to patent law has no explicit statutory basis. If anything, the language of the Patent Act

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21. *Bilski*, 561 U.S. at 594–95 ("In choosing such expansive terms . . . Congress plainly contemplated that the patent laws would be given wide scope.") (quoting *Chakrabarty*, 447 U.S. at 308)).

22. S. REP. NO. 82-1979, at 5 (1952); *see* H.R. REP. NO. 82-1923, at 6 (1952); *see also Chakrabarty*, 447 U.S. at 308.

23. *Chakrabarty*, 447 U.S. at 308–09 (quoting 5 Writings of Thomas Jefferson 75–76 (Washington ed. 1871)).

24. *See* Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1293 (2012) ("The Court has long held that [§ 101] contains an important implicit exception. '[L]aws of nature, natural phenomena, and abstract ideas' are not patentable.") (quoting Diamond v. Diehr, 450 U.S. 175, 185 (1981)).

25. *See Chakrabarty*, 447 U.S. at 309 ("Einstein could not patent his celebrated law that $E=mc^2$; nor could Newton have patented the law of gravity.").

26. *See Mayo*, 132 S. Ct. at 1293 ("Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work. And monopolization of those tools through the grant of a patent might tend to impede innovation more than it would tend to promote it.") (citation omitted).

27. *Id.* (quoting Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948)).

28. *See Chakrabarty*, 447 U.S. at 310 ("[Chakrabarty's] discovery is not nature's handiwork, but his own; accordingly it is patentable subject matter under § 101.").

undercuts it. Terms like "any . . . composition of matter"[29] unquestionably embrace things found in nature. One might distinguish between an invention made by human hands and the discovery of what nature has made, but § 101 refers to "[a]nyone who invents *or* discovers."[30] Section 101 does include the word "new," which might disqualify works of nature that have always existed. Courts have generally refused to grasp at that textual straw, maintaining that whether the invention is "new" is to be addressed only under §§ 102 (novelty) and 103 (obviousness).[31] Nevertheless, in spite of the absence of statutory support, courts have routinely held that natural laws, natural phenomena, and abstract ideas are ineligible for patenting. The reference in the Constitution to "Inventors" and their "Discoveries" (as opposed, perhaps, to natural philosophers and *their* discoveries)[32] may exclude works of nature, and Congress at its most expansive did allude, in the legislative history of the 1952 Patent Act, to the potential for patenting "anything under the sun *that is made by man*."[33] It seems beyond debate, therefore, that Congress did intend for there to be some unspoken limitations on the subject matter of patents.

B. The Other "Doors" to Patentability

An inventor who avoids claiming a natural law, natural phenomenon, or abstract idea is not automatically entitled to a patent. Section 101 is only the "first door" on the way to patentability,[34] and

29. 35 U.S.C. § 101 (2013).

30. "Discovers" may have been included in § 101 for reasons having nothing to do with patenting works of nature; it may have been included only to reinforce the principle expressed in § 103 that the patentability of an invention shall not depend on "the manner in which [it] was made." *See* CLS Bank Int'l v. Alice Corp., 717 F.3d 1269, 1295 (Fed. Cir. 2013) (Rader, C.J., concurring in part and dissenting in part). A patentable invention may be revealed through patient investigation or a happy accident, rather than the "flash of creative genius" that some cases prior to the 1952 Patent Act had suggested was the standard for invention. *See* Cuno Eng'g Corp. v. Automatic Devices Corp., 314 U.S. 84, 91 (1941). Under the 1952 Act, the standard for invention is nonobviousness. If § 101 had said only "[w]hoever invents . . . ," someone might have argued that persons who discover technological advancements by accident do not act with the intentionality required of "inventors."

31. *See, e.g.*, *In re* Bergy, 596 F.2d 952, 960 (C.C.P.A. 1979), *vacated in part sub nom.* Diamond v. Chakrabarty, 444 U.S. 1028 (1980), *aff'd sub nom.*, Diamond v. Chakrabarty, 447 U.S. 303 (1980) ("Notwithstanding the words 'new and useful' in § 101, the invention is not examined under that statute for novelty because that is not the statutory scheme of things or the long-established administrative practice.").

32. U.S. CONST. art. I, § 8, cl. 8.

33. S. REP. NO.82-1979, at 4(1952); H. R. REP. NO.82-1923, at 6 (1952).

34. *See In re Bergy*, 596 F.2d at 960 (introducing the analogy of multiple "doors" on the path to patentability).

§ 101 itself includes the requirement that the invention be "useful."[35] The utility requirement denies patents to inventions that do not work at all (e.g., perpetual motion machines),[36] or that have no concrete benefit except as the basis for further research.[37] If § 101 is satisfied, the next barrier is § 102, which governs novelty.[38] Among other things, § 102 denies a patent where "the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention."[39] An invention is "available to the public" under § 102 when human action, like the description of the invention in a scientific journal or its embodiment in a product offered for sale, has made it so.[40]

If a patent claim encompasses a prior art reference in one of § 102's enumerated categories, then the claim is "anticipated."[41] If the prior art is close to the claimed invention, but not precisely the same, the inquiry shifts to § 103, which denies a patent to an invention that is obvious.[42] Section 103 states:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.[43]

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35. 35 U.S.C. § 101 (2013).

36. *See* Process Control Corp. v. HydReclaim Corp., 190 F.3d 1350, 1358 (Fed. Cir. 1999).

37. Brenner v. Manson, 383 U.S. 519, 534 (1966) (denying a patent to a process for creating a steroid with no presently-known uses); *see also In re* '318 Patent Infringement Litig., 583 F.3d 1317, 1324 (Fed. Cir. 2009) (the utility requirement prevents one from patenting a "research proposal" or "mere ideas").

38. 35 U.S.C. § 102(a) (2013).

39. *Id.* Section 102 allows certain exceptions—for example, in cases where the public disclosure by another occurred less than one year before the application's filing date, and *after* public disclosure by the applicant. *See* 35 U.S.C. § 102(b) (2013). Section 102 changed substantially following the America Invents Act, but those changes are not relevant to the present discussion.

40. 35 U.S.C. § 102 (2013).

41. *See* Sanofi-Synthelabo v. Apotex, Inc., 550 F.3d 1075, 1082 (Fed. Cir. 2008) ("Claimed subject matter is 'anticipated' when it is not new; that is, when it was previously known."). "A 'single prior art reference must expressly or inherently disclose each claim limitation to anticipate a claim.'" Bard Peripheral Vascular, Inc. v. W.L. Gore & Assocs., 670 F.3d 1171, 1184 (Fed. Cir. 2012) (citation omitted).

42. *See* Net MoneyIN, Inc. v. Verisign, Inc., 545 F.3d 1359, 1371 (Fed. Cir. 2008) ("[D]ifferences between the prior art reference and the claimed invention, however slight, invoke the question of obviousness, not anticipation.").

43. 35 U.S.C. § 103 (2013). Prior to the America Invents Act, the relevant time for

The hypothetical "person having ordinary skill in the art" is a person who might lack the special insights of the inventor, but is who is competent in the ordinary manner and familiar with the prior art.[44] In addressing obviousness, it is appropriate to ask whether a person of ordinary skill might have started with a particular prior art reference and modified it in the manner claimed as an invention. For example, in *KSR Int'l Co. v. Teleflex Inc.*,[45] the Supreme Court determined that a person of ordinary skill in the design of accelerator pedals could have begun with an existing height-adjustable pedal and added an electronic sensor, given the general trend in the automotive industry to move toward electronic sensors.[46]

Even if the invention is new, useful, non-obvious, and patent-eligible, a patent applicant must satisfy the disclosure requirements of § 112. Under § 112(b), the patent specification must conclude with claims "particularly pointing out and distinctly claiming the subject matter which the inventor . . . regards as the invention."[47] The definiteness requirement ensures that the public knows "the bounds of the protected invention" and that competitors of the patentee can avoid infringement.[48] Section 112 also requires that the specification include "a written description of the invention . . . in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains . . . to make and use the same."[49] This language is the basis of two separate requirements: the written description requirement, which demands that the disclosures in the specification demonstrate the inventor's "possession" of the claimed invention,[50] and the enablement requirement, which demands that the specification include enough information to allow a person of ordinary skill to make and use the claimed invention without "undue experimentation."[51]

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considering obviousness was the time at which the invention was made. Graham v. John Deere Co., 383 U.S. 1, 3 (1966).

44. *See* Standard Oil Co. v. Am. Cyanamid Co., 774 F.2d 448, 454 (Fed. Cir. 1985) ("A person of ordinary skill in the art is . . . presumed to be one who thinks along the lines of conventional wisdom in the art and is not one who undertakes to innovate . . . .").

45. 550 U.S. 398 (2007).

46. *See id.* at 419.

47. 35 U.S.C. § 112(b) (2013).

48. Halliburton Energy Servs., Inc. v. M-I LLC, 514 F.3d 1244, 1249 (Fed. Cir. 2008).

49. 35 U.S.C. § 112(a).

50. *See* Ariad Pharm., Inc. v. Eli Lilly & Co., 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc).

51. *See* Streck, Inc. v. Research & Diagnostic Sys., Inc., 665 F.3d 1269, 1288 (Fed. Cir. 2012).

Both the written description requirement and the enablement requirement have been used to invalidate claims that were broader than could be justified by the disclosures of the specification. For example, in *In re Curtis*[52] the court held that a claim embracing dental floss made of Teflon with *any* friction-enhancing coating failed the written description requirement, when the applicant disclosed only *one* such coating, and discovering materials that would stick to Teflon was a notoriously difficult task.[53] In *Automotive Technologies Int'l, Inc. v. BMW of North America, Inc.*,[54] the court invalidated a claim covering electronic and mechanical side-impact crash sensors when the specification enabled only the latter.[55] The court warned that "claims must be enabled to correspond to their scope."[56]

Although § 101 is the only provision of the Patent Act that deals with patentable subject matter, it is wise to consider all of the tools available to the courts and the Patent Office when considering how § 101 should be applied. Courts have sometimes referred to § 101 as a "coarse filter"—a first, and rarely fatal obstacle that is followed by more demanding tests.[57] Even if § 101 were no impediment to patenting a natural law, natural phenomenon, or abstract idea, §§ 102 and 103 would prevent an applicant from claiming any natural law, natural phenomenon, or abstract idea that was already known, or obvious in light of information available to the public. Nothing could be taken from the public that, in that sense, it already possessed. Similarly, § 112 would require that an applicant who broadly claimed a principle provide disclosures of appropriate breadth and detail—a potentially impossible task if the invention was, in fact, nothing more than a principle. Courts limiting the scope of patentable subject matter fear that denying the fundamental tools of discovery to other researchers will impede, rather than promote, the progress of the useful arts.[58] Those concerns are valid. But § 101 is not the only tool, and not necessarily the best tool, for addressing those issues.

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52. 354 F.3d 1347 (Fed. Cir. 2004).

53. *Id.* at 1353.

54. 501 F.3d 1274 (Fed. Cir. 2007).

55. *Id.* at 1285.

56. *Id.*

57. *See, e.g.*, Research Corp. Techs., Inc. v. Microsoft Corp., 627 F.3d 859, 869 (Fed. Cir. 2010) (finding that section 112 "provides powerful tools to weed out claims that may present a vague or indefinite disclosure of the invention," even if the claim passes the "coarse eligibility filter" of section 101).

58. *See, e.g.*, Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1294 (2012) (noting that "upholding the patents would risk disproportionately tying up the use of the underlying natural laws, inhibiting their use in the making of further discoveries").

II. DISTINGUISHING NATURAL LAWS, NATURAL PHENOMENA, AND ABSTRACT IDEAS

It is a rare opinion that confines itself to discussing only one category of unpatentable subject matter. The discussion typically begins with a list of three types of unpatentable subject matter—natural laws, natural phenomena, and abstract ideas—and by the end, if a patent is denied, it is not always clear which forbidden category has been invoked. The ubiquitous grouping of three might suggest that natural laws, natural phenomena, and abstract ideas are one and the same (as a legal document might demand that one "stop, cease, and desist"); but the care taken to always list them separately indicates that they are genuinely different. The terminology varies. A court may refer to natural laws or abstract ideas as "principles"[59] or "abstract intellectual concepts."[60] Natural phenomena may be called "physical phenomena."[61] "Products of nature" is another common term, embracing natural phenomena and possibly natural laws as well.[62] Some courts add a fourth category of unpatentable subject matter—"mental processes."[63] Others may subsume mental processes within the category of abstract ideas. Mathematical formulas are also off-limits,[64] though it is not always clear if that is because they are laws of nature, abstract ideas, or both.

Although courts have not drawn clear distinctions between natural laws, natural phenomena, and abstract ideas, it will be helpful to differentiate between them as much as possible. They raise similar concerns, but if natural laws, natural phenomena, and abstract ideas are different, then different strategies may be best for dealing with them.

For purposes of discussion, we can define a natural law as a generalized description of how nature functions—the way nature behaves under particular circumstances, or a correspondence that one can regularly observe. It is a law of nature that, absent special circumstances, pure water turns to steam when it reaches a temperature of 100º C at sea level. Laws of nature are often expressed as mathematical formulas—like Newton's inverse-square law, which describes gravitational force according to the mass of the attracting

59. *See, e.g.*, Parker v. Flook, 437 U.S. 584, 589 (1978) ("A principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as no one can claim in either of them an exclusive right.") (quoting Le Roy v. Tatham, 55 U.S. 156, 175 (1853).

60. *See, e.g.*, Gottschalk v. Benson, 409 U.S. 63, 67 (1972).

61. *See, e.g.*, Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980).

62. *See id.* at 313.

63. *See, e.g.*, *Benson*, 409 U.S. at 67; *Flook*, 437 U.S. at 589.

64. *See Benson*, 409 U.S. at 71.

bodies and their distance from one another. A phenomenon of nature can be defined as a particular occurrence in nature, whether it is a tangible thing or an event. The conversion of water into steam that occurs in the reservoirs of Yellowstone's Old Faithful geyser, and the steam that is the result of that process, would be examples of natural phenomena. The last category, abstract ideas, has proven very difficult to define.[65] A dictionary definition recently invoked by Judge Rader of the Federal Circuit says that "abstract" means "disassociated from any specific instance . . . expressing a quality apart from an object."[66] The dictionary's example is "poetry," an abstract term that embraces any and all poems.

Natural laws, natural phenomena, and abstract ideas are not completely distinct concepts, which explains why courts often discuss them together, and ambiguously. Natural phenomena follow the dictates of natural laws. The eruptions of steam from Old Faithful occur because geothermal processes beneath the surface of the Earth have heated the water beyond its boiling point. Natural laws are necessarily abstract, because they are general descriptions of nature rather than particular instances. But they may vary in their degree of abstractness. It is a general law of nature that liquids have a boiling point at which they vaporize into gas; the boiling point of water is a more specific case. Natural phenomena can also be described in a manner that combines particular instances, giving the description an abstract character. "Steam," for example, is an abstract term with which to describe water in a gaseous state, whether it appears at Old Faithful or anywhere else. This kind of abstraction combines concrete phenomena of nature, linked by the common operation of natural laws, with the human capacity to conceptualize, generalize, and name. Some abstract ideas are not the work of nature at all, so long as one draws any distinction between nature and mankind.[67] Poetry is one example, life insurance another. Whether mathematics is the work of nature or of mankind is a question to engage the interest of philosophers.

