PREEMPTION, DIAGNOSTICS, AND THE MACHINE-OR-TRANSFORMATION TEST: FEDERAL CIRCUIT REFINEMENT OF BIOTECH METHOD ELIGIBILITY

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Patentable subject matter has been in disarray since the Supreme Court overhauled the doctrine with a string of decisions invaliding claims for ineligible subject matter.[1] The largely judge-made doctrine stems from section 101 of the Patent Act, which states that "[w]hoever invents or discovers any new and useful process, machine, manufacture, or composition of matter" is eligible for patent.[2] The Supreme Court has extrapolated from these patent-eligible categories to identify several patent-ineligible subject matters: laws of nature, natural phenomena, and abstract ideas.[3] The Court made clear that preemption concerns, or fears of undue impact on downstream innovation, drive this exclusionary principle.[4] Describing these ineligible concepts as "the basic tools of scientific and technological work," the Court worried "monopolization of those tools through the grant of patent might tend to impede innovation more than it would tend to promote it, thereby thwarting the primary object of the patent laws."[5] But the Court has also warned of the principle's limitations, "lest it swallow all of patent law," because "at some level, all inventions. . . embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas."[6] Thus, Supreme Court patentable subject matter

DOI: https://dx.doi.org/10.15779/Z38PN8XF4W

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1. *See* Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347 (2014); Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 133 S. Ct. 2107 (2013); Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289 (2012); Bilski v. Kappos, 561 U.S. 593 (2010).

2. 35 U.S.C. § 101 (2012).

3. *Alice*, 134 S. Ct. at 2354 (citing *Myriad*, 133 S. Ct. at 2116; *Bilski*, 561 U.S. at 601–02; O'Reilly v. Morse, 56 U.S. 62, 112–20 (1854); Le Roy v. Tatham, 55 U.S. 156, 174–75 (1853)).

4. *Alice,* 134 S. Ct. at 2354 ("We have described the concern that drives this exclusionary principle as one of pre-emption.") (citing *Bilski,* 561 U.S. at 611–12).

5. *Id.* (internal quotation marks and brackets omitted).

6. *Id.* (internal quotation marks and brackets omitted).

jurisprudence aims to optimize innovation through the patent system by balancing exclusive rights and preemption.[7]

The current standard for assessing section 101 eligibility is a two-step test attributed to *Mayo v. Prometheus* and solidified in *Alice v. CLS Bank*.[8] While *Alice* plainly stated two required steps, it provided little guidance for their application.[9] As a result, courts have struggled to find a clear standard for patentable subject matter, especially in the fields of biotechnology and computer science.[10] Notably, the Supreme Court did previously consider a different approach, which the Federal Circuit named the machine-or-transformation test.[11] However, the Court later rejected that test, and opted instead for a more nuanced standard, in order to better reflect its policy goals of balancing exclusive rights and preemption.[12]

For the last several years, the Supreme Court has dominated section 101 jurisprudence by the sheer number of cases it has decided. But the Court recently denied certiorari to a controversial subject matter case, *Ariosa v. Sequenom*,[13] which the Court then followed with denial of four additional petitions incorporating over 400 patents in software, internet, and medical diagnostics.[14] Thus, it seems the Supreme Court has returned the torch to the Federal Circuit to lead lower courts in refining the *Mayo/Alice* test.

This Note analyzes Federal Circuit treatment of biotechnology method claims since *Mayo*, specifically relating to section 101 policy drivers. Part I lays the foundation with an overview of Supreme Court policy and doctrine. Part II provides a summary of significant Federal Circuit cases, post-*Mayo*,

7. *See* Mark A. Lemley et al., *Life After* Bilski, 63 STAN. L. REV. 1315, 1329 (2011) (arguing subject matter eligibility "is about encouraging cumulative innovation and furthering societal norms regarding access to knowledge by preventing patentees from claiming broad ownership over fields of exploration rather than specific applications of those fields").

8. *Alice,* 134 S. Ct. at 2355 (citing *Mayo*, 132 S. Ct. at 1294).

9. *See id.*

10. *See* Joe Craig, Note, *Deconstructing Wonderland: Making Sense of Software Patents in a Post-*Alice *World*, 32 BERKELEY TECH. L.J. (forthcoming 2017) (discussing issues of patent eligibility in software).

11. *See* Diamond v. Diehr, 450 U.S. 175, 182–84 (1981); *In re* Bilski, 545 F.3d 943, 959 (Fed. Cir. 2008).

12. Bilski v. Kappos, 561 U.S. 593, 604–06 (2010); *see also Alice*, 134 S. Ct. at 2354–55.

13. Ariosa Diagnostics, Inc. v. Sequenom, Inc., 788 F.3d 1371 (Fed. Cir. 2015), *cert. denied*, 136 S. Ct. 2511 (2016). *Ariosa* was widely hailed as the Court's opportunity to clarify section 101. *E.g.*, Jason Rantanen, *Section 101 - Pivotal Moment for Clarity on Patent Subject Matter Eligibility*, PATENTLYO (Apr. 21, 2016), http://patentlyo.com/patent/2016/04/section-subject-eligibility.html [https://perma.cc/5UXW-PE7K].

14. Tony Dutra, *High Court Denies Petitions, Content with* Alice *Aftermath*, BLOOMBERG LAW (Oct. 03, 2016), https://www.bloomberglaw.com/document/XFVO84EC000000?campaign=bnaemaillink&jcsearch=bna%2520A0K2A1X7N6#jcite.

involving biotech method claims. Part III analyzes those decisions to address (1) whether they are consistent with Supreme Court policy, (2) how they suggest a return to the machine-or-transformation test, (3) the risk of future policy failure with respect to diagnostic methods, and (4) potential refinements of the *Mayo/Alice* test. Part IV concludes that the Federal Circuit could both improve administrability and better promote underlying policies by approaching *Mayo/Alice* step two in the context of a claim's breadth and capacity to generate downstream technologies.

I. THE SUPREME COURT STORY

Though subject matter eligibility is rooted in the broad language of section 101, the doctrine is essentially a judicial construct. Thus, the Supreme Court has played a vital role in identifying both the scope of the doctrine as well as underlying policy drivers.

A. UNDERLYING POLICY: PREEMPTION AND IMPACT ON DOWNSTREAM INNOVATION

The Supreme Court has identified excessive "preemption" as the primary rationale behind patentable subject matter doctrine.[15] In patent law, preemption refers to a patentee's exclusive right to make, use, or sell a claimed invention during the life of the patent.[16] The incentive scheme of patent law relies on exclusive rights as a motivator for innovation, so preemption is an inherent quality of every patent.[17] But not all claims preempt equally; a historical analysis reveals that the Court's main concern with overly preemptive claims is undue impact on downstream innovation.

1. *Sowing the Seed:* O'Reilly v. Morse *and* Neilson v. Harford

Supreme Court patentable subject matter jurisprudence dates back to the nineteenth century in the landmark case *O'Reilly v. Morse*.[18] In *Morse*, the Court addressed the validity of a claim in Morse's patent for the electromagnetic telegraph.[19] The contested claim covered the use of electric or galvanic current "however developed for marking or printing intelligible characters, signs, or letters, at any distances."[20] The Court rejected the claim as "too broad, and not warranted by law," as the claim allowed Morse to

15. *Alice*, 134 S. Ct. at 2354.
16. *See* 35 U.S.C. § 271 (2012).
17. *See id.*
18. *See* O'Reilly v. Morse, 56 U.S. 62 (1854).
19. *Id.* at 106.
20. *Id.* at 112.

combine his current invention with new scientific discoveries, providing rights to additional inventions not recorded with the patent office.[21] The Court feared Morse could then monopolize his undisclosed invention indefinitely because "the public must apply to him to learn what it is."[22]

Though *Morse* is widely considered a patentable subject matter case,[23] the Court did not actually address whether Morse claimed ineligible subject matter. Instead, the Court rejected his claim for lack of written description or enablement,[24] finding that Morse had claimed a "manner and process which he ha[d] not described and indeed had not invented, and therefore could not describe when he obtained his patent."[25]

The Court did, however, spend considerable time discussing *Neilson v. Harford*, a case from the English Court of Exchequer, which addressed both enablement and subject matter eligibility.[26] In *Neilson*, the patent claimed an improved method for heating furnaces that involved producing a current of air, first passed into a heated vessel, then into the furnace.[27] In essence, the invention was a mechanism to apply hot air to blast furnaces, which proved more effective than using cold air.[28] The Court in *Morse* identified two separate issues in *Neilson*: the question of written description and enablement decided by the jury[29] and the division between principle and

21. *Id.* at 113.

22. *Id.*

23. *See* Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1293 (2012) (citing *Morse* to support the statement that "[t]he Court has long held that [section 101] contains an important implicit exception[;] '[l]aws of nature, natural phenomena, and abstract ideas' are not patentable"); Parker v. Flook, 437 U.S. 584, 592 (1978) (referring to *Morse* as a "landmark decision" in patentable subject matter).

24. Rochelle C. Dreyfuss & James P. Evans, *From* Bilski *Back to* Benson: *Preemption, Inventing Around, and the Case of Genetic Diagnostics*, 63 STAN. L. REV. 1349, 1356–57 (2011); Lemley et al., *supra* note 7, at 1332 (noting that *Morse* is discussed as part of the "enablement" section in CRAIG ALLEN NARD, THE LAW OF PATENTS 51 (2008)).

25. *Morse*, 56 U.S. at 113.

26. *Id.* at 114–17 (citing Neilson v. Harford, 151 Eng. Rep. 1266 (1841)).

27. *Neilson*, 151 Eng. Rep. at 1266.

28. *See id.*

29. *See id.* at 1274. In addressing written description or enablement in *Neilson*, the court held that a valid patent must have a specification that "if fairly followed out by a competent workman, without invention or addition, would produce the machine for which the patent is taken out." In contrast to the court's discussion of principles versus applications of principles, this language parallels modern section 112, requiring written description and enablement of what is claimed. *See* 35 U.S.C. § 112 (2012). Thus, enablement or written description issues are best addressed under section 112, rather than section 101.

application of principle determined by the court.[30] In the latter, the *Neilson* opinion grappled with whether the patent claimed the relationship between air blast temperature and furnace fire temperature—a patent-ineligible principle—or an eligible application of that relationship.[31] The court concluded that even considering the principle as well known, Neilson invented a "mode of applying it by mechanical apparatus to furnaces" and thus claimed an eligible "machine embodying a principle."[32]

Neither *Neilson* nor *Morse*'s characterization of *Neilson* elaborated on the rationale for finding principles unpatentable. But by conducting separate analyses of whether a claim (1) embodied a principle, and (2) was properly described and enabled, the courts implied that the distinct inquiries may also have distinct policy drivers.[33] *Morse* can be read as suggesting that the goal of written description and enablement is to promote public access to knowledge; adequate disclosure allows subsequent inventors to manipulate and improve upon patented technologies.[34] More recent Supreme Court cases make clear that patentable subject matter doctrine instead focuses on preventing undue impact on downstream innovation (*i.e.*, excessive preemption), regardless of whether the claimed invention is disclosed to the public.

2. *Modern Policy:* Funk Brothers *and Beyond*

The Supreme Court broached the issue of undue preemption in *Funk Brothers v. Kalo*, which dealt with claims over a novel mixture of bacteria.[35] The Court found the claims to be invalid, in part because "[t]he qualities of these bacteria, like the heat of the sun, electricity, or the qualities of metals, are part of the storehouse of knowledge of all men."[36] While not explicitly addressing preemption, the Court implied that laws of nature, such as the listed examples, cannot be monopolized because they are fundamental to so many different applications.

Following *Funk Brothers*, the Court held in *Gottschalk v. Benson* that a computer-based method of binary conversion was patent ineligible.[37] The

30. *Morse*, 56 U.S. at 115.

31. *Neilson*, 151 Eng. Rep. at 1273 ("It is very difficult to distinguish [Neilson's specification] from the specification of a patent for a principle, and this at first created in the minds of some of the Court much difficulty.").

32. *Id.* at 1273.

33. *See Morse*, 56 U.S. at 114–15 (discussing *Neilson*, 151 Eng. Rep. at 1266).

34. *See id.* at 113.

35. Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127 (1948).

36. *Id.* at 130.

37. *See* Gottschalk v. Benson, 409 U.S. 63, 73 (1972).

Court prefaced its discussion by stating, "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."[38] The Court then went on to hold that Benson's claim was "so abstract and sweeping" that the end use could be performed through any machinery[39] and might "vary from the operation of a train to verification of drivers' licenses to researching the law books for precedents."[40] *Gottschalk* can thus be understood as identifying two distinct factors underlying a claim's preemptive effect: (1) breadth, and (2) capacity to generate dependent technologies.[41] The first factor may be viewed as the specificity of a claim, including limitations to particular materials, techniques, or applications.[42] The Court found Benson's claim "abstract and sweeping" as it had no limitations beyond those inherent to the algorithm for binary conversion.[43] The second factor can be considered a claim's estimated number of applications, or potential uses for a claim's end goal.[44] Here, the Court's laundry list of applications employing binary conversion suggested that the claim had high potential to generate dependent technologies.[45]

Nearly ten years after *Gottschalk*, the Supreme Court held in *Diamond v. Diehr* that a method of curing synthetic rubber was patentable subject matter despite incorporating a well-known mathematical formula.[46] The Court found that, unlike the "abstract and sweeping" claim in *Gottschalk*, Diehr's claims "describe in detail a step-by-step method for accomplishing

38. *Id.* at 67.

39. The issue of not being tied to specific machinery rings a bell for lack of enablement, but the Court's main focus was on the potential to tie up "basic tools of science." *See id.* at 67–68.

40. *Id.* at 68.

41. *Cf.* Lemley et al., *supra* note 7, at 1337, 1341 (suggesting that claim scope be the sole inquiry under section 101, but including as a factor of claim scope whether the claimed invention is "potentially generative of many kinds of new inventions").

42. *See id.* at 1343 (characterizing a method of diagnosing vitamin deficiency in *Metabolite* as sufficiently narrow under section 101 because it "diagnoses a particular vitamin deficiency" and "uses one particular blood test," meaning "[o]thers are free to develop new blood measurements and new ways to test for this particular deficiency, even if they cannot use the particular method disclosed in the patent," Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc., 548 U.S. 124 (2006)).

43. *See Gottschalk*, 409 U.S. at 68.

44. *See* Katherine J. Strandburg, *Much Ado About Preemption*, 50 HOUS. L. REV. 563, 576 (2012) ("The result in *Benson* is a relatively straightforward application of a subject matter exclusion based on overbroad downstream impact due to the wide range of potential uses of the claimed technology.").

45. *See Gottschalk,* 409 U.S. at 68.