So richly entangled are natural laws, natural phenomena, and abstract ideas that it might not seem worthwhile to treat them

65. *See* Bilski v. Kappos, 561 U.S. 593, 621 (2010) (Stevens, J., concurring) (complaining that the majority "never provides a satisfying account of what constitutes an unpatentable abstract idea").

66. CLS Bank, Int'l v. Alice Corp., 717 F.3d 1269, 1299 (Fed. Cir. 2013) (Rader, C.J., concurring in part and dissenting in part).

67. *See Alice*, 134 S. Ct. 2356 (observing that the economic practice identified in *Bilski* as an abstract idea "is a method of organizing human activity, not a 'truth" about the natural world 'that has always existed'" (citation omitted)).

separately. However, they do pose different issues as far as patent law is concerned. Natural laws are particularly difficult to separate from process claims. A natural law can often be stated as an "if . . . then" proposition—e.g., if water is heated to 100º C at sea level, then it will turn to steam. Process claims describe a series of steps undertaken to achieve a particular result—e.g., a method of producing steam, comprising (a) accumulating a quantity of water, (b) holding the water at atmospheric pressures equivalent to sea level, and (c) heating the water to 100º C. Any process claim, at some level, can be described by the operation of natural laws. Perhaps that is why some early cases indicate that processes are more a matter of "discovery" than "invention."[68] The distinction between a natural law and a patentable invention can often be reduced to the difference between potential and realization.

Where natural phenomena are concerned—things that actually occur in nature—the issue is commonly how much the man-made version must differ from its natural counterpart before it constitutes an invention. Could one, for example, patent purified water if it were purified to a degree never found in nature? All compositions of matter (and all machines and manufactures) are made of materials derived from nature, so the question is what one must do to those materials before the result can be patented. Because the natural product and the laboratory-altered version are equally concrete, the distinction between potential and realization is less obvious here.

Abstractness is an issue that infects all types of patent claims. A process claim that embraces only applications of a natural law could be expressed in a highly abstract manner—e.g., a claim to any use of steam to operate a power plant. The same issue could arise where a composition of matter claim covers materials substantially altered from their natural form—e.g., a claim to water purified in any manner beyond what can be found in nature. Although a claim that embraces a natural principle or natural phenomenon may be drawn abstractly, distinguishing the invention from nature and addressing the abstract qualities of the claim are potentially two very different things. Moreover, abstractness problems can arise in the context of inventions having very little to do with nature, such as those involving manners of

68. *See, e.g.*, Dolbear v. Am. Bell Tel. Co. (The Telephone Cases), 126 U.S. 1, 533 (1888) (discussing patents for those who "discover" processes and those who "invent" the means for carrying them out); Corning v. Burden, 56 U.S. 252, 267 (1854) (noting that a process "is usually the result of discovery; a machine, of invention").

conducting a business. Precedent dealing with natural principles may be difficult to apply in such cases.

As I discuss the history of unpatentable subject matter that has culminated in the present state of the law, I will distinguish between natural laws, natural phenomena, and abstract ideas as much as possible, even where the courts themselves have not troubled to do so. Afterwards, I will argue that the penumbral model of unpatentable subject matter is less suited to dealing with nature than is the binary alternative.

III. PATENTABLE INVENTIONS AND LAWS OF NATURE

A. The Early Cases

Although they long predate the current Patent Act, the patentable subject matter cases of the Nineteenth Century are still cited regularly today. Some of the earliest used the word "principle" to describe subject matter not eligible for patenting. In *Le Roy v. Tatham*,[69] the Supreme Court considered a patent application based on the discovery that a piece of lead could be firmly bonded to another under the application of pressure and heat, a discovery that the applicant had applied in the manufacture of lead pipes.[70] The fact that lead surfaces will adhere under those conditions can aptly be described as a principle of nature. After noting a lack of precision in the use of the word "principle," the majority nevertheless observed that "a principle is not patentable."[71] "A principle, in the abstract," the court explained, "is a fundamental truth; an original cause; a motive; these cannot be patented as no one can claim in either of them an exclusive right."[72] On the other hand, where a principle is "applied to any special purpose, so as thereby to effectuate a practical result and benefit not previously obtained," a patent for that application can be had, even if it is based on "the discovery of a great, general, and most comprehensive principle in science or law of nature."[73] Although the applicant in *Le Roy* had in fact applied his discovery to the manufacture of superior lead pipes, he made the mistake (fatal in the majority's view) of claiming his

69. 55 U.S. 156 (1853).
70. *Id.* at 157.
71. *Id.* at 175.
72. *Id.*
73. *Id.* (quoting Household Co. v. Neilson, Webster's Patent Cases 683 (1843)).

invention as the machinery used in the process. The machinery itself was not new.[74]

Dissenting Justice Nelson, who would have looked past the infirmities of the claim, expanded upon the same concept of principle versus application introduced by the majority. The patentee, he pointed out, had turned "the discovery of this property of lead, which had never before been known, but on the contrary, had been supposed and believed, by all men of science skilled in metals, to be impossible" into wrought lead pipe of such superiority that it had "wholly superseded [its predecessors] in the market."[75] The apparatus used by the patentee "was but incidental, and subsidiary to the new and leading idea of the invention"—the "leading idea" being "[t]he discovery of a new property in the article of lead."[76] That discovery "led naturally to the apparatus," which itself "required very little ingenuity."[77] Given "the state of the art at the time," the machinery could have been constructed by "[a]ny skillful mechanic."[78] Its importance was only in making practical use of the natural properties of lead.[79] Drawing support from English precedent involving Watt's steam engine patent, Judge Nelson observed that patenting a practical application did not amount to patenting a natural principle.[80] On the contrary, "[f]or every other purpose and end, the principle [remains] free for all mankind to use."[81]

Le Roy supports an either/or distinction between an unpatentable law or principle of nature and a patentable application—a theme revisited, in the context of an apparatus rather than a process, in *Mackay Radio & Telegraph Co. v. Radio Corp. of America*.[82] Here the invention concerned the design of a broadcast antenna, optimized through the use of a mathematical formula.[83] The court observed that "[w]hile a scientific truth, or the mathematical expression of it, is not a patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be."[84] In this case, the scientific

74. *See id.* at 176.

75. *Id.* at 178 (Nelson, J., dissenting).

76. *Id.* at 180.

77. *Id.*

78. *Id.* To expect novelty in the means, Judge Nelson wrote, would be "mistaking the skill of the mechanic for the genius of the inventor." *Id.* at 187.

79. *Id.* at 181.

80. *Id.* at 183.

81. *Id.* at 187.

82. 306 U.S. 86 (1939).

83. *See id.* at 91.

84. *Id.* at 94.

truth was not the discovery of the patentee; the mathematical formula had been published in a scientific journal thirty years before the patentee designed his antenna.[85] What the patentee claimed as his invention was an application of that scientific truth in the form of a superior apparatus.[86] Because the formula had been disclosed before, its application to antenna design could have been obvious (or, in the language current before the 1952 Patent Act, not an "invention").[87] The court assumed that it was not obvious (even though "it was achieved by the logical application of a known scientific law to a familiar type of antenna") before finding that the patentee's claims covered variants inconsistent with the formula on which his disclosures relied—a failure, apparently, to meet the written-description requirement.[88]

One of the most frequently cited patentable subject matter cases of the nineteenth century is an English case—*Neilson v. Harford*.[89] It concerns the discovery that a furnace will operate more efficiently if the air introduced into the combustion chamber is heated first (a system known as the "hot blast").[90] The patentee claimed an arrangement for heating the air in a separate vessel before it reached the combustion chamber.[91] He did not specify the size or shape of the vessel, or the materials from which it should be made.[92] The court held the invention to be eligible for patenting.[93] The case is consistent with the principle/application dichotomy of *Le Roy* or *Mackay*. It is a principle of nature that heated air facilitates efficient combustion; it is an application of that principle to heat the air in a separate vessel in order

85. *Id.* at 93.

86. *Id.* at 93–94.

87. *Cf.* Deforest Radio Co. v. Gen. Elec. Co., 283 U.S. 664, 681–82 (1931). In *Deforest*, scientific publications had disclosed the fact that ionization could be eliminated in vacuum tubes by increasing the vacuum. *Id.* at 678–79. The patentee, armed with that knowledge, reduced the pressure in known vacuum tubes and achieved a more regular current. *Id.* at 681–82. The court observed that with knowledge of the principles at work it did not need the "genius of the inventor" to act upon them by increasing the vacuum. *Id.* at 682. The patentee may have understood better than others why the tubes produced superior results, but "[i]t is the method and device which may be patented and not the scientific explanation of their operation." *Id.* at 684–85. The opinion is not as clear as it could be, but it does suggest, by its reference to the "genius of the inventor," that an invention could be challenged on grounds obviousness (as opposed to patent-eligible subject matter) where it consists of an application of *known* scientific principles.

88. "The claimed use of the empirical formula for the calculation of the angle for wires which are not multiples of half wave lengths long thus involved a departure from what [the patentee's] application had described as his invention, and a contradiction of it." *Id.* at 99.

89. (1841) 51 Eng. Rep. 1266 (Exch. Of Pleas).

90. *Id.* at 1273.

91. *Id.*

92. *Id*. at 1274.

93. *Id.*

to improve the combustion in a furnace. "The plaintiff," the court found, "does not merely claim a principle, but a machine embodying a principle, and a very valuable one."[94] The discussion in *Neilson*, however, introduces one element that clouds the picture. The court said: "We think the case must be considered as if, the principle being well known, the plaintiff had first invented a mode of applying it by a mechanical apparatus to furnaces."[95]

Why the court thought it necessary to consider the case as if the newly discovered natural principle were "well known" cannot be determined from the context. The court may only have meant that an application of a natural principle can qualify as an invention *even if* the principle is well known—as *Mackay's* antenna could have qualified as a patentable-eligible application of a known mathematical formula. Therefore a patentee who actually discovers a natural principle should be in no worse position. On the other hand, the court could have meant that one should actually pretend that a newly discovered natural principle is well known, and somehow factor this in when deciding whether an invention constitutes the principle itself or a patentable application of the principle. If this is what the court meant, it contrasts sharply with Judge Nelson's understanding of the principle/application dichotomy, wherein an application may be a patentable invention even though the "leading idea" behind it is the discovery of the principle itself.

B. Funk Bros.

The doubts planted in *Neilson* were compounded in *Funk Bros. Seed Co. v. Kalo Inoculant Co*.[96] The case concerned strains of root-nodule bacteria, called inoculants, used to fix nitrogen in leguminous plants.[97] Farmers generally applied to each crop a single strain of bacteria adapted to that species of plant.[98] Strains were not mixed in multi-use combinations because different strains of bacteria were thought to have a mutually inhibiting effect.[99] The patentee discovered that certain strains could be mixed together without reducing their effectiveness, leading to a single product that could be applied, for

94. *Id.* at 1273.
95. *Id.*
96. 333 U.S. 127 (1948).
97. *Id.* at 128–29.
98. *Id.* at 129.
99. *Id.* at 129–30.

example, to clover, alfalfa, and soybeans.[100] The Supreme Court held that the inoculant mixture was not a patentable invention.

Citing *Le Roy*, the court held that "patents cannot issue for the discovery of the phenomena of nature."[101] They are "part of the storehouse of knowledge of all men . . . free to all men and reserved exclusively to none."[102] The court reaffirmed the principle/application dichotomy that we have seen before:

> He who discovers a hitherto unknown phenomenon of nature has no claim to a monopoly of it that the law recognizes. If there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end.[103]

The non-inhibiting qualities of certain strains of bacteria the court called the "handiwork of nature."[104] Taking advantage of those qualities by devising a multi-use combination of selected inoculant strains would appear to be an application of a natural principle to a new and useful end.[105] In fact, the court admits that it is.[106] But the court proceeds to dismiss the invention as a negligible advancement in packaging, "however ingenious the discovery of [the] natural principle may have been."[107]

> [O]nce nature's secret of the non-inhibitive quality of certain strains of the species of Rhizobium was discovered, the state of the art made the production of a mixed inoculant a simple step. Even though it may have been the product of skill, it certainly was not the product of invention. There is no way in which we could call it such unless we borrowed invention from the discovery of the natural principle

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100. *See id.*

101. *Id.* at 130. *Funk Bros.* is a case that blurs the distinction between principles and phenomena of nature. The bacteria were not genetically engineered, so they might be characterized as phenomena of nature. *Id.* The fact that certain strains of bacteria are mutually non-inhibiting is a fact about nature, best characterized as a natural law or principle. *Id.* Whether non-inhibition is also a phenomenon of nature would depend, according to our working definition, on whether these strains of bacteria were found combined in nature, so that their non-inhibiting qualities were more than theoretical. *Id.*

102. *Id.*

103. *Id.*

104. *Id.* at 131.

105. *See id.* ("There is, of course, an advantage in the combination. The farmer need not buy six different packages for six different crops. He can buy one package and use it for any or all of his crops of leguminous plants.").

106. "The aggregation of select strains of the several species into one product is an application of that newly-discovered natural principle." *Id.* Moreover, "[t]he application of this newly-discovered natural principle to the problem of packaging of inoculants may well have been an important commercial advance." *Id.* at 132.

107. *Id.* at 132.

> itself. That is to say, there is no invention here unless the discovery that certain strains of the several species of these bacteria are non-inhibitive and may thus be safely mixed is invention. But we cannot so hold without allowing a patent to issue on one of the ancient secrets of nature now disclosed.[108]

Here the court shifts from the principle/application distinction of patent eligibility to the question of "invention"—the quantum of ingenuity required of a patentable advancement in relation to the state of the art. After "nature's secret" has been revealed, the combination of non-inhibiting strains of bacteria is an easy step; hence, to call the combination an "invention" one would have to "borrow[] invention from the discovery of the natural principle itself." Judge Nelson expressed the view in *Le Roy* that "the most important part of the invention, may consist in . . . the discovery of the principle of science . . . and little or no pains may have been taken in working out the best mode of the application of the principle."[109] As a "principle turned to account," wrote Judge Nelson, the application is, nevertheless, a patent-eligible advancement.[110] *Funk Bros.* suggests, on the contrary, that one must discount the natural principle when deciding if the application of it is "inventive" enough to receive a patent, even if the principle is in fact newly discovered. Otherwise, patents could issue on the "ancient secrets of nature." The binary principle/application distinction is not decisive; to claim more than the natural principle itself, one must not only apply the principle to a new and useful end, one must apply it in an ingenious manner.