46. Diamond v. Diehr, 450 U.S. 175, 175 (1981) (noting that the method at issue incorporated the Arrhenius equation).

[the end goal of curing synthetic rubber]," such that they sought "only to foreclose from others the use of [the] equation in conjunction with all of the other steps in their claimed process."[47] Thus, it may be reasoned that the claims were not unduly preemptive because detailed "other steps" tied them to specific techniques and applications.[48] Further, the end goal of "curing synthetic rubber" can be understood as narrow and unlikely to generate many dependent technologies[49]—a reading consistent with the fact that the Court did not raise the same laundry list of potential uses as it did in *Gottschalk*.[50]

To date, the Court has given its clearest explanation of the risks associated with overly preemptive claims in the landmark case *Mayo v. Prometheus*.[51] Prometheus claimed a method of optimizing drug dosage, comprising "administering" a drug and "determining" the blood level of a specific metabolite, "wherein" the user applied an algorithm linking metabolite level to optimal drug dosage.[52] Like the claims in *Gottschalk*, the Court found Prometheus's claims to be "overly broad" and analogous to "just sa[ying] 'apply the algorithm.'"[53] However, like the claims in *Diehr*, Prometheus's claims can also be understood as unlikely to generate many dependent technologies; the Court described the incorporated laws of nature

47. *Id.* at 184, 187.

48. *See* Lemley et al., *supra* note 7, at 1335 (reading *Diehr* as a straightforward application of their theory that section 101 is primarily an issue of claim breadth, as the patented process "was tied to a specific practical application of the formula that did not unduly foreclose future innovation relying on the formula").

49. *See* Strandburg, *supra* note 44, at 605 (arguing that even if Diehr's claims are considered to wholly preempt the particular algorithm for programming a computer to calculate rubber curing time, there was really no other application for that method and thus "it cannot seriously be maintained that this preemption indicates that Diehr's claims would have broad downstream effects on innovation").

50. *See Diehr*, 450 U.S. at 187; *cf. Gottschalk,* 409 U.S. at 68.

51. Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1301–02 (2012) ("[T]here is a danger that the grant of patents that tie up [the use of basic tools of scientific and technological work] will inhibit future innovation premised upon them, a danger that becomes acute when a patented process amounts to no more than an instruction to 'apply the natural law,' or otherwise forecloses more future invention than the underlying discovery could reasonably justify."). Though most clearly stated in *Mayo*, *Alice* also affirmed impact on downstream innovation as the Court's main policy driver. Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2358 (2014) (holding that a computer-based method for mitigating settlement risk was patent ineligible because given the "ubiquity of computers" it would risk monopolizing the abstract idea itself, and thus the holding "accord[ed] with the pre-emption concern that undergirds [Supreme Court] § 101 jurisprudence") (internal brackets omitted).

52. *Mayo*, 132 S. Ct. at 1295.

53. *Id.* at 1301.

as "narrow laws that may have limited applications," and only identified the claim's potential use in "more refined treatment recommendations."[54] Yet the Court ultimately found the claims invalid because "even a narrow law of nature (such as the one [in *Mayo*]) can inhibit future research."[55] Thus, *Mayo* can be read as finding undue preemption, despite little opportunity for dependent technologies, where a claim is so broad as to encompass most practical uses of the incorporated law of nature.[56]

In summary, Supreme Court patentable subject matter policy can be understood as targeting overly preemptive patents, or those likely to cause undue impact on downstream innovation. A claim's preemptive effect may then depend on two factors: (1) breadth and (2) capacity to generate dependent technologies. The next section discusses how the Court has applied this policy to determine subject matter eligibility, specifically in method patents.

B. DEVELOPMENT OF DOCTRINE

The Supreme Court has taken two conflicting approaches to patentable subject matter. The *Mayo/Alice* test focuses on an inventive concept, while the machine-or-transformation test is centered on physical change. The Court ultimately established the former as the definitive test for section 101 eligibility, but continued to regard the latter as an important and useful clue.

1. *The Path of Unfortunate Word Choice: Confusion of Novelty, Nonobviousness, and Patentable Subject Matter*

The Supreme Court has a long history of addressing section 101 in the language of novelty and nonobviousness. Both are requirements for patentability, but they are explicitly defined under sections 102 and 103 of the Patent Act.[57] The compounded effect of numerous Supreme Court cases confusing the three doctrines culminated in *Alice v. CLS Bank*, which

54. *See id.* at 1302; Arti K. Rai, *Diagnostic Patents at the Supreme Court*, 18 MARQ. INTELL. PROP. L. REV. 1, 6 (2014) ("In the context of conceding that the law of nature in question was narrow, the *Mayo* Court did emphasize the relatively trivial contribution made by the patentee.").

55. *See Mayo*, 132 S. Ct. at 1303. As all patents preempt in some capacity, the Court likely meant even a narrow law of nature may *unduly* inhibit future research. The Court also stated that the judiciary is not well suited to distinguish between different laws of nature, so it endorsed "a bright-line prohibition against patenting laws of nature, mathematical formulas and the like, which serves as a somewhat more easily administered proxy for the underlying 'building-block' concern." *Id*.

56. *See id.* at 1295.

57. 35 U.S.C. §§ 102–103 (2012) (laying out requirements for novelty and nonobviousness).

described the second step of the two-step test for patent-eligible subject matter as a "search for an 'inventive concept.'"[58]

The problems began in *Morse*, and specifically *Morse*'s discussion of *Neilson*.[59] The Court noted that Neilson's claim was a patentable application of a principle,[60] rather than an unpatentable claim on the principle itself, because the "interposition of a heated receptacle, in any form, was the *novelty* he invented."[61] The Court appears to have used "novelty" as a synonym for "application,"[62] but by using a term of art, the Court invited confusion of the novelty and patentable subject matter doctrines.

Following *Morse*, the Court in *Parker v. Flook* further read novelty and nonobviousness into section 101. In *Flook*, the Court held that a computer-based method of updating alarm limits was invalid.[63] The Court explicitly limited its holding to section 101, rather than sections 102 or 103, arguing that patentability must precede determination of whether an invention is "new or obvious."[64] However, the Court then concluded that conventional or obvious "post-solution activity," or steps that occur after the principle is applied, cannot make a patent-ineligible claim eligible.[65] Rather, it held that "the discovery of [a phenomenon of nature or mathematical formula] cannot support a patent unless there is some other inventive concept in its application."[66] Whereas *Neilson* merely required the application of a principle, *Flook* confused sections 101, 102, and 103 by requiring the *inventive* application of a principle.[67]

The modern test for patentable subject matter follows *Flook* and reads both novelty and non-obviousness into section 101 with the "inventive

58. *Alice*, 134 S. Ct. at 2355.

59. O'Reilly v. Morse, 56 U.S. 62, 112–13 (1854).

60. The principle being that the application of hot air creates a hotter fire.

61. *Morse*, 56 U.S. at 116 (emphasis added).

62. *Id.* ("Undoubtedly, the principle that hot air will promote the ignition of fuel better than cold, was embodied in this machine. But the patent was not supported because this principle was embodied in it. . . . But *his patent was supported, because he had invented a mechanical apparatus*, by which a current of hot air, instead of cold, could be thrown in. And this new method was protected by his patent. *The interposition of a heated receptacle, in any form, was the novelty he invented.*") (emphasis added).

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

64. *Id.* at 588, 593.

65. *Id.* at 590 ("The notion that post-solution activity, no matter how conventional or obvious in itself, can transform an unpatentable principle into a patentable process exalts form over substance.").

66. *Id.* at 594.

67. *See* O'Reilly v. Morse, 56 U.S. 62, 115 (1854); Neilson v. Harford, 151 Eng. Rep. 1266, 1266 (1841).

concept" requirement. Introduced in *Mayo v. Prometheus*, and solidified in *Alice v. CLS Bank*, the modern two-step test requires determining (1) whether the claims are "directed to" a patent-ineligible concept, then if so, (2) whether they include an "inventive concept . . . sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself."[68] The Court further described claims that lack an "inventive concept" as "simply appending conventional steps, specified at a high level of generality, to laws of nature, natural phenomena, and abstract ideas."[69] Thus, the "inventive concept" requirement stems from the Court's concern with undue preemption. Because ineligible concepts such as laws of nature "considered generally, are the basic tools of scientific and technological work,"[70] a claim that merely instructs one to "apply the natural law . . . forecloses more future invention than the underlying discovery could reasonably justify."[71] Or rephrased, a claim that lacks an "inventive concept" amounts to a patent upon the natural law itself, which is then unduly preemptive and patent ineligible.

The *Mayo/Alice* test focuses on method claim eligibility and leaves many questions unanswered. In contrast, the Court has taken a simpler approach to composition claims; between *Mayo* and *Alice*, the Court decided *Association for Molecular Pathology v. Myriad*, which held that naturally occurring compositions are ineligible subject matter.[72] Returning to the language of section 101, the Court found Myriad's cancer gene composition claim ineligible because it failed to claim a "new and useful . . . composition of matter," as the "location and order of the nucleotides existed in nature before Myriad found them" and "separating that gene from its surrounding genetic material [was] not an act of invention."[73] However, the Court also held that merely removing the noncoding regions of the gene using common laboratory techniques was sufficient to differentiate the new sequence from an ineligible "product of nature."[74] Thus, *Myriad* made clear that subject matter eligibility of composition claims hinges on whether that composition exists in nature, and any alterations aside from mere isolation

68. Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2355 (2014) (citing Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1294 (2012)).

69. PerkinElmer, Inc. v. Intema Ltd., 496 F. App'x 65, 69 (Fed. Cir. 2012) (quoting *Mayo*, 132 S. Ct. at 1300).

70. *Mayo*, 132 S. Ct. at 1301 (internal quotation marks omitted).

71. *Id.* (internal quotation marks omitted).

72. Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 133 S. Ct. 2107, 2116–17 (2013).

73. *Id.* at 2116–17.

74. *Id.* at 2119.

are sufficient to make the claim patent eligible.[75] This Note focuses on section 101 as applied to method claims, which remains a gray area despite the Court's attempts to clarify the doctrine in *Mayo* and *Alice.*

2. *An Alternative Approach: The Machine-or-Transformation Test*

In parallel to *Flook*, the Supreme Court took an alternative view to method claim eligibility, which the Federal Circuit dubbed the "machine-or-transformation test."[76] The test holds that patentable method claims must either be tied to a particular machine, or transform or reduce an article to a "different state or thing."[77] Though the Federal Circuit shaped much of the jurisprudence in this area, the test originated from Supreme Court cases *Gottschalk v. Benson* and *Diamond v. Diehr*.[78] And like the *Alice* inventive concept test, it too was adopted to address undue preemption; a claim's tangible limitations to a particular machine or transformation act as a proxy for acceptable levels of preemption.[79]

In *Gottschalk*, the Court strongly encouraged the machine-or-transformation test via discussion of its own precedent. Specifically, the Court highlighted methods for manufacturing flour (reducing grain to powder) and glycerine (chemical transformation) as examples of patentable transformations or reductions "to a different state or thing."[80] Likewise, the Court referenced a patent-eligible process for expanding metal (physical transformation) that produced a "new and useful result."[81] Ultimately, the Court declined to find the machine-or-transformation test definitive of

75. *Id.* at 2116–19.

76. *In re* Bilski, 545 F.3d 943, 958–62 (Fed. Cir. 2008).

77. *Id.*; *see also* Diamond v. Diehr, 450 U.S. 175, 192 (1981); Gottschalk v. Benson, 409 U.S. 63, 71 (1972).

78. Notably, the Supreme Court decided *Diehr* in 1981 and the Federal Circuit was created in 1982, making *Diehr* the gold standard for patentable subject matter doctrine at the time.

79. *In re* Bilski, 545 F.3d at 954 ("A claimed process involving a fundamental principle that uses a particular machine or apparatus would not pre-empt uses of the principle that do not also use the specified machine or apparatus in the manner claimed. And a claimed process that transforms a particular article to a specified different state or thing by applying a fundamental principle would not pre-empt the use of the principle to transform any other article, to transform the same article but in a manner not covered by the claim, or to do anything other than transform the specified article."); *see also Gottschalk*, 409 U.S. at 69–70 (citing Corning v. Burden, 56 U.S. 252 (1854) (finding a process for tanning, dyeing, etc. not tied to particular machinery, but incorporating changes in "articles or materials" sufficient to confine the patent monopoly "within rather definite bounds")).

80. *Gottschalk,* 409 U.S. at 69–70 (citing Cochrane v. Deener, 94 U.S. 780 (1877); Tilghman v. Proctor, 102 U.S. 707 (1881)).

81. *Id.* (citing Expanded Metal Co. v. Bradford, 214 U.S. 366, 385–86 (1909)).

subject matter eligibility, but it also failed to define the test's limitations or suggest an alternative approach.[82]

The Court again endorsed the machine-or-transformation test in *Diamond v. Diehr*. The Court held that a claim was patentable if it applied an ineligible concept "in a structure or process which, when considered as a whole, is performing a function which the patent laws were designed to protect (*e.g.*, transforming or reducing an article to a different state or thing)."[83] Remarkably, between deciding *Gottschalk* and *Diehr*, the Court decided *Flook*, in which it made no mention of the machine-or-transformation test.[84] The Court in *Diehr* also emphasized, notably counter to *Flook*, that "the 'novelty' of any element or steps in the process, or even of the process itself" does not factor into section 101 eligibility.[85]

Thus, despite being temporally close, *Flook* and *Diehr* applied vastly different doctrines. *Flook* focused on whether the application of an ineligible concept was *inventive*, whereas *Diehr* asked whether the application *reduced or transformed* matter to a different state or thing.[86] Hence, a period of uncertainty followed *Diehr*, as lower courts grappled with the conflicting doctrines.[87] *Mayo* and *Alice* provided a definitive

82. *Id.* at 71–73 (acknowledging that there might be method claims that fail the test, but are still eligible for patent). The Court struggled to find a suitable method for limiting the scope of patents dealing with algorithms and seemed to land on the machine-or-transformation test as the best, but imperfect, approach. The Court ended with a plea to Congress to address issues of patentable subject matter in computer science, indicating that it believed the problem to be beyond the scope of judicial power. *Id.*

83. Diamond v. Diehr, 450 U.S. 175, 192 (1981) ("[W]hen a claim containing a mathematical formula implements or applies that formula in a structure or process which, when considered as a whole, is performing a function which the patent laws were designed to protect (*e.g.*, transforming or reducing an article to a different state or thing), then the claim satisfies the requirements of §101.").

84. *See* Parker v. Flook, 437 U.S. 584, 588–96 (1978).

85. *Compare Diehr,* 450 U.S. at 188–89, *with Flook*, 437 U.S. at 594 (holding that "the discovery of [ ] a phenomenon [of nature] cannot support a patent unless there is some other *inventive* concept in its application") (emphasis added).