Today we would ask whether the court was talking about patentable subject matter under § 101 or obviousness under § 103. Under the current law, one could reach the same result without disturbing the principle/application dichotomy of patentable subject matter by treating even unknown natural principles as a form of prior art, in comparison to which the invention must be nonobvious. But *Funk Bros.* was decided in 1948, before the 1952 Patent Act made nonobviousness, as expressed in § 103, the applicable standard of inventiveness. Before the 1952 Patent Act, courts would ask whether the claimed advancement qualified as an "invention" in comparison to the prior art—a leap that might require the "genius" of an inventor, rather than the skill of a mechanic.[111] This makes *Funk Bros.*'s

108. *Id.*

109. Le Roy v. Tatham, 55 U.S. 156, 185 (1853) (Nelson, J., dissenting).

110. *Id.*

111. *See* Cuno Eng'g Corp. v. Automatic Devices Corp., 314 U.S. 84, 91 (1941).

confusing muddle of subject matter and ingenuity more understandable, if no less unfortunate.

C. "Invention" and Obviousness

A handful of Appellate Court cases after *Funk Bros.*, but before the 1952 Patent Act, deal with the subject of "invention" in a similar manner. *Davison Chemical Corp. v. Joliet Chemicals, Inc.* involved the manufacture of silica gel, a substance with microscopic pores that is useful as a desiccant.[112] The material was manufactured by treating sodium silicate with an acid, after which the acid was washed away with water.[113] The patentee discovered that the size of the pores in the silica gel was a product of the temperature of the water, and that a higher temperature produced a product of lower density.[114] Based on this "scientific fact [that] no other delver in the art had discovered," the patentee claimed a process for controlling the density of silica gel by adjusting the temperature of the water.[115] Acknowledging the long-standing principle/application dichotomy, the court observed that "[i]t is one thing to discover a scientific fact, a law existing in nature, and quite another to invent a means of making that discovery useful."[116] Yet the question here was whether the patentee's application of the newly discovered principle amounted to an "invention."[117] This depended on whether a "skilled scientist, having been informed of the newly discovered scientific fact," would have found adjusting the temperature of the water to be more than "the exercise of ordinary skill in his profession."[118] In other words, the principle discovered by the patentee must be treated as though it were prior art.[119] Here, had the principle been known, the adjustment of the water temperature would have been a matter of ordinary skill and routine experimentation.[120]

Even after the passage of the 1952 Patent Act had replaced lack of "invention" with obviousness, the kind of analysis seen in *Davison*

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112. 179 F.2d 793 (7th Cir. 1950).

113. *Id.* at 794.

114. *See id.*

115. *Id.*

116. *Id.*

117. *Id.*; *see also In re* Arnold, 185 F.2d 686, 691 (C.C.P.A. 1950) (holding that it is not an "invention" to select the frequency to be used in an alternating electrostatic field, when the selection is routine following the discovery of a previously unknown scientific relationship).

118. *Davison*, 179 F.2d at 794.

119. *See id.* at 795 ("Discovery of a previously unknown law of operation, involved in no new method, has never been held to be invention. The application of the law must be novel and inventive in character.").

120. *Id.*

continued at the appellate court level. In 1963, the Ninth Circuit Court of Appeals decided *National Lead Co. v. Western Lead Products Co.*, a case concerning the manufacture of lead oxide.[121] Much like the patentee in *Davison*, the patentee in *National Lead* discovered a relationship between the temperature used in existing processes for producing lead oxide and the qualities of the resulting material.[122] By controlling the temperature, the patentee could control the size, nature, and uniformity of particles within the manufactured product.[123] He did this by adjusting the flow of molten lead into the "pot."[124] The court assumed that the patentee had discovered the natural relationship between temperature and particle formation, but framed the issue as "whether an artisan, *knowing* that the temperature of the reaction determines the uniformity of the product, would require more than ordinary skill to discover the [patentee's] process of controlling the reaction temperature."[125] The answer to that question was no.[126]

The Third Circuit reached similar results in *Armour Pharmaceutical Co. v. Richardson-Merrell, Inc.*,[127] where the patentee discovered that the optimal point for the absorption of the enzyme trypsin, an anti-inflammatory agent, was the ileum—the lower third of the human small intestine.[128] To deliver orally administered trypsin to the ileum, past the acidic environment of the stomach, the patentee applied an enteric coating to the trypsin pill by a well-known process.[129] Because one cannot patent a law of nature, the court found that one could not claim "the discovery that the ileum will absorb orally administered trypsin."[130] Here the inventor did not claim the principle itself or every use of the principle; he claimed only the use of trypsin as an anti-inflammatory agent and its administration through a coated pill.[131] Although the pill constituted a useful application of the discovery, and the court found no policy reason for demanding that the method of applying the discovery be nonobvious, the court reasoned

121. 324 F.2d 539 (9th Cir. 1963).
122. *Id.* at 541.
123. *Id.*
124. *Id.*
125. *Id.* at 542 (emphasis added).
126. *Id.* at 545–46.
127. 396 F.2d 70 (3d Cir. 1968).
128. *See id.* at 72.
129. *See id.*
130. *Id.* at 72–73.
131. *Id.* at 71 n.3.

that, under *Funk Bros.*, the pill must be found unpatentable.[132] The test, as the court read *Funk Bros*., was this: "[w]ould an artisan, knowing the newly discovered natural phenomenon[,] require more than ordinary skill to discover the process by which to apply that phenomenon as the patentee had done?"[133] In this case, "[o]nce nature's secret that the ileum would absorb trypsin was uncovered," any person skilled in the art could have taken advantage of that secret by applying a suitable coating to the pill.[134]

Davison, *National Lead*, and *Armour* approach the issue from the novelty side—asking not whether the patentee's application of a natural principle is patentable subject matter, but whether it marks the kind of inventive leap worthy of a patent. They turn natural principles into a kind of prior art by assuming, contrary to fact, that they were already known, and imagining whether a person of ordinary skill, so informed, would have been able to apply the principle in the manner claimed. If the principles *had* been known—because, for example, they had been published in scientific journals—then the analysis would be appropriate. The reports in the journals would be a component of the art, and one should ask whether claimed methods of applying those reports were nonobvious. But there is a danger in treating even unknown principles as a given, or a starting place for invention. As Justice Frankfurter remarked in his *Funk Bros.* concurrence, "[e]verything that happens may be deemed 'the work of nature.'"[135] If one hypothesizes a person skilled in the art knowing everything there is to know about the principles underlying an invention, then the application of those principles inevitably becomes a matter of routine.

Cases like *National Lead* and *Armour* are difficult to square with a concurrent line of authority addressing whether one may assume an exhaustive understanding of the problem when asking whether the *solution* to the problem warrants a patent. In *In re Connover*, the applicant discovered that roller bearings failed from excess heat caused by the galling of certain parts in the assembly.[136] The solution, which he sought to patent, was to plate those surfaces with a non-galling metal.[137] Because the source of the problem was unknown, the plating had not been previously done; however, if the source of the problem

132. *See id.* at 74.

133. *Id.*

134. *Id.*

135. Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 135 (1948) (Frankfurter, J., concurring).

136. 304 F.3d 680, 681 (C.C.P.A. 1962).

137. *Id.* at 683–84.

had been known, the plating would have been an obvious solution. Applying § 103, the court held that it was "unobvious to discover the cause of the bearing failures," and that "the unobvious cause of the problem solved, as well as the solution proposed," must be considered.[138] In the context of obviousness, the invention must be evaluated "as a whole," and in this case the applicant's "composite contribution" consisted of both the discovery of the nature of the underlying problem and the means to solve it.[139] The same reasoning would suggest that the obviousness of an invention applying a newly discovered principle should also be evaluated "as a whole"—with consideration of the "composite contribution" that consists of the discovery of a natural principle as well as the means to apply it in a new and useful manner.

D. The Software Trilogy

The Supreme Court returned to patentable subject matter—as a question distinct from nonobviousness—in its trilogy of software patent cases: *Gottschalk v. Benson*,[140] *Parker v. Flook*,[141] and *Diamond v. Diehr*.[142] *Benson* concerned a software algorithm for converting one form of a binary number to another.[143] The court reaffirmed the principle/application distinction, holding that "phenomena of nature" are unpatentable as "basic tools of scientific and technological work," and citing *Funk Bros.* for the proposition that "[i]f there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end."[144] The court found Benson's algorithm claims so "abstract and sweeping" that they would preempt

138. *Id.* at 684.

139. *Id.*; *see also In re* Roberts, 470 F.2d 1399, 1401 (C.C.P.A. 1973) ("a patentable invention may lie in the discovery of the source of a problem even though the remedy may be obvious once the source of the problem is identified;" understanding the problem is a part of the "subject matter as a whole" that must be evaluated under § 103). In a similar case, *In re* Prater, 415 F.2d 1393 (C.C.P.A. 1969), the applicant invented an improved method of spectral analysis based on the use of a newly-discovered principle of mathematics to program a digital computer. *Id.* at 1405–06. The programmed computer, as an apparatus, should not have been deemed obvious when the principle dictating its programming was new to the art. The discovery was "part of [the applicant's] contribution;" the examiner's analysis, which treated the mathematical principle as though it were prior art, was "fatally defective." *Id.* at 1405. The programmed computer could not be obvious under § 103 "because one not having knowledge of [the applicant's] discovery simply would not know what to program the computer to do." *Id.* at 1406.

140. 409 U.S. 63 (1972).

141. 437 U.S. 584 (1978).

142. 450 U.S. 175 (1981).

143. *Benson*, 409 U.S. at 65.

144. *Id.* at 67 (quoting *Funk Bros*., 333 U.S. at 130).

all uses of the mathematical principle and amount to a patent on the concept itself.[145] *Benson* turned on the applicant's lack of *specificity* in applying the mathematics, rather than on whether the means for applying it was itself inventive.[146]

Not until *Flook* did the court revisit the relationship between patentable subject matter and novelty. *Flook* dealt again with a mathematical formula, which the court deemed to be "like a law of nature," and similarly unpatentable.[147] The question to be addressed was "whether the identification of a limited category of useful, though conventional, post-solution applications of such a formula makes [the claimed] method eligible for patent protection."[148] The invention concerned the adjustment of "alarm limits" in a process for the catalytic conversion of hydrocarbons.[149] Alarm limits are threshold values for measured variables like temperature, pressure, and flow rates.[150] If a measurement exceeds the alarm limit it indicates a problem.[151] The applicant claimed a method of "updating" alarm limits during transient process stages, like start-up, through a process of constant measurement and calculation.[152] The applicant's mathematical algorithm, executed by a programmed computer, the court assumed to be "novel and useful."[153] However, the algorithm was the only difference between the applicant's method and conventional methods already in use.[154]

Flook cites *Le Roy* for the proposition that a "principle, in the abstract" is a "fundamental truth" in which no one can claim an exclusive right.[155] Quoting *Funk Bros.*, the court observes that, "[i]f there is to be invention from [the discovery of a law of nature], it must come from the application of the law of nature to a new and useful

145. *Id.* at 68.

146. *Id.* at 68, 72. The court observed that the claim was so "abstract and sweeping" that the use of the mathematical principle could "vary from the operation of a train to verification of drivers' licenses to researching the law books for precedents," and that the technique could be "be performed through any existing machinery or future-devised machinery or without any apparatus." *Id.* at 68.

147. *Flook*, 437 U.S. at 589.

148. *Id.* at 585.

149. *Id.*

150. *Id.*

151. *Id.*

152. *See id.*

153. *Id.* at 588.

154. *Id.* at 585–86.

155. *Id.* at 589 (quoting Le Roy v. Tatham, 55 U.S. 156, 175 (1853)).

end."[156] But the court rejected the applicant's argument that a process "implementing a principle in some specific fashion . . . automatically falls within the patentable subject matter of § 101," leaving novelty and nonobviousness to §§ 102 and 103.[157] The court rejected, in other words, a binary principle/application dichotomy for § 101. Instead, it demanded that "the process . . . itself be new and useful,"[158] meaning that some aspect of the process other than the principle must be inventive. This is determined by treating the mathematical formula "as if [it] were well known,"[159] and "a familiar part of the prior art,"[160] and by asking if there is "some other inventive concept"[161] to be found in the claimed invention. The applicant's claim fell short. Except for the mathematical algorithm discovered by the applicant, everything about the catalytic conversion of hydrocarbons was well known. If the algorithm were also treated as "a familiar part of the prior art," then nothing remained to constitute a patentable invention.[162]

The court justified this approach as an answer to the "draftsman's art."[163] Any "competent draftsman," the court warned, "could attach some form of post-solution activity to almost any mathematical formula."[164] It would "exalt[] form over substance" to say that "post-solution activity, no matter how conventional or obvious in itself, can transform an unpatentable principle into a patentable process."[165] To meaningfully distinguish between a principle and an invention, the applicant should not only apply the principle, but apply it in an inventive manner. Hence, like a prior art reference under § 102, a principle casts a penumbra of unpatentability, its borders defined by whatever applications are conventional or obvious once the principle has become known.

The reasoning in *Flook* is easily criticized. Judge Rich of the Court of Customs and Patent Appeals, who played a prominent role in crafting the 1952 Patent Act, had little good to say about it in *In re*

156. *Id.* at 591 (quoting Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948)).

157. *Id.* at 593.

158. *Id.* at 591 ("The process itself, not merely the mathematical algorithm, must be new and useful. Indeed, the novelty of the mathematical algorithm is not a determining factor at all.").

159. *Id.* at 592.

160. *Id.*

161. *Id.* at 594.

162. *Id.*

163. *Id.* at 593.

164. *Id.* at 590.

165. *Id.*

Bergy[166] the following year. He found in *Flook* "an unfortunate and apparently unconscious, though clear, commingling of distinct statutory provisions which are conceptually unrelated"[167]—namely, patentable subject matter under § 101 and nonobviousness under § 103.[168] The commingling undermined both provisions. To treat a law of nature as "a familiar part of the prior art," when, in fact, "it was not familiar, was not prior, was discovered by the applicant for patent, was novel at the time he discovered it, and was useful," was to give the technical term "prior art," in Judge Rich's words, "an entirely new dimension with consequences of unforeseeable magnitude."[169] Moreover, to inquire at the "first door"—the door of patentable subject matter—whether aspects of the invention are new and unconventional is to misunderstand the statutory scheme: "[a]n invention can be statutory subject matter and be 100% old, devoid of any utility, or entirely obvious."[170]

In fact, the problem with *Flook* runs deeper than the blurring of statutory categories. Presumably, the applicant's use of a newly-discovered mathematical formula to update alarm limits changed something about the operation of the catalytic conversion process. Perhaps disasters were averted that would otherwise have occurred, or processes were allowed to continue that would otherwise have been needlessly aborted. If so, it would be counterfactual to call the application of the formula "conventional," or even "obvious." One can say that the application *would have been* obvious if someone else had already discovered the formula and made it public, but to ignore what actually occurred gives little credit and no reward to someone whose efforts advanced the progress of the useful arts. Perhaps that is why Judge Rich warned, in *In re Bergy*, of "[t]he potential for great harm to the incentives of the patent system."[171]

The Supreme Court backtracked considerably in *Diehr*, the final case of the trilogy. The invention in *Diehr* concerned the operation of a rubber molding press.[172] The applicant used a mathematical formula[173] and constant temperature measurements to calculate, using

166. 596 F.2d 952, 959 (C.C.P.A. 1979).