86. *See Flook*, 437 U.S. at 588; *Diehr*, 450 U.S. at 188–89.

87. *See, e.g.*, Prometheus Labs., Inc. v. Mayo Collaborative Servs., No. 04-CV-1200, 2008 U.S. Dist. LEXIS 25062 (S.D. Cal. Mar. 28, 2008) (holding that patentee need not pass the machine-or-transformation test, but instead asked whether the claim "wholly pre-empts" all practical use of the unpatentable subject matter); *cf. In re* Bilski, 545 F.3d 943, 956 (Fed. Cir. 2008) (reaffirming that "the machine-or-transformation test, properly applied, is the governing test for determining patent eligibility of a process under § 101"). On appeal, the Supreme Court then held the machine-or-transformation test was not definitive. *Bilski*, 561 U.S. at 604. However, the Court did not provide a clear alternative approach and thus failed to ease tensions between the *Flook* and *Diehr* frameworks. *Id.*

answer by implementing *Flook*'s inventive concept requirement,[88] while reducing the machine-or-transformation test to an "important and useful," but non-conclusive, factor.[89]

II. BIOTECH METHODS POST-*MAYO*

Mayo and *Alice* offer little practical guidance for applying section 101, which has had substantial impact in the biotechnology industry. Thus, this Note evaluates the biotechnology method patent cases decided by the Federal Circuit post-*Mayo*. While these decisions may appear consistent with Supreme Court policy drivers, they can also be understood as a return to the machine-or-transformation test.

A. *ASSOCIATION FOR MOLECULAR PATHOLOGY V. USPTO*

Association for Molecular Pathology dealt with several Myriad Genetics patents relating to breast and ovarian cancer genes.[90] The Supreme Court later granted certiorari for the composition claims, but left the Federal Circuit's finding of patent eligibility for Myriad's method of screening potential cancer therapeutics.[91] The method comprised of (1) growing a "transformed host cell" with an altered BRCA1 gene, (2) in the presence or absence of a therapeutic, and (3) comparing growth rates of different host cells.[92]

The Federal Circuit distinguished the case from *Mayo* by focusing on the "'transformed' host cell."[93] "Transformed" here refers to cells with an increased growth rate that divide indefinitely,[94] not "transformed" as a term of art in the machine-or-transformation test. Though cell transformation can occur spontaneously, the court emphasized that these transformed host cells

88. Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2355 (2014); Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1294 (2012).

89. *Mayo*, 132 S. Ct. at 1296 (citing *Bilski*, 561 U.S. at 603).

90. Ass'n for Molecular Pathology v. USPTO, 689 F.3d 1303 (Fed. Cir. 2012).

91. Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 133 S. Ct. 2107, 2116–19 (2013) (holding that claims over naturally occurring genes are invalid, but claims over man-made complimentary DNA (cDNA) are valid); *Ass'n for Molecular Pathology*, 689 F.3d at 1336–37.

92. *Ass'n for Molecular Pathology*, 689 F.3d at 1336.

93. *Id.*

94. *Selecting the Appropriate Cell Line*, THERMO FISHER SCI., https://www.thermofisher.com/us/en/home/references/gibco-cell-culture-basics/cell-lines.html (last visited Nov. 11, 2017) [https://perma.cc/2RKP-8YZA]; *What Is Cell Culture*, THERMO FISHER SCI., https://www.thermofisher.com/us/en/home/references/gibco-cell-culture-basics/introduction-to-cell-culture.html (last visited Nov. 11, 2017) [https://perma.cc/5UT2-MC4G].

were a product of man, not nature.[95] Invoking the language of the machine-or-transformation test, the court held that "performing operations, even known types of steps, on, or to create, novel, *i.e.*, transformed[96] subject matter is the stuff of which most process or method invention consists."[97] Thus, the court found that when a composition of matter, such as the "transformed host cell," is patent eligible, "applying various known types of procedures to it is not merely applying conventional steps to a law of nature," because the underlying man-made subject matter makes the claim patent eligible.[98]

The Federal Circuit emphasized that the claim was also narrow, since it was "tied to specific host cells *transformed* with specific genes and grown in the presence or absence of a specific type of therapeutic."[99] Therefore, the claimed method would not preempt similar work with all cells or therapeutics, or other methods of determining a drug's therapeutic effect.[100] Arguably, the method also had low potential to generate dependent technologies because the end goal of using transformed host cells to test cancer therapeutics would likely be limited to similar applications in cancer drug development.

B. *PERKINELMER V. INTEMA*

In *PerkinElmer*, the Federal Circuit held that a method for estimating risk of fetal Down's syndrome was not patent eligible.[101] The claimed method comprised (1) measuring an unidentified screening marker in the first trimester of pregnancy, (2) measuring an unidentified screening marker in the second trimester, (3) comparing both to statistics for the same markers in unaffected and Down's syndrome pregnancies, and (4) combining the markers into a single Down's syndrome risk calculation.[102]

In step one of the *Mayo*/*Alice* test, the Federal Circuit found that Intema's claims recited a law of nature—"an eternal truth that exists in

95. *Ass'n for Molecular Pathology*, 689 F.3d at 1335 ("The parties agree that the transformed cells arose from human effort; *i.e.*, they are not natural products.").

96. Here, the Court used "transformed" as a term of art referring to the machine-or-transformation test, which happens to be fulfilled by the "transformed host cell," as defined in the biotechnology industry.

97. *Ass'n for Molecular Pathology*, 689 F.3d at 1336.

98. *Id.*

99. *Id.* at 1336–37. However, by specific type of therapeutic, the court is referring to any "compound suspected of being a cancer therapeutic," which is still quite broad. *Id.* at 1310.

100. *See id.* at 1336–37.

101. PerkinElmer, Inc. v. Intema Ltd., 496 F. App'x 65, 71 (Fed. Cir. 2012).

102. *Id.* at 66–68.

principle apart from any human action"—via the relationship between screening marker levels and the risk of fetal Down's syndrome.[103] In step two, the court found additional steps of "measuring" marker levels and "determining" risk insufficient to make the claim patent eligible.[104] The court noted that the steps were "specified at a high level of generality," suggesting that it rejected the claims in part because they were fairly broad.[105] The court emphasized that the "measuring" step was not limited to a specific method, but merely told the user to apply "whatever known method they wish[ed]," and likewise, the "determining" step used "unspecified and unclaimed statistical calculation."[106] However, similar to the claims in *Association for Molecular Pathology*, Intema's claims also likely had low potential to generate dependent technologies.[107] The court characterized the end goal of Intema's method as "non-invasive screening to determine the risk that a fetus has Down's syndrome," used to inform a doctor when to proceed with invasive diagnostic testing.[108] The claim was thus unlikely to apply to many dependent technologies as it was only useful in the narrow field of fetal Down's syndrome diagnostics. [109]

After applying the *Mayo/Alice* test, the Federal Circuit bolstered its analysis with the machine-or-transformation test.[110] Intema purported transformations through "assaying a sample" and "measuring" an ultrasound scan.[111] The court held that "assaying," a broad industry term for "testing," was insufficient transformation because it could be done without inducing change in the sample.[112] "Measuring" likewise failed the test because transforming ultrasound data to Down's syndrome risk data merely converted one type of data to another, creating no "tangible output."[113] The court further distinguished the case from *Association for Molecular Pathology* because Intema's claim did not have a patent-eligible

103. *Id.* at 70–71 (quoting Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1297 (2012)) (internal quotation marks omitted).
104. *Id.* at 71.
105. *See id.* at 72.
106. *Id.* at 71.
107. *See* Ass'n for Molecular Pathology v. USPTO, 689 F.3d 1303, 1335–37 (Fed. Cir. 2012); *PerkinElmer*, 496 F. App'x at 66.
108. *PerkinElmer,* 496 F. App'x at 66.
109. *See id.*
110. *Id.* at 72–73.
111. *Id.*
112. *Id.*
113. *Id.*

composition of matter equivalent to Myriad's "transformed host cell."[114] Having already found the claim unpatentable under *Alice*, the court's superfluous application of the machine-or-transformation test reflects its strong reliance on the test as, at minimum, an "important and useful clue" to subject matter eligibility.[115]

C. *ARIOSA DIAGNOSTICS V. SEQUENOM*

In *Ariosa*, the Federal Circuit held that a method of detecting fetal DNA in maternal blood was patent ineligible.[116] The existence of such DNA, dubbed cell-free fetal DNA ("cffDNA"), was previously unknown and opened the door to safer, inexpensive methods of prenatal diagnostics.[117] The claimed method comprised (1) amplifying DNA from a maternal blood sample, and (2) detecting the presence of cffDNA. [118]

In step one, the court found the claims "directed to matter that is naturally occurring."[119] The court reasoned that because cffDNA is a natural phenomenon, and the cffDNA was not altered by the detection process, the "method therefore beg[an] and end[ed] with a natural phenomenon."[120] The court then found in step two that the preparation and amplification of DNA from blood samples, done through standard lab techniques, were "well-understood, routine, conventional activities" insufficient to make the claim patent eligible.[121]

Though the court did not explicitly address breadth, the claim was clearly very broad. Sequenom claimed general steps of amplifying and detecting DNA, only limited by application to cffDNA.[122] As compared to a single gene or class of genes, which make up a fraction of the genome, Sequenom's claim extended over an entire genome.[123] Further, as the court highlighted, the discovery of cffDNA "reflect[ed] a significant human

114. *PerkinElmer,* 496 F. App'x at 72–73 (citing Ass'n for Molecular Pathology v. USPTO, 689 F.3d 1303, 1336–37 (Fed. Cir. 2012)).

115. *See* Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1296 (2012) (citing Bilski v. Kappos, 561 U.S. 593, 603 (2010)).

116. Ariosa Diagnostics, Inc. v. Sequenom, Inc., 788 F.3d 1371 (Fed. Cir. 2015), *cert. denied*, 136 S. Ct. 2511 (2016).

117. *Id.* at 1373.

118. *Id.* at 1373–74.

119. *Id.* at 1376.

120. *Id.*

121. *Id.* at 1377–78 (noting that the patent specification itself refers to the methods for preparing and amplifying as "standard").

122. *See id.* at 1373–74.

123. *See id.*

contribution . . . that revolutionized prenatal care."[124] Thus, the method's end goal of detecting and accessing cffDNA likely had high potential to generate dependent technologies.

D. *RAPID LITIGATION V. CELLZDIRECT*

CellzDirect is one of two Federal Circuit opinions post-*Mayo* in which the court found a biotech method claim to be patent eligible.[125] The claims in *CellzDirect* covered a method for producing hepatocytes (liver cells) capable of surviving multiple freeze-thaw cycles, comprising (1) thawing frozen hepatocytes and separating the viable and nonviable cells, (2) recovering the viable cells, and (3) refreezing the viable cells, which will remain viable after re-thawing.[126]

In an unprecedented move for biotech method claims, the court held that the claims were not "directed to" a patent-ineligible concept under *Mayo/Alice* step one, rendering step two unnecessary.[127] The court reasoned that instead of being directed to the ability of hepatocytes to survive multiple freeze-thaw cycles—a patent-ineligible law of nature—the claims were directed to "a new and useful laboratory technique for preserving hepatocytes."[128] The court focused on the claims' physical product of twice-frozen hepatocytes, or the "*tangible* and useful result," which made the method "precisely the type of claim that is eligible for patenting."[129] Applying the same language quoted in *Gottschalk*, and previously used to hold a claim eligible under the machine-or-transformation test, the court emphasized that the method at issue achieved a "new and useful end."[130] The court further analogized the claims to "thousands of others that recite processes to achieve a desired outcome," such as producing a new compound, treating cancer with chemotherapy, and treating headaches with aspirin.[131] All of the listed examples would pass the machine-or-

124. *Id.* at 1379–80.

125. Rapid Litig. Mgmt. v. CellzDirect, Inc., 827 F.3d 1042, 1043 (Fed. Cir. 2016). It was also the first life sciences case to be decided following the Supreme Court's denial of certiorari for *Ariosa*. *See Ariosa Diagnostics*, 788 F.3d 1371.

126. *CellzDirect*, 827 F.3d at 1046.

127. *Id.* at 1048.

128. *Id.*

129. *Id.* at 1048–50 (highlighting with emphasis that "the claims recite a *method of producing* a desired preparation of multi-cryopreserved hepatocytes") (citing Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2354 (2014)).

130. *Id.* at 1048; *see also* Gottschalk v. Benson, 409 U.S. 63, 69–70 (1972) (discussing Expanded Metal Co. v. Bradford, 214 U.S. 366, 385–86 (1909) (holding a method for expanding metal patent eligible because it generated a "new and useful result")).

131. *CellzDirect,* 827 F.3d at 1048–49.

transformation test.[132] In contrast, the court characterized prior claims that failed step one as "amount[ing] to nothing more than observing or identifying the ineligible concept itself."[133]

While passing step one should end the inquiry, the court went on to show that had the claim failed step one it was still patent eligible under step two.[134] The court held that the claims sufficiently "transform[ed] the process into an inventive application of the patent-ineligible concept" because they "applie[d] the discovery that hepatocytes can be twice frozen to achieve a new and useful preservation process."[135] Unfortunately, by justifying step two with the same rationale as used in step one, the court neither clarified step two nor made a meaningful distinction between the steps.[136]

Notably, the Federal Circuit ended its opinion by addressing preemption. The court found that the claims did not "lock up the natural law in its entirety," and in fact, the defendant had already managed to engineer around the patent, indicating that the claims were narrow.[137] However, the court's emphasis on the introduction of a new laboratory technique showed that it did find moderate potential for dependent technologies; the claims' end goal of producing twice-frozen hepatocytes was a "new and useful" result that could potentially be applied to any invention requiring hepatocytes.[138]

III. DISCUSSION

An analysis of post-*Mayo* Federal Circuit cases reveals that while the decisions appear consistent with Supreme Court preemption policy, they also indicate a return to the machine-or-transformation test. If so, the

132. The creation of a new compound clearly passes the machine-or-transformation test as transforming individual elements through chemical binding. The court's explanation that treating cancer with chemotherapy is not directed to the cancer cell's inability to survive chemotherapy also highlights a clear transformation—the change from live cancer cells to dead cancer cells. Likewise, by holding that treating headaches with aspirin is not directed to the human body's natural response to aspirin, the court emphasized the body's transformation from headache to non-headache state.