167. *Id.*

168. *Id.*

169. *Id.* at 965.

170. *Id.* at 963.

171. *Id.* at 966.

172. Diamond v. Diehr, 450 U.S. 175, 177–78 (1981).

173. The mathematical formula was the Arrhenius equation, a formula that was already known in the art. *Id.* at 177 n.2.

a computer, the proper time to open the press.[174] The method addressed the problem of over- or undercuring.[175] As claimed, the applicant's process began with the loading of uncured rubber and ended with the automatic opening of the press.[176] The court observed that manufacturing processes of this kind had long been eligible for patenting, and its status was not changed merely because certain steps of the process took advantage of a mathematical formula and a programmed computer.[177] Reverting to a binary model of unpatentable subject matter, the court described as "commonplace" the idea that "an *application* of a law of nature or a mathematical formula" may be patented.[178] Even if the formula was "not patentable in isolation," a process for curing rubber that employed the formula would not be "barred at the threshold by § 101."[179]

The court did not follow in the footsteps of *Flook* by treating the Arrhenius equation as prior art (which in this case it actually was), and inquiring whether the rest of the claimed process included elements that were nonobvious or unconventional. The applicant's claim, wrote the court, must be evaluated "as a whole:"

> It is inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis. . . . The "novelty" of any element or steps in a process, or even of the process itself, is of no relevance in determining whether the subject matter of a claim falls within the § 101 categories of possibly patentable subject matter.[180]

The court flatly denied that it had used a contrary analysis in *Flook*—an analysis that would ignore a newly-discovered natural principle as a component of the invention.[181] "[I]f carried to its extreme," that approach would "make all inventions unpatentable because all inventions can be reduced to underlying principles of nature, which, once known, make their implementation obvious."[182] The court also distinguished *Flook* on the facts. The process in *Flook* was completed with the updating of the alarm limit.[183] The court

174. *Id.* at 178–79.
175. *See id.*
176. *Id.* at 184.
177. *Id.* at 185.
178. *Id.* at 187 (emphasis in original).
179. *Id.* at 188.
180. *Id.* at 188–89.
181. *Id.* at 189 n.12.
182. *Id.*
183. *Id.* at 192 n.14.

referred to this as "token post-solution activity."[184] The application in *Flook* did not provide any details about the catalytic conversion process, including the selection of variables for the alarm limits or the means for setting off an alarm.[185] Like the claimed invention in *Benson,* the claimed invention in *Flook* began and ended with a number.[186] In contrast, the claim in *Diehr* described a complete process of molding rubber, beginning with the loading of the press and ending with a perfectly-cured rubber product—"a result heretofore unknown in the art."[187] Although the court did not say it, by this reasoning the invention in *Flook* would have qualified as patentable subject matter if it had been claimed as a complete process for the catalytic conversion of hydrocarbons, one part of which was the adjustment of alarm limits by a newly-devised mathematical formula. The process, in that case, would have ended not with a number but with correctly-processed hydrocarbons.

E. The Recent Cases

Diehr seemed to reinstate the binary principle/application model of patentable subject matter. Laws of nature, as such, are not patent-eligible. However, put a law of nature in the context of a concrete application and the result is patent-eligible, even in cases where, if the law of nature had been already discovered, the remaining elements of the invention would have been obvious. Nevertheless, the penumbral model of unpatentable subject matter was not finished, and in recent years it has achieved a prominence not seen since the days of *Funk Bros*. and *Flook*.

It began with *Laboratory Corp. of America v. Metabolite Laboratories*.[188] The patent disclosed a process for diagnosing vitamin deficiencies by measuring the level of the amino acid homocysteine in a patient's blood.[189] The correlation between vitamins and homocysteine is a principle of nature, and the claim required nothing more than measuring the homocysteine level, using existing tests, and reflecting on what it meant.[190] The Supreme Court granted certiorari to

184. *Id.*
185. *Id.*
186. *Id.*
187. *Id.* at 193 n.15.
188. 548 U.S. 124 (2006).
189. *Id.* at 125.
190. *Id.* at 129. The claim read: "A method for detecting a deficiency of cobalamin or folate in warm-blooded animals comprising the steps of: assaying a body fluid for an elevated level of total homocysteine; and correlating an elevated level of total homocysteine in said body fluid with

consider whether the patent claimed eligible subject matter.[191] When the court reconsidered and dismissed certiorari, Justice Breyer, who would have found the invention unpatentable subject matter, dissented.[192] Laws of nature, he wrote, are unpatentable because they are "basic tools" of research, and part of the "storehouse of knowledge" that should be reserved to common use.[193] Although rewarding the discovery of such "basic tools" could create positive incentives, it would "too often severely interfere with, or discourage, development and spread of useful knowledge itself."[194] It would be a case of "too much patent protection" actually impeding the progress of the useful arts.[195]

One could argue that diagnosing a vitamin deficiency (presumably as a prelude to treatment) is a useful *application* of the natural relationship between vitamins and homocysteine. However, Justice Breyer was less interested in utility than in preemption. He conceded that "laws of nature" may be useful, and that research into those laws "may prove of great benefit to the human race."[196] Yet he questioned whether even natural laws applied in a practical manner necessarily qualify as patentable subject matter.[197] The Federal Circuit, he observed, had referred to a "useful, concrete, and tangible result" as the key to identifying an abstract principle that had been applied in a patentable way.[198] Indeed, it is difficult to see how a process that produces a "useful, concrete and tangible result" could be anything other than a practical application of a natural law. Justice Breyer could have found that the process claimed in *Lab Corp.*, which ended with the contemplation of the test results, did *not* produce a "useful" result. Instead, he rejected the Federal Circuit's formulation as inconsistent with Supreme Court precedent.[199] Even if the diagnostic process

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a deficiency of cobalamin or folate." *Id.*

191. *Id.* at 125.

192. *Id.*

193. *Id.* at 127.

194. *Id.* at 128.

195. *Id.* at 126.

196. *Id.*

197. *Id.* at 126–27.

198. *See In re* Alappat, 33 F.3d 1526, 1544 (Fed. Cir. 1994) (en banc); State St. Bank & Trust v. Signature Fin. Grp., 149 F.3d. 1368, 1373 (Fed. Cir. 1998).

199. Justice Breyer's examples are interesting. One is *O'Reilly v. Morse*, 56 U.S. 62 (1854), which turned on the applicant's failure to limit his claim to any specific manner of using electromagnetism to transmit printed messages—more an issue of breadth than of a natural law *per se*. *See infra* Part V. Justice Breyer's other examples are *Benson* and *Flook*, each a case concerning the calculation of numbers, and in which any useful, concrete or tangible result was, at best, implied. Justice Breyer said of *Benson* that the transformation of numbers from one binary

applied the natural correspondence in a useful, concrete, and tangible way, Justice Breyer would not have found it patentable.

The Supreme Court next considered patentable subject matter in *Bilski v. Kappos*.[200] Because the case concerned methods of hedging risks in commodities markets,[201] it is far removed from natural laws and their practical application. Yet the court confirmed some basic principles. "Laws of nature, physical phenomena, and abstract ideas" are unpatentable subject matter—part of the "storehouse of knowledge" that is exempt from patenting.[202] The court described the exceptions as "consistent with the notion that a patentable process must be 'new and useful.'"[203] On the other hand, "an application of a law of nature or mathematical formula" may qualify as patentable subject matter.[204] Although the court cited *Diehr* for the proposition that a claim must be evaluated as a whole and without ignoring the presence of "old elements,"[205] the court also cited *Flook* for its dismissal of "token post solution components."[206] Reverting to the mingling of statutory subject matter and novelty that was characteristic of *Flook*, the court relied on the applicant's addition, in *Bilski*, of "well known random analysis techniques" to the abstract idea of hedging risk.[207] Justice Breyer, concurring, questioned once again the Federal Circuit's standard of a "useful, concrete, and tangible result" to identify patentable subject matter, complaining of its association with patents that border on absurdity.[208] Justice Stevens, who also concurred, cautioned against conflating novelty with the separate issue of patentable subject matter.[209]

Classen Immunotherapies, Inc. v. Biogen IDEC, a Federal Circuit case of the following year, refocused attention on natural laws and the practice of medicine.[210] The patentee discovered that the schedule used

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format to another was "useful, concrete, and at least arguably (within the computer's wiring system) tangible." *Lab. Corp.*, 548 U.S. at 137. But, like the claim in *Lab. Corp.* which ended with the mere contemplation of test results, the claims in *Benson* did not direct that anything specifically useful be done with numbers following their calculation. *Benson*, 409 U.S. at 73–74.

200. 561 U.S. 593 (2010).
201. *Id.* at 599.
202. *Id.* at 601–02.
203. *Id.* (quoting 35 U.S.C. § 101).
204. *Id.* at 611.
205. *Id.* (quoting Diamond v. Diehr, 450 U.S. 175, 185 (1981)).
206. *Id.* at 612.
207. *Id.*
208. *Id.* at 659 (Breyer, J., concurring).
209. *Id.* at 620–21 (Stevens, J., concurring).
210. 659 F.3d 1057 (Fed. Cir. 2011).

for immunizing infants against infectious diseases could affect the later occurrence of chronic disorders like asthma and diabetes.[211] The patents-in-suit included broad claims. Some would be infringed when a health care professional (a) reviewed the literature indicating a correspondence between an immunization schedule and a chronic disorder, and (b) immunized according to the schedule promising a reduced risk.[212] Other claims would be infringed merely by assessing the risk, even if the information did not lead to a different treatment.[213] The patentee characterized the invention as "a new and useful application of a newly discovered scientific fact."[214] As to the first type of claim, the court agreed. When they included "the physical step of immunizing on the determined schedule," the claims were "directed to a specific, tangible application."[215] But the other claims did not pass even the "coarse filter"[216] of patent eligibility:

> [These] claims do not include putting [the knowledge gleaned from reviewing the literature] to practical use, but are directed to the abstract principle that variation in immunization schedules may have consequences for certain diseases. In contrast, the [other] claims . . . require the further act of immunization in accordance with a lower-risk schedule, thus moving from abstract scientific principle to specific application.[217]

The court did not discuss whether immunizing according to the indicated schedule would have been an obvious or conventional step once the natural correspondence was revealed. It is difficult to imagine that it would not have been obvious. Hence, in spite of developments at the Supreme Court, the Federal Circuit in *Classen* still seemed firmly in the camp of a binary analysis of unpatentable subject matter. When the claim calls for nothing more than contemplation of a natural law, it is unpatentable subject matter; when it applies a natural law to a practical use, it is patentable-eligible.

Yet, shortly afterward, the Supreme Court dealt a serious blow to the binary model of unpatentable subject matter. In *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*,[218] the patent covered a process for determining whether the dosage of thiopurine

211. *Id.* at 1060.
212. *Id.* at 1061.
213. *See id.*
214. *Id.* at 1063.
215. *Id.* at 1066.
216. *See id.*
217. *Id.* at 1067–68.
218. 132 S. Ct. 1289 (2012).

drugs, used to treat autoimmune diseases, was too high or too low, by measuring the level of certain metabolites in the patient's blood.[219] The Supreme Court called the relationship between the metabolite level and the optimal dosage a "natural law."[220] Like the rejected claims in *Classen*, the patent in *Mayo* could be infringed by testing for the metabolite levels, even if no change in treatment followed.[221] The claims included only an "administering" step, referring to the use of thiopurine drugs; a "determining" step, referring to the tests that measure metabolite concentrations; and a "wherein" step (not really a "step" at all, because it required no action), referring to the significance of the measured concentrations.[222]

The court recited the usual list of unpatentable subject matter—"[l]aws of nature, natural phenomena, and abstract ideas."[223] They are the "basic tools" of innovation, and exclusive rights to them would impede the progress of technology.[224] However, too broad an exclusion would "eviscerate patent law" because "all inventions at some level embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas."[225] An application of a natural law might qualify as patentable subject matter.[226] So far, the binary principle/application dichotomy appears to be alive and well. But, as in *Flook*, the court expressed the concern that patent eligibility should not depend on the "draftsman's art."[227] In order to "transform a law of nature into a patent-eligible application" one must "do more than simply state the law of nature while adding the words 'apply it.'"[228]

The court held that in order to "transform" a natural law into a patentable application, a process claim must include "other elements or

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219. Before the discovery of how metabolites could be used to determine the proper dosage, "it [had] been difficult for doctors to determine whether for a particular patient a given dose [was] too high, risking harmful side effects, or too low, and so likely ineffective." *Mayo*, 132 S. Ct. at 1295.

220. *Id.* at 1297. The general correlation was already known; the patentee's research first identified the correlation "with some precision." *Id.* at 1295.

221. *See id.* at 1296 ("The District Court . . . accepted Prometheus' view that a doctor using Mayo's test could violate the patent even if he did not actually alter his treatment decision in the light of the test.").

222. *See id.* at 1297. According to the court, the "wherein" clause "at most add[s] a suggestion that [a doctor] should take [the natural correlation] into account when treating his patient . . . while trusting [doctors] to use [the information] appropriately." *Id.*

223. *Mayo*, 132 S. Ct. at 1293.

224. *Id.*

225. *Id.*

226. *See id.* at 1293–94.

227. *See id.* at 1294.

228. *Id.*

a combination of elements, sometimes referred to as an 'inventive concept,' sufficient to ensure that the patent in practice amounts to significantly more than a patent on the natural law itself."[229] In this case, the process claims included no such "inventive concept." The claims included, in addition to the natural correlation between metabolite levels and appropriate dosages, only the administration of the drugs and the blood tests needed to detect the metabolites. The additional elements constituted "well understood, routine, conventional activity previously engaged in by researchers in the field."[230]

Mayo, like *Classen*, could have adhered to a binary principle/application model of unpatentable subject matter while still rejecting a claim that amounts to little more than a reference to a natural correlation. Without the concrete utility that comes with altered treatment, the process is not genuinely an *application* of a natural law. On the other hand, it would have been so easy to add the step of adjusting the dosage that the court might have deemed the addition a matter of the "draftsman's art."[231] In substance, the claim would still have covered all useful applications of the natural correlation, thereby preempting, as a practical matter, a "basic tool of research."[232] Instead the court relied on a penumbral model of unpatentable subject matter, wherein a natural law must be "transformed" by the addition of "other elements" that are themselves "inventive." Those "other elements" cannot be "well-understood, routine, [or] conventional." It is not enough that a natural law be practically applied, it must also by applied—so it seems—by means that are novel or nonobvious.[233] Were Judge Rich still alive, he might accuse the Supreme Court of, once again, confusing one "door" to patentability with another.

In some respects, *Mayo* did not present a good case for clarifying the intersection between unpatentable natural laws and patentable

229. *Id.*

230. *Id.*

231. *See id.* at 1297 ("If a law of nature is not patentable, then neither is a process reciting a law of nature, unless that process has additional features that provide practical assurance that the process is more than a drafting effort designed to monopolize the law of nature itself.").

232. The court observed that "[a]nyone who wants to make use of these laws" must administer the drug and measure the metabolite concentrations; consequently, the claimed process "amounts to nothing significantly more than an instruction to doctors to apply the applicable laws when treating their patients." *Id.* at 1298. It seems equally clear that anyone wanting to "make use" of the natural correlation would also have to adjust the dosage when the tests showed adjustment to be appropriate.

233. The court relied on *Flook* for the proposition that "conventional or obvious" pre-solution or post-solution activity is not enough to "transform an unpatentable law of nature into a patent eligible application of such a law." *Mayo*, 132 S. Ct. at 1298.

applications. The claims in *Mayo* do appear to be products of the "draftsman's art," not because of what they include, but because of what they omit. One would expect a process claim to include the final step that makes the process useful, as the claims in *Diehr* ended with the production of perfectly-cured rubber. The real-world benefit of the process described in *Mayo* would come with the adjustment of the dosage, so that a patient receiving too large a dosage would be relieved of harmful side-effects, or a patient receiving too little would be given effective treatment. The patentee may have left out that step so that firms conducting tests on behalf of a doctor, but not themselves directing treatment, could be sued more easily.[234] In any event, we have claims covering steps already in use (the administration of the drug, and the tests to measure metabolites) with the only addition being information about what the test results mean. Even if that information was new, the correlation between certain measurements and the need for more or less medicine would have been inherent all along—in the same way that a certain quantity of energy was always equivalent to a certain quantity of mass, even before Einstein revealed the formula $E=mc^2$ that makes the quantity known. Accordingly, if the "administering" and "determining" steps were indeed "routine and conventional," and the "wherein" element added only information about what was already there, then the claims could have been, and perhaps should have been, rejected on grounds of novelty, rather than patentable subject matter.

A better *Mayo* case would have included some claims that included the adjustment of the dosage. Then the court could have explained whether the process of treatment as a whole, improved by a new understanding of a natural correlation, constituted patentable subject matter (as *Diehr* would suggest), or whether the obviousness of adjusting the dosage when the correlation was understood, or the fact that all practical uses of the natural correlation were still preempted, meant that the process was not patent-eligible.[235] Instead, we are left with unanswered questions about the role of "conventional" steps in

234. Or the intention might have been to cover situations where the tests showed no need to adjust the dosage.

235. The court did not decide whether the subject matter would still have been ineligible if the steps that accompanied the natural law had been "less conventional." *Mayo*, 132 S. Ct. at 1302. The court did volunteer that "typical patent[s] on . . . a new way of using an existing drug" more successfully "confine their reach to particular applications of [natural] laws." *Id.* If the claim in *Mayo* had called for an adjustment of the dosage, perhaps that would qualify as "as new way of using" thiopurine drugs, and one qualifying as a "particular application" of the natural correlation. We cannot be sure.

determining patentable subject matter, and ambiguity as to whether a binary principle/application model or a penumbral model of unpatentable subject matter is the correct one to apply.

IV. PATENTABLE INVENTIONS AND PHENOMENA OF NATURE

Mayo could be said to involve both natural laws and natural phenomena. The correlation between metabolites and an effective dosage is a natural law, and the process that causes the body to produce metabolites is, in the court's words, "an entirely natural process."[236] But the natural law is a "relation [that] exists in principle apart from any human action."[237] In contrast, the process is dependent on "human action" through the administration of thiopurine drugs. Nature supplies the potential, but it requires a human being to set things in motion. In another type of case, a phenomenon exists in nature without human intervention, and the question is whether, and to what extent, a human who has discovered its existence or put it to use can claim the rights of an inventor. The phenomenon might be a pre-existing material, like uranium, a pre-existing process, like photosynthesis, or a pre-existing force, like electricity. From the beginning, courts have held that a patent-eligible invention must involve more than the discovery of a natural phenomenon. Hence, when a patent applicant claims a process or composition of matter that is subtly altered from its natural counterpart, courts must draw difficult distinctions.

A. The Early Cases

Once again, the story begins in the nineteenth century. Some of the early cases discuss "powers" that exist in nature without human intervention. *Le Roy* states that no one can claim an exclusive right to steam, electricity, or "any other power in nature, which is alike open to all."[238] Invention is not a matter of discovering such powers, but of "applying them to useful objects."[239] Specifically, one can patent the methods devised "to extract, modify, and concentrate natural agencies"[240] so that they can be used to advantage. The *Telephone Cases*,[241] involving Alexander Graham Bell's patents, support the same distinction. Bell claimed a "method of, and apparatus for, transmitting

236. *Id.*
237. *Id.* at 1297.
238. Le Roy v. Tatham, 55 U.S. 156, 175 (1853).
239. *Id.*
240. *Id.*
241. 126 U.S. 1 (1888).

vocal or other sounds telegraphically . . . by causing electrical undulations, similar in form to the vibrations of the air accompanying the said vocal or other sounds."[242] Electricity exists in nature, but "left to itself, [it] will not do what is wanted."[243] Bell did not claim "electricity in its natural state as it comes from the battery," claiming instead a means for "chang[ing] . . . its condition," by altering its intensity to correspond to sound vibrations, so that it could serve as the medium for transmitting speech.[244] Bell could patent his method of controlling the force of electricity to accomplish his purpose.[245] In fact, even if sounds could be transmitted through electricity *only* in the manner invented by Bell, the court would not deny him a patent, but commend him on the significance of his discovery.[246]

When a force of nature has to be controlled by an apparatus to make it useful, nature supplies the potential and the inventor the realization. The separation of potential and realization invites an analysis for forces of nature similar to what we have seen for principles of nature, and cases like *Le Roy* and the *Telephone Cases* treat them as the same. On the other hand, cases involving tangible materials found in nature look somewhat different.

An early example is *Ex Parte Latimer*, concerning the extraction of fibers from the needles of the *Pinus australis* tree.[247] The inventor successfully patented his method of extracting the fibers, but not the fibers themselves. The applicant's discovery was "unquestionably very valuable" and of "immense benefit to the people of the country in which the *Pinus australis* grows."[248] The fiber was stronger, more durable, and cheaper to produce than others used in fabrics, and likely to take their place in manufacturing.[249] But the applicant did not claim that the fibers had been changed in any way in the process of extraction.[250] Freed from their natural context, the fibers were still

242. *Id.* at 531.

243. *Id.* at 532.

244. *Id.* at 534.

245. *Id.*

246. "It may be that electricity cannot be used at all for the transmission of speech except in the way Bell has discovered, and that therefore, practically, his patent gives him its exclusive use for that purpose, but that does not make his claim one for the use of electricity distinct from the particular process with which it is connected in his patent. It will, if true, show more clearly the great importance of his discovery, but it will not invalidate his patent." *Id.* at 535.

247. *Ex Parte* Latimer, 1889 DEC. COMM'R PAT. 123, 125 (1889).

248. *Id.* at 127.

249. *Id.*

250. *Id.* at 125.

"essentially the same thing."[251] Although the fibers were useful, they could not be patented:

> [T]he mere ascertaining of the character or quality of trees that grow in the forest and the construction of the woody fiber and tissue of which they are composed is not a patentable invention . . . any more than to find a new gem or jewel in the earth would entitle the discoverer to patent all gems which should be subsequently found.[252]

The court described the fibers as something that "nature has produced" and that "nature has intended to be equally for the use of all men."[253] If Latimer were allowed to patent the fibers of the *Pinus australis*, then patents might be granted thereafter on all "the trees of the forest and the plants of the earth, which of course would be unreasonable and impossible."[254]

Latimer made a valuable discovery, but he could not claim the natural fibers or their inherent properties as his invention. Courts have never deviated from that principle. In the 1930s, the Court of Customs and Patent Appeals held that ductile uranium was not patentable: "[u]ranium is a product of nature and the appellant is not entitled to a patent on the same, or upon any of the natural qualities of that metal."[255] In *Funk Bros.*, the Supreme Court held that the natural characteristics of certain strains of Rhizobium bacteria (to function without inhibiting other strains) were not the patentee's invention.[256] Those characteristics were "the work of nature."[257] Researchers who discover new plants, minerals, or bacteria often make contributions to human welfare, but not the sort of contributions that are rewarded with patents. In contrast, the bacteria at issue in *Chakrabarty*—produced in the laboratory though genetic engineering—had the ability to break down oil spills in a manner possessed by no naturally-occurring species.[258] This "markedly different characteristic" served to distinguish the human-made invention from the handiwork of nature.[259]

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251. *Id.*

252. *Id.* at 125.

253. *Id.*

254. *Id.*

255. *In re* Marden, 47 F.2d 957, 957 (C.C.P.A. 1931); *see also In re* Marden, 47 F.2d 958, 959 (C.C.P.A. 1931) (holding that ductility of vanadium is "a quality of a natural product and as such is not patentable").

256. Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130–31 (1948).

257. *Id.* at 130.

258. *See* Diamond v. Chakrabarty, 447 U.S. 303, 305 (1980).

259. *Id.* at 310.

B. Nature Processed and Purified

Although all machines, manufactures, and compositions of matter are made of raw materials found in nature, usually they have been processed to a degree that makes it easy to distinguish a human-made invention from its natural components. The difficult cases are the ones where the raw ingredients have been minimally processed—perhaps only by removing those ingredients from their natural environment, as Latimer extracted the fibers from the needles of the *Pinus australis*.[260] A subject-matter distinction based solely on potential and application might suggest that the extracted fibers are an invention; in their original context of pine needles, those fibers can hardly have been useful in manufacturing. Yet few things in nature are useful until removed, in some way, from their natural environment. Fruit must be picked, ores must be mined, and so forth. If removing products of nature from their surroundings were enough to constitute an invention, then, in the context of tangible things, the prohibition on patenting natural phenomena would mean little.

Even combining products of nature in new ways, where their natural characteristics can find additional utility, may be treated as nothing more than a change of context. In *Funk Bros*., the combination of mutually non-inhibiting strains of bacteria was not found in nature, and the combination, useable on a variety of crops, provided a more valuable product.[261] But the advantages of the combination were attributed to the natural characteristics of the bacteria. They were not, in the court's view, the product of invention; they were "no more than the discovery of some of the handiwork of nature."[262]

In many cases, courts have relied on physical differences to distinguish an invention from a product of nature. In *Latimer*, the court observed that the process of removing the fibers from the needles produced "no chemical combination . . . by which the fiber becomes something new or different from the fiber in its natural state."[263] Because the fibers were not made stronger or given any other characteristic not found in nature, "in selecting and obtaining [these fibers] from the trees the applicant has done little more than one who gathers the pebbles along the seashore, where the forces of nature have placed them."[264] Similarly, in *American Fruit Growers, Inc. v. Brogdex*

260. *Ex Parte* Latimer, 1889 DEC. COMM'R PAT. 123, 125 (1889).
261. *See Funk Bros.*, 333 U.S. at 131–32.
262. *Id.* at 131.
263. *Ex Parte Latimer*, 1889 DEC. COMM'R PAT. at 126.
264. *Id.*

Co., the Supreme Court held that the addition of borax to the rind of fresh oranges—a step that protected the fruit from the development of mold—did not produce a patentable "manufacture."[265] The combination of borax and the natural rind did not give those materials "a new or distinctive form, quality, or property."[266] The fruit did not undergo any change in its "name, appearance, or general character."[267] It was still "a fresh orange fit only for the same beneficial uses as before."[268]

The result in *American Fruit Growers* is questionable. If the treated fruit were more resistant to mold, they did have a new and distinctive property compared to oranges found in nature. The court may have been influenced by its focus on the term "manufacture." The court had dealt with the term previously in *Hartranft v. Wiegmann*, where the question was whether seashells that had been treated with acid and polished by an emery wheel (to expose "the brilliant inner layer") were products of manufacturing.[269] The polished shells were found to be "still shells" because "[t]hey had not been manufactured into a new and different article, having a distinctive name, character or use."[270] Like those shells, the oranges in *American Fruit Growers* had not been "tranform[ed]" into "a new and different article" with "a distinctive name, character, and use."[271] They were still, basically, oranges. *Hartranft*, which has been cited in a number of patent cases, was actually a tax case.[272] The term "manufactures" was at issue because "manufactures of shell" were subject to an import duty that did not apply to shells as such.[273] Although tax law and patent law have the word "manufacture" in common, one could doubt whether the policy considerations are the same, particularly when the Patent Act also includes the alternative category "composition of matter."[274] This term, on its face, covers articles that have not been "transformed" in any way.

Some of the most difficult cases involve products of nature that have been purified in the laboratory. Purification can be viewed as either a process of extracting a natural material from its surroundings,

265. 283 U.S. 1, 11–12 (1931).
266. *Id.* at 11.
267. *Id.* at 12.
268. *Id.*
269. 121 U.S. 609, 613–14 (1887).
270. *Id.* at 615.
271. 283 U.S. at 13.
272. *Hartranft*, 121 U.S. at 613–14.
273. *Id.* at 613.
274. *See* 35 U.S.C. § 101 (2013).

or as a process that creates a new material—at least in cases where the process creates a material of greater purity than can be found in nature. Some courts have held that in instances of purification it is not physical differences that matter (other than the purification itself), but whether the purified material offers practical benefits that the unpurified material does not. In *Parke-Davis & Co. v. H.K. Mulford Co.*, Judge Learned Hand held that crystals of purified adrenalin, derived from glandular tissues, were a patentable invention.[275] The patentee was "the first to make it available for any use by removing it from the other gland-tissue in which it was found," so that it "became for every practical purpose a new thing commercially and therapeutically."[276] Although, in spite of *Latimer*, Judge Hand found "no rule" that products "extracted . . . without change" are unpatentable, in this case the "ample practical differences" demonstrated that the patentee's crystals were "not merely the old dried glands in a purer state."[277] Judge Hand cautioned that "[t]he line between different substances and the same substance is to be drawn rather from the common usages of men than from nice considerations of dialectic."[278]

The Fourth Circuit reached similar conclusions in *Merck & Co., Inc. v. Olin Matheison Chemical Corp.*,[279] a case involving vitamin B12. The same chemical substance could be found in natural fermentates, but in such minute quantities that it had "no utility, therapeutically or commercially."[280] The court observed that all tangible things are "products of nature in the sense that nature provides the basic source materials."[281] That a new product was the result of the "extraction, concentration and purification" of materials found in nature did not make it ineligible for patenting.[282] The purified form of B12 was a product of great utility, compared to which the natural fermentates were "wholly useless."[283] The "step from complete

275. 189 F. 95, 103 (C.C.S.D.N.Y. 1911), *aff'd in part, rev'd in part sub nom.*, 196 F. 496 (2d Cir. 1912).

276. *Id.* at 103.

277. *Id.*; *see also* Kuehmsted v. Farbenfabriken of Elberfeld Co., 179 F. 701, 705 (7th Cir. 1910) (medicine that was sufficiently purified to make it "therapeutically available" was a patentable invention, even though "lifted out of a mass [a material created by other researchers] that contained, chemically, the compound;" the patentee had caused the mass "to yield something to the useful arts.").

278. *Parke-Davis*, 189 F. at 103.

279. 253 F.2d 156 (4th Cir. 1958).

280. *Id.* at 161.