133. *CellzDirect*, 827 F.3d at 1048 (citing Genetic Techs. Ltd. v. Merial LLC, 818 F.3d 1369, 1373–74 (Fed. Cir. 2016)); Ariosa Diagnostics, Inc. v. Sequenom, Inc., 788 F.3d 1371, 1373–74 (Fed. Cir. 2015); BRCA1- & BRCA2-Based Hereditary Cancer Test Patent Litig. v. Ambry Genetics Corp., 774 F.3d 755, 761–62 (Fed. Cir. 2014)).

134. *Id.* at 1050–51.

135. *Id.*

136. *See id.*

137. *Id.* at 1052.

138. *See id.* at 1048–52.

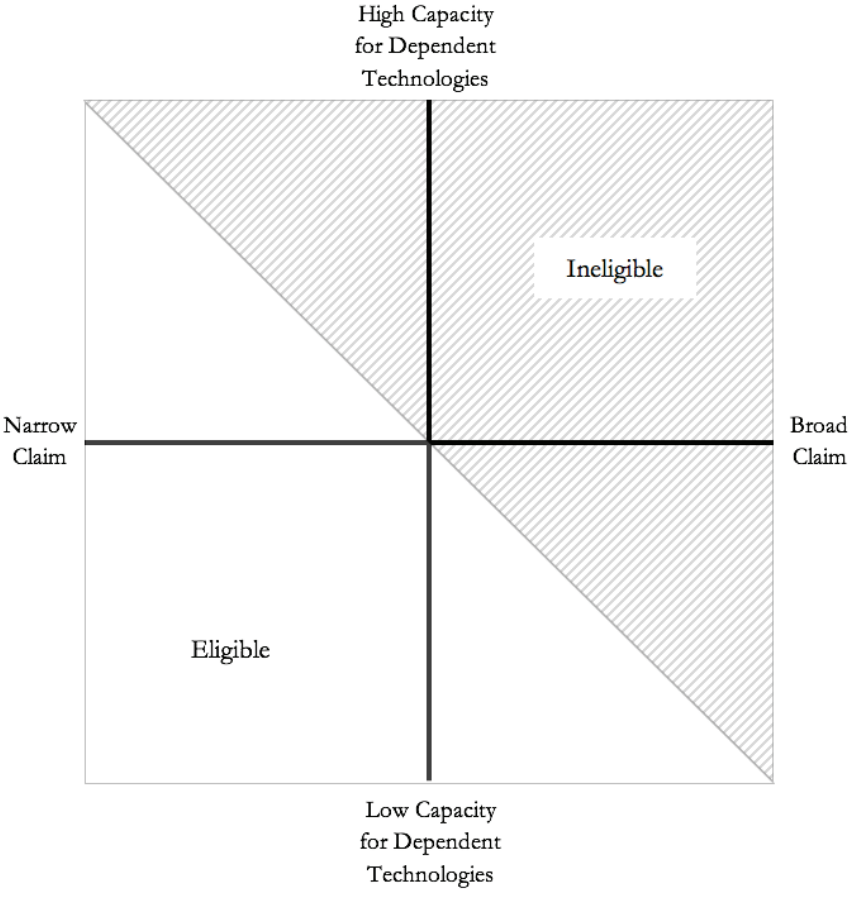
Federal Circuit has rung a death knell for diagnostic method claims, divorced from their actual preemptive effect. Thus, this Note suggests that courts should instead consider preemption directly in their *Mayo/Alice* step two analyses, improving both the test's administrability and consistency with section 101 policy drivers.

A. POST-*MAYO* DECISIONS APPEAR CONSISTENT WITH SUPREME COURT PREEMPTION POLICY

Supreme Court jurisprudence places heavy emphasis on the role of preemption in determining patentable subject matter.[139] As discussed in Part II, preemption policy translates into curbing undue impact on downstream innovation, which may be estimated by weighing a claim's breadth and capacity to generate dependent technologies. Figure 1 provides a visualization of the relationship between those factors and patent eligibility.

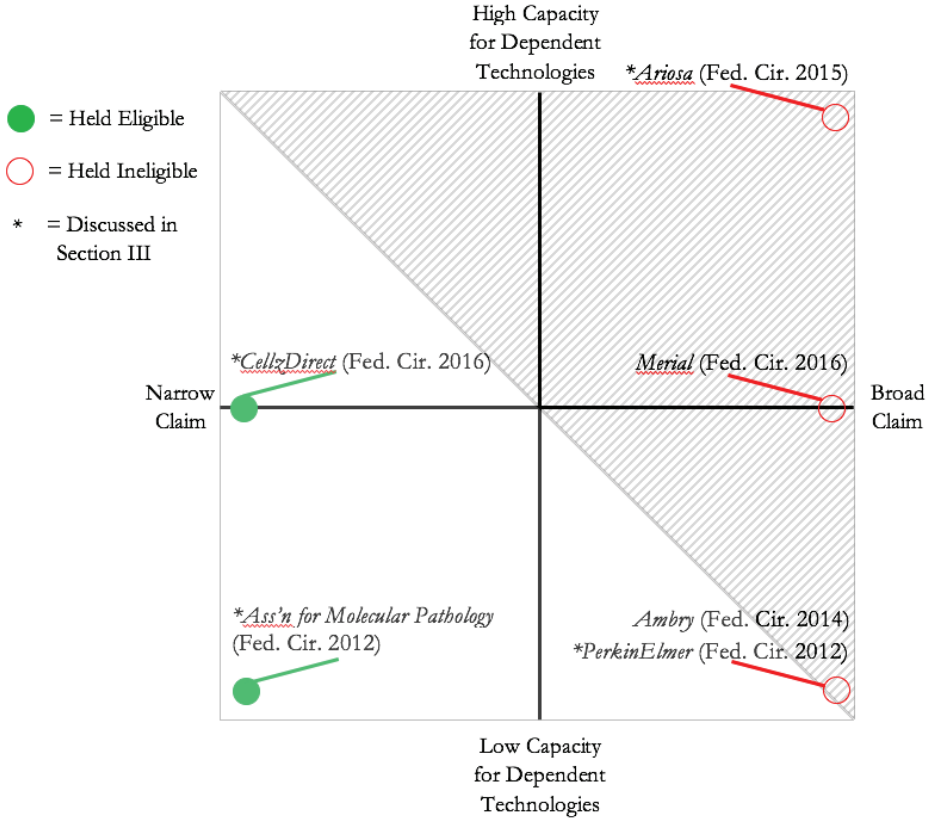
139. Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2354 (2014) ("We have described the concern that drives this exclusionary principle as one of pre-emption.").

Figure 1: Patent eligibility as a function of preemption. Pursuant to Part II, a claim's preemptive effect is broken down into (1) breadth and (2) capacity to generate dependent technologies.



Regarding biotech method claims in particular, Figure 2 reveals that post-*Mayo* Federal Circuit decisions have been roughly in line with Supreme Court preemption policy.

Figure 2: Post-*Mayo* Federal Circuit decisions charted by preemptive effect of the claims at issue. The decisions appear to be consistent with Supreme Court preemption policy as visualized in Figure 1.



1. *Factor 1: Claim Breadth*

The Federal Circuit likely found the claims to be narrow in both *Association for Molecular Pathology* and *CellzDirect* because the methods at issue were tied to limitations so specific that comparable functions could be achieved with noninfringing designs.[140] The court noted that in *Association for Molecular Pathology*, a competitor need only use different host cells, genes, or therapeutics to be noninfringing.[141] Even more

140. *See CellzDirect,* 827 F.3d at 1052; Ass'n for Molecular Pathology v. USPTO, 689 F.3d 1303, 1336–37 (Fed. Cir. 2012).