281. *Id.* at 162.

282. *Id.* at 163.

283. *Id.* at 164.

uselessness to great and perfected utility is a long one," and a step that, as a practical matter, created an entirely new product.[284]

In other instances, courts have been skeptical of substances that are improved by purification, but not changed in character. In *In re Merz*,[285] the Court of Customs and Patent Appeals held that purification of a known material did not create a patentable invention unless the purified substance differed from its source in kind, rather than in degree.[286] While the purified ultramarine dye at issue in *Merz* was brighter and more desirable, it had the same essential utility as its unpurified counterpart. *In re King*[287] concerned vitamin C, a substance found naturally in foods and that had been used for centuries, in the form of lemon juice, to prevent and treat scurvy.[288] The applicant was first to determine the chemical properties of vitamin C and to isolate it in a concentrated form suitable for use as a food additive.[289] However, because lemon juice contained the same substance and had long been employed for the same purpose, the purified form did not constitute a patentable invention.[290] It is significant that in these cases the source materials were not "wholly useless" in their unpurified form, nor was their utility unknown in the art.

While the cases on purified materials raise some doubts, courts have generally adhered to the principle that merely separating a product of nature from its natural environment does not create a patent-eligible invention. In *Bergy*, the court confirmed that *Latimer* still provides an accurate statement of the law.[291] A product of nature "freed from its surroundings" cannot be patented.[292]

C. Myriad

Today, attention has shifted to DNA. The DNA molecule, in its natural form, contains the information that governs inheritance. Isolated segments of DNA have uses in medicine, including as probes to detect the presence in a sample of a targeted genetic sequence. In

284. *Id.*

285. 97 F.2d 599 (C.C.P.A. 1938).

286. *Id.* at 601.

287. 107 F.2d 618 (C.C.P.A. 1939).

288. *See id.*

289. *Id.* at 619. Another scientist had isolated the substance before, but he had not recognized it as vitamin C. *Id.*

290. *Id.* at 620.

291. *In re* Bergy, 596 F.2d 952, 982 (C.C.P.A. 1979).

292. *Id.*

Association for Molecular Pathology v. Myriad Genetics, Inc.,[293] the patentee, Myriad, claimed isolated human DNA having mutations associated with susceptibility to breast and ovarian cancer.[294] The isolated DNA can be used to identify patients who have an elevated risk of developing the disease. Some of Myriad's claims covered molecules identical to their natural counterparts, except for their separation from a longer strand of nucleotides. Other claims covered equivalent cDNA—molecules including the same genetic information, but synthesized in the laboratory from different components, and omitting the "introns" that do not code for proteins.[295] The issue was whether the isolated DNA sequences, or their cDNA counterparts, were products of nature or patentable inventions.

The Federal Circuit produced three opinions, each illustrating a distinct approach to patentable subject matter. Judge Lourie found that the isolated genes were patent-eligible compositions of matter—"product[s] of human ingenuity"[296]—primarily because physical differences distinguished the invention from naturally-occurring DNA.[297] The severing of covalent bonds created a molecule with a "distinctive chemical identity."[298] Judge Moore reached the same result, but rather than emphasizing physical or chemical changes, she stressed the practical applications made possible by isolation of the genes—a "new and important utility."[299] Judge Bryson would not have found the isolated genes eligible for patenting.[300] Comparing the isolated genes to leaves plucked from a tree,[301] he would have applied the same approach to DNA, a natural phenomenon, that the Supreme Court applied to natural laws in *Mayo*.[302] Specifically, Judge Bryson would have required an "inventive concept" that added to the naturally-occurring genes "more than 'well-understood, routine, conventional'

293. 133 S. Ct. 2107 (2013).

294. *Myriad*, 133 S. Ct. at 2112–13.

295. *Id.* at 2113.

296. Ass'n for Molecular Pathology v. U.S. Patent & Trademark Office, 689 F.3d 1303, 1325 (Fed. Cir. 2012).

297. Although the isolated sequence coded for the same proteins as the sequence found in nature, Judge Lourie found the "informational content" of the DNA irrelevant. *Id.* at 1330. "We recognize that biologists may think of molecules in terms of their uses, but genes are in fact materials having a chemical nature and, as such, are best described in patents by their structures rather than by their functions." *Id.*

298. *Id.* at 1328.

299. *See id.* at 1341–42 (Moore, J., concurring).

300. *Id.* at 1348.

301. *Id.* at 1352 (Bryson, J., concurring).

302. *Id.* at 1354–55.

elements."[303] Isolation of the DNA by known techniques fell short of that "inventive concept."[304] However, Judge Bryson agreed with the other judges that cDNA, which must be created in the laboratory, is patent-eligible subject matter.[305]

The Supreme Court agreed with Judge Bryson that isolated DNA cannot be patented. Identifying the genes in question was a significant advancement in knowledge, but that was the essence of Myriad's contribution.[306] Myriad did not create the genes, and isolating them from their surroundings was "not an act of invention."[307] The cDNA, on the other hand, was the product of human ingenuity and, as such, eligible for patenting.[308] In some respects, the brief opinion does not take us far beyond *Latimer*, which held in 1889 that products of nature extracted from their natural surroundings are not patent-eligible inventions. The court does not call explicitly for an "inventive concept" to distinguish a patent-eligible invention from a product of nature. Instead, the opinion suggests a relatively stark distinction between creation and discovery.[309] The cDNA can be patented because it is "something new" that "the lab technician unquestionably creates."[310] The court does not explore whether creating cDNA is a conventional or routine step after the target gene has been identified. With respect to the DNA, the court suggests that one might patent new *applications* made possible by the discovery, and it notes that Myriad is in an "excellent position" to do so.[311] Whether such an application would be judged as though the gene had already been identified, the court does not explain.[312] Although Judge Bryson would have adopted a penumbral mode of unpatentable subject matter, at the moment there is

303. *Id.* at 1355.

304. *See id.*

305. *Id.* at 1356.

306. *.See* Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 133 S. Ct. 2107, 2117–18 (2013). "Groundbreaking, innovative, or even brilliant discovery does not by itself satisfy the § 101 inquiry." *Id.* at 2117.

307. *Id.* at 2117.

308. *Id.* at 2119.

309. Although the court acknowledged that the isolated DNA constituted a "nonnaturally occurring molecule," it found that the claims were "not expressed in terms of chemical composition" and did not "rely in any way on the chemical changes that result from the isolation." *Id.* at 2118. The "focus" of the claims was on the unchanged genetic information. *Id.*

310. *Id.* at 2119.

311. *Id.* at 2119–20.

312. The court does say that if Myriad had used "an innovative method of manipulating genes," rather than routine processes for isolating DNA, that "innovative method" might have been patentable. *Id.* at 2119.

little evidence that the Supreme Court will do so in the context of concrete natural phenomena like DNA.

V. PATENTABLE INVENTIONS AND ABSTRACT IDEAS

After natural laws and natural phenomena, the third category of unpatentable subject matter is "abstract ideas." Currently there is much uncertainty as to what the term "abstract idea" means.[313] In the context of patent claims, "abstract" could refer to an absence of detail or to an absence of tangible embodiments. A claim to "any electrical generator" is abstract in the first sense, but each example of a generator within the scope of the claim would be, by its nature, concrete. In contrast, a claim to a method of structuring a loan might be quite detailed, but any embodiment within the scope of the claim would consist of symbols, financial obligations, and legal consequences—another layer of intangibles. If we are concerned about patents that are too broad, the former claim might be most objectionable; if we are concerned about patents that exceed the traditional bounds of technology, the latter is more problematic. To further complicate things, "abstract" can also refer to an absence of utility. If Einstein had claimed $E=mc^2$ without reference to any practical application, his claim might have been deemed abstract in that sense. On the other hand, if he had claimed "the use of $E=mc^2$ in the operation of a nuclear power plant," the claim would have lacked detail, but not practical application. Without defining our terms, we cannot agree on which of these claims embraces an abstract idea.

Judge Nelson, writing in dissent in *Le Roy* and referring to the case involving Neilson's furnace, concluded that non-utility is the measure of abstractness.[314] An "abstract principle," he wrote, means "a principle considered apart from any special purpose or practical operation."[315] When a principle is applied to a useful purpose, "[i]t is no longer an abstract principle."[316] It becomes "a principle turned to account, to a practical object, and applied to a special result."[317] In *Neilson*, the abstract principle was a fact about nature: that warm air provides more efficient combustion. The invention was the application of that principle in a furnace by pre-heating the air, before it enters the

313. *See* Mark A. Lemley, *Life After* Bilski, 63 STAN. L. REV. 1315, 1316 (2011) ("Put simply, the problem is that no one understands what makes an idea 'abstract.'").

314. Le Roy v. Tatham, 55 U.S. 156, 185 (1853) (Nelson, J., dissenting).

315. *Id.*

316. *Id.*

317. *Id.*

combustion chamber, in a separate vessel. The patentee did not limit himself to any particular type of vessel by specifying its size or shape, or the materials from which it should be made.[318] But having crossed the line from principle to application, the invention was no longer abstract.

Samuel Morse's telegraph patent included a claim even less detailed than Neilson's. Morse's eighth claim embraced "the use of the motive power of the electric or galvanic current . . . however developed for marking or printing intelligible characters, signs, or letters, at any distances."[319] Disallowing the claim, the majority called attention to its breadth, and the danger that it would preempt further advancements in the art:

> It is impossible to misunderstand the extent of this claim . . . . If this claim can be maintained, it matters not by what process or machinery the result is accomplished. For aught that we now know some future inventor, in the onward march of science, may discover a mode of writing or printing at a distance by means of the electric or galvanic current, without using any part of the process or combination set forth in the plaintiff's specification. His invention may be less complicated—less liable to get out of order—less expensive in construction, and in its operation. But yet if it is covered by this patent the inventor could not use it, nor the public have the benefit of it without the permission of this patentee.[320]

Dissenting Judge Grier argued that Morse's claim, like Neilson's, was not abstract. In spite of its breadth,[321] the claim covered no more than a useful application of the natural forces of electro-magnetism. Reverting to the principle/application dichotomy, Grier wrote that one "who takes this new element or power, as yet useless, from the laboratory of the philosopher, and makes it the servant of man . . . is the benefactor to whom the patent law tenders its protection."[322] If Morse's "art" consisted of "compelling this hitherto useless element," electricity, to convey printed messages at a distance, "how can it be said that the claim is for a principle or an abstraction?"[323]

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318. Neilson v. Harford, 51 Eng. Rep. 1266, 1274 (Exch. Of Pleas) (1841).

319. O'Reilly v. Morse, 56 U.S. 62, 112 (1854).

320. *Id.* at 112–13.

321. Grier viewed the claim, unlimited as it was, as nothing more than Morse's "whole invention." *Id.* at 135 (Grier, J., dissenting). If other inventors improved upon Morse's "art," they could obtain their own patents—an arrangement that had not been found to hinder the advance of technology in the case of patented machines. *Id.* at 134.

322. *Id.* at 132–33.

323. *Id.* at 135.

In fact, it is not clear that even the majority viewed Morse's claim as one to "a principle or an abstraction." Their complaint was that Morse's claim was broader than what his detailed disclosures showed to be his invention.[324] Morse claimed "a manner and process which he has not described and indeed had not invented, and therefore could not describe when he obtained his patent."[325] The court distinguished *Neilson* as a case in which the vessel might be built in any number of ways, and "all of them would produce the effect in greater or less degrees."[326] Anyone who employed an air-heating vessel, no matter how they did it, would be taking advantage of Neilson's advancement. Morse, in contrast, claimed his invention in terms of a result—transmitting messages by electricity. Others who obtained the same result might do so by entirely different means, so Morse's disclosures could not justify such a broad claim. Today, such overbreadth might be treated as a failure to satisfy the written description or enablement requirements.[327]

The association of abstract ideas with non-utility did not end with *Morse*. In *In re Alappat*, the Federal Circuit defined "abstract ideas" as "disembodied concepts or truths which are not 'useful' from a practical standpoint standing alone, i.e., they are not 'useful' until reduced to some practical application."[328] However, breadth and preemption—the qualities singled out in *Morse*—have become more prominent markers of unpatentable subject matter. In *Benson*, the court did not deny that the applicant's mathematical algorithm for converting one form of binary number to another could be usefully applied.[329] The problem lay in the breadth of the claim. It was "so abstract and sweeping as to cover both known and unknown uses of the BCD to binary conversion."[330] The algorithm might be used to operate a train, verify drivers' licenses, or research legal precedents, and it might be performed with machinery yet to be invented, or no machinery at all.[331] Because the applicant had not limited himself to a particular use of the mathematical algorithm, his claim was too abstract to be patented.

The Supreme Court addressed abstract ideas in *Bilski v. Kappos*, where the patentee claimed a method of hedging risks for buyers and

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324. *Id.* at 113.
325. *Id.* at 113.
326. *Id.* at 115–16.
327. *See supra* Part I.B.
328. 33 F.3d at 1526, 1542 n.18 (Fed. Cir. 1994) (en banc).
329. Gottschalk v. Benson, 409 U.S. 63, 68 (1972).
330. *Id.*
331. *See id.*

sellers of energy market commodities by engaging the services of a middleman.[332] With little explanation, the court identified risk-hedging itself as an "abstract idea."[333] Although the claims limited the use of risk-hedging to certain markets, the court found that even "limiting an abstract idea to one field of use or adding token post solution components [does] not make the concept patentable."[334] The claims in *Bilski* added nothing to the underlying abstract idea other than "the use of well known random analysis techniques."[335] The authority on which the court principally relied was *Flook*, which had been similarly dismissive of field-of-use limitations and "token" additions representative of "the draftsman's art." Justice Stevens, in a concurring opinion, criticized the majority for inadequately defining "abstract ideas," and for seeming to interject into the subject matter inquiry considerations of indefiniteness and novelty.[336]

The Federal Circuit has often dealt with cases like *Bilski* involving endeavors far removed from the industrial settings traditionally associated with patentable inventions. Inventions today often manipulate information, rather than the forces of nature. The intangible quality of the subject matter makes concerns of abstractness difficult to avoid. In such cases, the Federal Circuit, focusing on preemption, has looked for some "meaningful limits" imposed by the use of computers or other technology.[337] In *SiRF Technology, Inc. v. International Trade Commission*,[338] the court found that the claimed methods could not be performed without a GPS receiver, and that the necessity of such a receiver "place[d] a meaningful limit on the scope of the claims."[339] In *Bancorp Services, L.L.C. v. Sun Life Assurance Co.*, the patent claimed a computer-implemented system for stabilizing the value of employee life insurance policies owned by corporations and banks.[340] Here the court did not find that the use of a computer was "integral to the claimed invention, facilitating the process in a way that a person making calculations or computations could not."[341]

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332. Bilski v. Kappos, 561 U.S. 593, 599 (2010).

333. *Id.* at 611–12.

334. *Id.* at 612.

335. *Id.*

336. *Id.* at 620–21 (Stevens, J., concurring).

337. The Federal Circuit's earlier attempt to limit patentable process claims to those that work a physical transformation, or that require a particular machine, was rejected by the Supreme Court in *Bilski*. *Id.* at 602–03.

338. 601 F.3d 1319 (Fed. Cir. 2010).

339. *SiRF Technology*, 601 F.3d at 1332–33.

340. *See* 687 F.3d 1266, 1269–70 (Fed. Cir. 2012).

341. *Id.* at 1278; *see also* Fort Props., Inc. v. Am. Master Lease LLC, 671 F.3d 1317, 1323

The Federal Circuit's emphasis on "meaningful limitations" leaves one question unresolved: does anything that restricts the scope of claim suffice, or must a patentee add something "inventive" to the abstract idea—something, other than the idea itself, that is unconventional or nonobvious? In other words, does the penumbral model of unpatentable subject matter, associated in *Mayo* with laws of nature, apply equally to abstract ideas?[342] The Supreme Court's recent decision in *Alice Corp. v. CLS Bank International* suggests that it does.[343]

The patents in *Alice* concern a method of eliminating "settlement risk"—the risk that one party to a transaction will fail to meet its obligations—through the use of a trusted intermediary.[344] In this case, the intermediary generates "shadow" records reflecting the current assets of the transacting parties in real-world financial institutions, and permits transactions only in cases where the records demonstrate the existence of sufficient resources.[345] In the end, it compels the financial institutions to execute the transfers necessary to meet the parties' obligations.[346] The patent included claims to the method itself and to a computer programmed to carry it out.[347]

The Federal Circuit's en banc decision elicited seven separate opinions.[348] The brief per curiam opinion found all the claims ineligible for patenting.[349] Of the remaining opinions, Judge Lourie's concurrence was the most ambitious. He called for a "consistent, cohesive, and accessible approach to the § 101 analysis"[350] based on the concept of preemption. Patent claims, he wrote, should not preempt "fundamental principle[s]."[351] Accordingly, a claim premised on an

(Fed. Cir. 2012) (finding that the "basic character" of a claim to an abstract idea "is not changed by claiming only its performance on computers;" the machine "must impose meaningful limits on the claim's scope." (citations omitted)).

342. Judge Mayer of the Federal Circuit, following the lead of *Bilski* and *Mayo*, argued that the disclosure of "conventional computer technology" could not make patent-eligible an otherwise abstract idea; what is needed is "new technology or [an] 'inventive concept.'" Highmark, Inc. v. Allcare Health Management Sys., Inc., 687 F.3d 1300, 1324 (Fed. Cir. 2012) (Mayer, J., dissenting in part).

343. 134 S. Ct. 2347 (2014).

344. *Id.* at 2349.

345. *Id.* at 2351.

346. *Id.*

347. *See id.* at 2349.

348. *See* CLS Bank International v. Alice Corp., 717 F.3d 1269 (Fed. Cir. 2013) (en banc).

349. *Id.* at 1273.

350. *Id.* at 1277 (Lourie, J., concurring).

351. "Guarding against wholesale preemption of fundamental principles should be our primary aim." *Id.* at 1281.

abstract idea must include "substantive limitations that . . . add 'significantly more' to the basic principle, with the result that the claim covers significantly less."[352] Although the limitation may be called an "inventive concept," we are not looking for ingenuity or nonobviousness.[353] What we are looking for is a "genuine human contribution"[354] sufficient to "materially narrow[] the claims relative to the abstract idea they embrace."[355]

Judge Rader's concurring opinion put less emphasis on breadth and more on the principle/application dichotomy. Referring to the *Neilson* case, Judge Rader observed that "the abstract ideas exception deals not merely with breadth, because the 'hot air' claims were broad and covered many 'mechanical arrangements' but yet [were] found patent eligible."[356] The question is "whether the claim seeks to patent an idea itself, rather than an application of that idea."[357] However, this still turns on the presence of "meaningful limitations" that prevent the claim from covering *every* application of an abstract idea.[358] While the Supreme Court in *Mayo* referred to "routine" or "conventional" steps as inadequate to constitute an "inventive concept," Judge Rader viewed this as merely "shorthand" for discounting steps that one would "necessarily use" whenever applying a fundamental principle.[359]

The Supreme Court affirmed, explicitly adapting its *Mayo* framework to the question of whether a patent claim based on an abstract idea is eligible for patenting.[360] In order to distinguish a patent-eligible application of an abstract idea from the idea itself, one must determine whether the claim includes an "inventive concept"—

352. *Id.* at 1281 (quoting Mayo Collaborative Servs. v. Prometheus Labs., Inc., 123 S. Ct. 1289, 1294 (2012)). "With the pertinent abstract idea identified, the balance of the claim can be evaluated to determine whether it contains additional substantive limitations that narrow, confine, or otherwise tie down the claim so that, in practical terms, it does not cover the abstract idea itself." *Id.* at 1282.

353. *Id.* at 1284. Although the Supreme Court, in *Bilski* and *Mayo*, dismissed additions that were conventional or routine, according to Judge Lourie it was not the lack of novelty that mattered but the failure of those limitations to avoid "a claim that effectively covers the natural law or abstract idea itself." *Id.*

354. *Id.* at 1283.

355. *Id.* at 1286.

356. *Id.* at 1299 (Rader,J., concurring in part and dissenting in part).

357. *Id.*

358. "The relevant inquiry must be whether a claim includes meaningful limitations restricting it to an application, rather than merely an abstract idea." *Id.*

359. *Id.* at 1303. "If, to implement the abstract concept, one *must* perform the additional step, then the step merely separately restates an element of the abstract idea, and thus does not further limit the abstract concept to a practical application." *Id.* (emphasis in original).

360. Alice Corp. v. CLS Bank Int'l, 134 S. Ct. 2347, 2349–50 (2014).

described here as "additional features" ensuring that the claim is more than a drafting exercise designed monopolize the idea itself.[361] Although (regrettably) the court did not "labor to delimit the precise contours of the 'abstract ideas' category,"[362] it found "no meaningful distinction" between the idea of intermediated settlement and the risk hedging found to be abstract in *Bilski*.[363] The court also found that limiting the idea to implementation via a programmed computer—a limitation amounting to "[s]tating [the] abstract idea while adding the words 'apply it with a computer'"—did not supply the missing element needed for patent eligibility.[364]

The Court refers to the computer needed to carry out the claimed invention as "generic."[365] While this may suggest that the claims, like those in *Benson*, were too broad, the court also observes that the functions performed by the computer, like electronic record-keeping, are "well-understood, routine, [and] conventional."[366] The patentee did not purport to have "improve[d] the functioning of the computer itself," nor did the invention "affect an improvement in any other technology or technical field."[367] In the end, "the claims at issue amount[ed] to 'nothing significantly more' than an instruction to apply the abstract idea of intermediated settlement using some unspecified, generic computer," and that was not 'enough' to transform [the] abstract idea into a patent-eligible invention."[368] The use of a "generic" computer did not supply the "inventive concept" that the court demanded.[369] As in *Mayo*, the court seems to say that it is not the usefulness of the combination that determines whether it is patentable, but whether ingenuity can be found in something other than the abstract idea itself. If implementing the intermediated settlement required novel programming techniques, and the claims were limited accordingly, it seems likely that the court would have found the combination eligible for patenting.

361. *Id.* at 2357.
362. *Id.*
363. *Id.* ("Both are squarely within the realm of 'abstract ideas' as we have used that term.").
364. *Id.* at 2358.
365. *Id.* at 2350.
366. *Id.* at 2359.
367. *Id.* at 2351.
368. *Id.*
369. *Id.* at 2350.

VI. THE APPEAL OF SYNTHESIS AND THE SHORTCOMINGS OF THE PENUMBRAL MODEL

One can sense in Judge Lourie's call for a "consistent, cohesive, and accessible approach to the § 101 analysis"[370] a longing for some kind of grand synthesis that would address all the three exceptions to patentable subject matter—natural laws, natural phenomena, and abstract ideas—in a common framework. In recent years, the Supreme Court has heard four subject matter cases. Two cases, *Bilski* and *Alice*, involved abstract ideas;[371] another one, *Mayo*, involved natural laws;[372] and one, *Myriad*, involved natural phenomena.[373] Each decision relies on the same body of law and invokes the same policy concerns—namely, that invention receives adequate reward, but that the "basic tools" of inquiry be spared from preemption. In two of these three contexts—abstract ideas and natural phenomena—the Supreme Court used the term "inventive concept" to describe the additional something that distinguishes a patent-eligible invention from its ineligible counterpart.[374] Judge Bryson would have applied the same "inventive concept" standard to the natural phenomena of human DNA.[375]

If there is in fact one key to all varieties of unpatentable subject matter, and that key is the notion of an "inventive concept," we might achieve a symmetry in patent law that is simple and elegant. On the novelty side, prior art would not be patentable, nor would variations on prior art that one of ordinary skill could achieve. On the subject matter side, fundamental truths would not be patentable, nor would applications of those truths that were not "inventive." We could go so far as to define laws of nature, natural phenomena, and abstract ideas as common law categories of prior art, to coexist with statutory categories like prior patents and publications. To complete the symmetry, we merely have to define the "inventive concept" that distinguishes a fundamental principle from a patentable invention as a non-obvious leap. *Flook* paved the way by dismissing the notion that "post-solution activity, no matter how . . . obvious in itself, can transform an unpatentable principle into a patentable process."[376]

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370. CLS Bank International v. Alice Corp., 717 F.3d 1269, 1277 (Fed. Cir. 2013) (en banc) (Lourie, J., concurring).

371. *See* discussion *supra* Part V.

372. *See* discussion *supra* Part III.E.

373. *See* discussion *supra* Part IV.C.

374. *Alice*, 134 S. Ct. at 2357; *Mayo*, 132 S. Ct. at 1294.

375. *Myriad*, 689 F.3d at 1355 (Bryson, J., concurring).

376. Parker v. Flook, 437 U.S. 584, 590 (1978).

Obviousness is, in many respects, the central concept of the 1952 Patent Act, and unlike many other standards in patent law, it is a relatively concrete measure. Obviousness depends on what a person of ordinary skill would have thought, and it can be evaluated through objective evidence—the so-called "secondary considerations" that include commercial success, long-felt need, and near-simultaneous invention.[377] In this way, novelty and patentable subject matter could be linked by a common penumbral model. As one who has advocated a role for obviousness in infringement's doctrine of equivalents,[378] I cannot deny the intuitive appeal of this kind of scheme.

Unfortunately, the problems with synthesis in this case outweigh the potential benefits. The first problem is that patentable subject matter is one area of patent law that is not designed to deal in matters of degree. A claim might be somewhat indefinite, or an improvement almost obvious, but an invention cannot be somewhat a process or almost a composition of matter. Section 101's use of the expansive terms "process, machine, manufacture, or composition of matter," with the comprehensive "any," suggests that subject matter was intended to be a "coarse filter"[379] with little ambiguity. Two of the exceptions created by the courts can only be either/or propositions. One might argue over definitions, but something is a law of nature or a natural phenomenon, or it is not. It cannot be almost a law of nature, or barely a natural phenomenon. The concept of obviousness inherently involves blurred lines and matters of degree; subject matter does not. The one exception is "abstract idea." An idea, or a patent claim, can be abstract to a certain extent. In fact, *all* claims are abstract to a certain extent,[380] so if "abstract idea" is a subject matter category, one must ask *how abstract* a claim must be to fall in the forbidden category. This is one clue that "abstract idea" does not belong here.

Further problems arise if the transition from a fundamental principle to a patentable invention requires the addition of something non-obvious (or unconventional, non-routine, or not "well-known"). As Judge Rich argued in *Bergy*, except for the inclusion of the word "new" in § 101, the Patent Act is designed to segregate patentable subject matter from novelty and nonobviousness.[381] If one tried to

377. *See* Graham v. John Deere Co., 383 U.S. 1, 17–18 (1966); Star Scientific, Inc. v. R.J. Reynolds Tobacco Co., 655 F.3d 1364, 1375 (Fed. Cir. 2011).

378. *See* Alan L. Durham, *Patent Symmetry*, 87 B.U. L. REV. 969, 1019 (2007).

379. *See* Classen Immunotherapies, Inc. v. Biogen IDEC, 659 F.3d 1057, 1066 (Fed. Cir. 2011).

380. *See* Alan L. Durham, *The Paradox of "Abstract Ideas,"* 2011 UTAH L. REV. 797, 843.

381. *See In re* Bergy, 596 F.2d 952, 960–61 (C.C.P.A. 1979).

patent a device long in use, or an obvious variant of a device long in use, the fact that it *was* a device would be enough by itself to clear the subject matter hurdle. When one turns to the provisions that deal with novelty and obviousness, they make no reference to natural laws, natural phenomena, or abstract ideas. Obviousness under § 103 is premised on the prior art of § 102, all of which is human-made, and all of which makes, or will make, knowledge of the invention available to the public.[382] If Congress had included natural laws and natural phenomena as categories of prior art, regardless of whether they were known, the logic behind the obviousness inquiry would have suffered. We would have to pretend that a person of ordinary skill in the art had information that no one skilled in the art possessed. The secondary considerations would be useless. Factors like commercial success and long-felt need can demonstrate whether something was actually obvious, but not whether something would have been obvious if an undiscovered law of nature or natural phenomenon had been known. On reflection, it seems Congress had good reasons for not including pre-existing natural laws and phenomena in § 102.

This is not to say that it would be impossible to include a purely hypothetical obviousness inquiry in our § 101 analysis. References used today to demonstrate obviousness under § 103 may be so obscure that the inquiry is already mostly hypothetical.[383] Even "secret prior art" can be the basis of a finding of obviousness, an example being a prior patent application that had not yet been published.[384] Although no one in the art, other than the applicant, had access to the information, it is fair game for obviousness because the information was on a path to public disclosure. Hence we could, with some difficulty, imagine whether an application of a natural law, natural phenomenon, or abstract idea would have been obvious had the underlying principle been known, even in cases where it was yet to be discovered. The bigger problem is how this approach would disregard the nature of invention.

As the Supreme Court said in *Mayo*, "all inventions at some level embody, use, reflect, rest upon, or apply laws of nature, natural

382. *Id.* at 965 n.7 ("Basically, the concept of prior art is that which is publicly known, or at least known to someone who has taken steps which do make it known to the public.").

383. *See, e.g.*, Bruckelmyer v. Ground Heaters, Inc., 445 F.3d 1374, 1379 (Fed. Cir. 2006) (holding that illustrations in a Canadian patent application that related to cancelled claims, and that were omitted from the patent that issued, were still sufficiently accessible to the public to constitute prior art); *In re* Hall, 781 F.2d 897, 900 (Fed. Cir. 1986) (a single catalogued thesis in a German library was sufficiently accessible to the art to constitute a printed publication).

384. 35 U.S.C. § 102 (a)(2), (d) (2013).

phenomena, or abstract ideas."[385] The Wright brothers' airplane flew because of the laws of aerodynamics. Edison's light bulb glowed thanks to the properties of electromagnetism. Invention consists in a new understanding of what nature can be made to do; in other words, "if you do this . . . you get that." Discovery and invention go hand in hand. Discoveries reveal what nature allows; inventions apply that understanding in a useful way. The potential exists in nature before it is concretely applied (the principles of aerodynamics came before the building of the airplane), but as an act, or a state of mind, discovery does not precede invention. They are one and the same. Both the Constitution, awarding to "inventors" the rights to their "discoveries," and § 101, referring to "[w]hoever invents or discovers," suggest the connection. If, in evaluating patentable subject matter, we try to separate the discovery from the invention, we are missing the point. For example, the invention in *Le Roy*—a method of uniting lead under heat and pressure—was inseparable from the discovery that lead is capable of uniting under heat and pressure.[386] If we treat the discovery as a given, and dismiss the invention as an obvious application, then we discount what was, at the time, a significant advancement in metallurgy.

On the other hand, the reluctance to allow patents on things that already exist in nature is as well-founded as it is long-enduring. One cannot "invent" what is already there. Moreover, the benefits of nature's handiwork may already be enjoyed. Even before nuclear fusion was understood as a natural phenomenon, it gave us sunlight. The policy objective of the patent laws—encouraging the advancement of the useful arts—does not support awarding rights to what already exists. It would be inconsistent, as well, with § 101's reference to patenting only that which is "new." Although Judge Rich gave little significance to that word,[387] it does fill a gap if interpreted to exclude from patenting things that already exist, but that are not within one of the human-made prior art categories of § 102.

With respect to natural laws, the key to resolving the tension—between recognizing the role of discovery in invention, and avoiding patents to what is already there—is the ancient distinction between principle and application. Natural laws include what nature *can* do, but is not doing already. An inventor who discovers the potential, and by that discovery makes possible a new and useful application, has a

385. Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1293 (2012).

386. Le Roy v. Tatham, 55 U.S. 156 (1853).

387. *See supra* Part III.D.

legitimate claim to a patent. The reasoning in *Mayo*, which stresses the necessity of an "inventive concept" beyond the discovery of nature's laws, is therefore off track. If we frame the discovery in *Mayo* in terms of a natural law—that certain metabolite levels reflect a need for different quantities of thiopurine drugs—then a useful application of that principle, in the form of corrected dosages, should be a patent-eligible process. Some elements of that process, like the tests that reveal the metabolite levels, may be routine already. However, that is not relevant to whether the process as a whole is patent-eligible. If the correlation was previously unknown, the process as a whole, including the corrected dosages, could not have been routine—it was a new and useful invention. To pretend otherwise ignores how invention occurs.

Laws of nature themselves are not eligible for patenting. They are not new, or useful, or invented. But applications of those laws in the form of new and useful processes, machines, manufactures, or compositions of matter should be patent-eligible. In *Mayo*, the claimed invention was not an application of the natural correlation between the metabolites and the optimal dosage. The claim only referred to administering the drugs and conducting the tests, "wherein" certain results indicated the presence of an incorrect dosage.[388] Because it did not specify any changes in treatment, the "wherein" clause did not embody an application. It was a statement about nature and nothing more. Moreover, because the drugs and the tests were already known in the art, nothing about the claimed process was new. Certain test results always indicated incorrect dosages, even if no one could correctly interpret them. When a claim refers to a natural law but does not require that anything be done with it, it lacks the completed utility that is the mark of an invention.[389] The same is true of the Supreme Court's hypothetical claim that merely sets forth a natural law and says "apply it."[390] A claim that invites others to find ways of applying a natural law does not itself correspond to an application of a natural law. A claim to an application of a natural law should indicate in some manner *how* it is applied, not merely that it *is* applied.[391]

388. *Mayo*, 132 S. Ct. at 1297.

389. Similarly, in *Flook* the claims culminated in the adjustment of an alarm limit—just a number—with no action, including sounding an alarm or interrupting the process, taken as a result. Parker v. Flook, 437 U.S. 584, 585 (1978).

390. *Mayo*, 132 S. Ct. at 1294.

391. The simplest tool to deal with a claim that sets out a natural law and invites one to "apply it" is probably the written description requirement. It is unlikely that any patent disclosure could demonstrate that the inventor was in possession of every manner of applying a natural law. *See supra* Part V.

With the qualification that application implies concrete utility, the principle/application dichotomy works well to distinguish between natural laws, which cannot be invented, and patent-worthy inventions that rely on natural laws. The most serious objection to this binary analysis is that a claim to an application of a natural law may be phrased in such a way that it embraces *all* practical applications of the law, with the same effect as a claim to the law itself. One might, therefore, insist on something extra that imposes "meaningful limits."[392] I will discuss the issue of breadth separately. The first concern should be distinguishing between nature and invention, and if the claim genuinely describes an application—whether it is phrased narrowly or broadly—the first concern has been dealt with. In *Mayo*, it would have been easy enough, from a technological and patent-drafting standpoint, to add a final element to the claim calling for appropriate adjustments to the dosage. Issues of breadth aside, that should have been enough to make a process claim that was eligible for patenting. The novelty or obviousness of the thiopurine drugs, the tests, or the adjustment of the dosages should have been issues for §§ 102 and 103 alone.

When we are dealing with natural phenomena rather than natural laws, the situation is more difficult. A natural phenomenon, as I have defined it, is something already manifested in nature—like electricity, pine needles, or human DNA. As is the case where natural laws are concerned, a person who merely finds what is already there should not receive a patent; the subject of the discovery is not new, and it is not an invention. In this case, however, a simple distinction between nature and invention is harder to maintain. The difference between a natural law and a patent-eligible process is the difference between potential and realization. Nature dictates what *can* be done; a human-invented process makes it happen. But if we are comparing, for example, pine needle fibers found in nature to the same fibers extracted in the laboratory, both are concrete and tangible, and both require further effort to produce something with real utility. If we must find a difference to distinguish between nature and invention, what difference are we looking for?

One answer is to accept any difference at all, but this might lead to patents on pebbles gathered from the beach, fruit plucked from the trees, and so forth. Any product of nature separated from its environment is different in that respect at least. A standard that required nothing more would, effectively, remove any distinction between those who invent new things in the laboratory and those discover new things

392. *See supra* Part V.

in nature. The tradition behind that distinction is too well-established to ignore. The *Hartranft* formula demands "a distinctive name, character or use" in a patentable manufacture, in comparison to a product of nature.[393] A distinctive "name" is meaningless, and "character" ambiguous. One could demand physical differences, like the breaking of the chemical bonds that occurs when fragments of DNA are removed from their natural context. However, the differences of opinion in the Federal Circuit's *Myriad* decision show that it would be difficult to agree on how much change is significant.[394] There is no standard by which to measure it. A better answer is to focus, once again, on utility. In her concurring opinion in *Myriad*, Judge Moore focused on the things that one could do with isolated fragments of DNA that could not be done with the DNA found in nature.[395] This, more than an emphasis on chemical changes, serves to tie the patentable subject matter analysis to the basic goal of patent law—to advance technology through the introduction of new utility.

The concept of inherency could play an important role here. A patent claim is invalid by anticipation if a prior art reference includes every element of the claim, either expressly or inherently.[396] If, for example, a claimed invention is "the natural result" of an existing process, the claim is anticipated.[397] Recent decisions hold that an inherent characteristic of the prior art need not have been recognized to be anticipating.[398] An inherent characteristic may be the work of nature, like the cancer-inhibiting properties of the vegetable sprouts at issue in *In re Cruciferous Sprout Litigation*.[399] Those properties "have existed as long as the sprouts themselves," so there was no patentable novelty in a claim that referred to them.[400] The same approach might be applied in the context of patentable subject matter. If nature, without human intervention, already supplies a benefit, then the person who discovers that benefit cannot claim it as a patent-eligible invention. If vitamin C naturally occurs in foods and it inherently prevents scurvy, the person

393. Hartranft v. Wiegmann, 121 U.S. 609, 635 (1887).

394. *See supra* Part IV.C.

395. *Myriad*, 689 F.3d at 1341–42 (Moore, J., concurring).

396. *See* Bard Peripheral Vascular, Inc. v. W.L. Gore & Assocs., Inc., 670 F.3d 1171, 1184 (Fed. Cir. 2012), *vacated in part on reconsideration*, 682 F.3d 1003 (Fed. Cir. 2012), *vacated in part on reh'g en banc*, 476 F. App'x 747 (Fed. Cir. 2012).

397. King Pharm., Inc. v. Eon Labs., Inc., 616 F.3d 1267, 1275 (Fed. Cir. 2010).

398. *See, e.g.*, Leggett & Platt, Inc. v. VUTEk, Inc., 537 F.3d 1349, 1355 (Fed. Cir. 2008); Abbott Labs. v. Baxter Pharm. Prods., Inc., 471 F.3d 1363, 1367–68 (Fed. Cir. 2006).

399. 301 F.3d 1343 (Fed. Cir. 2002).

400. *Id.* at 1350.

who discovers the connection cannot claim the ingestion of vitamin C as a method of preventing scurvy. That much has happened already. On the other hand, someone who turns a new understanding of nature into a process, machine, manufacture, or composition of matter with utility not found in nature has made an invention, and the invention should be eligible for patenting. If a vitamin C concentrate is shelf-stable in a way that no naturally-occurring vitamin C can match, then the concentrate and methods of using it should be patentable subject matter. The inventor has made a contribution to human welfare that nature itself did not supply.

This is a sensible approach in general, even if in particular cases it is difficult to apply. In *Myriad*, one could use the isolated genes in ways that one cannot use the lengthy strands of DNA that occur in nature. On the other hand, one can use apples picked from the tree in ways that one cannot use apples that are still attached. Perhaps the answer there is that apples fall naturally from the tree, whereas genes may not separate themselves without human intervention. In any case, the last thing we should do is to introduce a hypothetical obviousness inquiry in which we pretend that every phenomenon of nature has already been discovered. An invention may come about because the inventor discovered a new phenomenon of nature that could be exploited. A more potent medicine, for example, might be owed to the discovery of a new species of plant. If the medicine derived from the plant is new, useful, and nonobvious, it should be patentable, no matter how the invention was made. The medicine cannot be less of a manufacture, or more the work of nature, depending on whether or not similar ways of processing similar plants had already been devised.

Appending an obviousness inquiry to patentable subject matter would mean fewer restrictions on the ability of the public to use those "basic tools" that courts have said should not be patented. But if every obvious application of a newly-discovered "basic tool" is itself a "basic tool," then many valuable contributions to technology will go unrewarded. For example, Neilson's vessel for preheating the air in his "hot blast" furnace must have been an obvious step, if not an inevitable one, once it was known that heated air induced superior combustion. It is one thing to treat the information available to the public (through § 102 prior art references) as a starting point for invention, and demand that patents be reserved for nonobvious leaps. It is another thing to treat a discovery about nature as the same sort of baseline, when such discoveries can be the very essence of invention. Whether the discovery involves an unknown natural law or an unknown natural phenomenon makes little difference.

The category of "abstract ideas" presents issues unique to itself. If an "abstract idea" means a concept that cannot be reduced to tangible embodiments—like certain concepts in economics, law or mathematics—then they arguably fall outside the scope of patentable subject matter because they do not come within the technological "useful arts."[401] Whether a "useful arts" restriction is advisable is a topic beyond the scope of this article. If, on the other hand, abstractness is a matter of too much generality and breadth—a quality that can apply to patent claims dealing with the most traditional and concrete sorts of technology—then the answer can only be to require "meaningful limits." The problem is that all patent claims, by their nature, are abstract. They describe classes of things that share common attributes—the attributes that, in combination, constitute the invention. An infinite variety of mousetraps may fall within a claim to a mousetrap comprising A, B, and C. Because all patent claims generalize, it is difficult to say when a claim leaves out so much detail, and covers so much territory, that it should be rejected as too abstract.

As I have argued elsewhere,[402] the enablement and written description requirements are better instruments for dealing with overbreadth than patentable subject matter. That is because they demand a comparison between the claim and the detailed disclosures that provides a standard of measurement. The disclosure of a fundamental breakthrough, making possible a wide variety of applications without further contributions to the art, justifies a broad claim. A narrow disclosure paired with an all-embracing claim—perhaps a claim that includes any method of achieving certain results—demands a different outcome. In those cases, the enabling disclosure is not commensurate in scope with the claim, and it does not demonstrate that the applicant was, in any meaningful sense, in possession of the claimed invention. Section 112 evaluates the claims within the context of the specification and the state of the art when the patent application was filed. Section 101 supplies no such context, making decisions about abstractness more arbitrary, and less connected to the "bargain"—an exchange of exclusive rights for disclosure—that is an important aspect of patent law policy.[403]

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401. *See* Alan L. Durham, *"Useful Arts" in the Information Age*, 1999 BYU L. REV. 1419, 1520–23 (1999).

402. *See* Durham, *The Paradox of "Abstract Ideas," supra* note 380, at 846–47.

403. *See* Wellman, Inc. v. Eastman Chem. Co., 642 F.3d 1355, 1360 (Fed. Cir. 2011) (referring to the "bargained-for exchange by which a patentee obtains the right to exclude . . . and the public receives knowledge of the preferred embodiments for practicing the claimed invention").

CONCLUSION

Subject matter eligibility—on its face the simplest of all tests of a patentable invention—has become a difficult conundrum. Perhaps this is because so much innovation now occurs in areas such as biotechnology and computer programming, where invention is increasingly difficult to distinguish from fundamental truths. The notion of exclusive legal rights to a fundamental truth is, justifiably, a source of concern to anyone interested in the advancement of human welfare. Nevertheless, the ancient binary distinction between principle and application, born in the era of telegraphs and steam engines, is still a useful one to apply today at the threshold of patentability. When fundamental truths, or principles or manifestations of nature, are applied by human beings to produce new utility, we have entered the realm of technological advancement that is properly subject to patenting. If the inventor claims too much—perhaps framing the invention in terms of a fundamental truth rather than a specific application of it—tools like the enablement and written description requirements may be used to confine the patent to the inventor's contribution to the art, as demonstrated in the patent application's detailed disclosure. Moreover, if the claimed invention is, in fact, no more than a trivial application of a known truth, or a natural phenomenon previously discovered, a patent may be denied on grounds of obviousness. This step-by-step approach respects the basic structure of the Patent Act, while ensuring that patents do not inhibit, more than they advance, the progress of technology.

The alternative penumbral model of patentable subject matter demands that a patent-eligible invention add to a fundamental truth (even if it is a truth newly discovered) an "inventive concept." This seems to require not only an application of the fundamental truth, but an application that is unconventional in its own right, or one that a person of ordinary skill could not have achieved even if informed of the discovery that made it possible. This penumbral model leads to ambiguity and matters of degree in applying § 101 of the Patent Act—a provision seemingly drafted with breadth and certainty in mind, and not one that depends (like § 103) on the ever-evolving state of the art. Most importantly, the requirement of an "inventive concept" distinct from the discovery of an underlying truth misconceives the very substance of invention. Invention is a matter of discovering what nature *can* do, when artfully manipulated. Such discoveries should not be treated as a starting-point for invention, but as the essence of it. If the penumbral model of unpatentable subject matter encourages us to

overlook that, the binary potential/application model is much in need of revival.