141. *Ass'n for Molecular* Pathology, 689 F.3d at 1336–37.

persuasive, in *CellzDirect*, the competing party had already engineered around the claims.[142]

In contrast, the court characterized the claims as considerably broader in *Ariosa* and *PerkinElmer*.[143] These claims employed general terms like "measuring" and "determining" that allowed the user to apply "whatever known method they wish[ed]."[144] Thus, the claims left no room for competing methods aimed at similar functionalities; the claims in *Ariosa* and *PerkinElmer* could be understood to cover all processes for detecting cffDNA via maternal blood and determining risk of fetal Down's syndrome via screening markers, respectively.[145]

Some may argue that broad claims are necessary to incentivize innovation through the patent system, as easily designed-around claims provide negligible competitive advantage.[146] That argument goes to the

142. *See CellzDirect,* 827 F.3d at 1052; *Ass'n for Molecular Pathology*, 689 F.3d at 1336–37. Indeed, some have argued that "a better way to grapple with preemption may be to ask whether the claim can be practiced in other ways—or as patent lawyers say, 'invented around.'" Dreyfuss & Evans, *supra* note 24, at 1360–61 (finding claims in Laboratory Corp. of America Holdings v. Metabolite Laboratories, Inc., 548 U.S. 124 (2006) more preemptive than those in Mayo Collaborative Services v. Prometheus Laboratories, Inc., 132 S. Ct. 1289, 1296 (2012) because doctors cannot practice around the claims in *Metabolite*, but "there are arguably other ways to achieve the goals of the patent" in *Mayo*).

143. The same applies to *BRCA1- & BRCA2-Based Hereditary Cancer Test Patent Litigation v. Ambry Genetics Corp.*, 774 F.3d 755, 756 (Fed. Cir. 2014), and *Genetic Technologies Ltd. v. Merial LLC*, 818 F.3d 1369, 1369 (Fed. Cir. 2016), both of which found method claims patent ineligible. *Ambry* dealt with a method for detecting variations of BRCA cancer genes, while *Merial* addressed a method for detecting genetic protein-coding regions via their relationship with noncoding regions. In *Ambry*, the claims broadly described comparing BRCA sequences and determining the existence of alterations, which the court noted was not limited by number of covered comparisons, purpose of the comparison, alteration being detected, or type of cancer associated with. *Ambry*, 774 F.3d at 763–64. Likewise, in *Merial*, the court found the claim at issue "broad in scope" because it "encompass[ed] methods of detecting a coding region allele by amplifying and analyzing any linked non-coding region, which could be found within the same gene as the coding region, within a different gene, or within an intergenic region." *Merial*, 818 F.3d at 1372–73.

144. PerkinElmer, Inc. v. Intema Ltd., 496 F. App'x 65, 70–72 (Fed. Cir. 2012); *see also Merial*, 818 F.3d at 1377 (method comprising general DNA "amplifying" and "detecting" steps); Ariosa Diagnostics, Inc. v. Sequenom, Inc., 788 F.3d 1371, 1373–74 (Fed. Cir. 2015) (same); *Ambry*, 774 F.3d at 763–64 (finding the claim broad because the "comparing" step was "not restricted by the purpose or the alteration being detected," and the additional steps of "hybridizing," "detecting," "amplification," and "sequencing" were merely general descriptions of the steps any scientist would take to compare two genes).

145. *See Ariosa*, 788 F.3d at 1373–74; *PerkinElmer,* 496 F. App'x at 70–72.

146. *See* Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 276–77 (1977) (formulating the "prospect theory" of patent rights, which

heart of the section 101 inquiry—when does the preemptive effect of a claim outweigh its role in promoting development of new inventions?[147] Claim breadth is only one factor of preemption—the next section considers the second factor, capacity to generate dependent technologies.

2. *Factor 2: Capacity to Generate Dependent Technologies*

A claim's capacity to generate dependent technologies relates to the number of inventions in which that claim's end goal can be applied. Thus, the claims in *Association for Molecular Pathology* and *PerkinElmer* likely had low capacity for generating dependent technologies, as they covered methods aimed at very specific end goals.[148] *Association for Molecular Pathology* dealt with a method for cancer drug testing via transformed host cells, which was likely limited to developing similar cancer drug research techniques.[149] Likewise, the claims in *PerkinElmer* aimed to identify the risk of fetal Down's syndrome, which only applied to other inventions in fetal Down's syndrome diagnostics.[150]

In comparison, *CellzDirect* involved a method with greater potential for dependent technologies because it produced an outcome with numerous likely applications; the method for producing more resilient hepatocytes could apply to any invention requiring hepatocytes.[151] Nonetheless, the

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argues that broad patent coverage is economically efficient because, among other benefits, it allows coordination with potential competitors to reduce inefficient duplication of R&D, and provides incentive to maximize the patent's value without fear that fruits of investment will be unpatentable information appropriable by competitors); Yusing Ko, *An Economic Analysis of Biotechnology Patent Protection*, 102 YALE L.J. 777, 791–92 (1992) (describing the "incentive-to-invent" theory for patent scope—"an inventor demands compensation for his investment in research and development . . . [thus] if competition prevents the inventor from recouping his investment, his incentive to invent vanishes . . . [which] may significantly delay socially beneficial inventions, or prevent them entirely").

147. Merges and Nelson were some of the first to address this question in the context of claim scope, concentrating on "how changing patent coverage affects the balance between incentives to the inventor and underuse of the invention due to patent monopolies." Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope,* 90 COLUM. L. REV. 839, 868 (1990).

148. The same reasoning applies to *BRCA1- & BRCA2-Based Hereditary Cancer Test Patent Litigation v. Ambry Genetics Corp.*—while the court worried that the broad claim would "impede a great swath of research relating to BRCA genes," the end-goal of screening for BRCA genes constrains any dependent technologies to the relatively narrow field of BRCA-related diagnostics. 774 F.3d 755, 761–62, 764 (Fed. Cir. 2014).

149. *See* Ass'n for Molecular Pathology v. USPTO, 689 F.3d 1303, 1310 (Fed. Cir. 2012).

150. *See* PerkinElmer, Inc. v. Intema Ltd., 496 F. App'x 65, 66–68 (Fed. Cir. 2012).

151. *See* Rapid Litig. Mgmt. v. CellzDirect, Inc., 827 F.3d 1042, 1046 (Fed. Cir. 2016). *Genetic Technologies Ltd. v. Merial LLC* also falls in the same category because the

potential applications in *CellzDirect* are dwarfed by those derived from the method of detecting cffDNA in *Ariosa*.[152] While prior cases dealt with the potential to locate fractions of genes,[153] which are themselves fractions of the genome, Sequenom's claims extended over the entire fetal genome.[154] Thus, the end goal of detecting cffDNA would likely apply to any invention relating to the broad field of fetal diagnostics.

The chart analysis ultimately suggests that Federal Circuit treatment of biotech method patents might be consistent with Supreme Court policy. The next question is *how* the Federal Circuit has been making these decisions. A close read of the court's post-*Mayo* opinions indicates that while reaching for refinements of the *Mayo/Alice* test, the Federal Circuit has de facto re-adopted the machine-or-transformation test.

B. CONTINUED RELIANCE ON THE MACHINE-OR-TRANSFORMATION TEST

An analysis of the Federal Circuit cases discussed in Part III reveals a clear divide between claims that pass the machine-or-transformation test and are found valid and those that fail and are rejected.

In *Association for Molecular Pathology*, the transformed, man-made nature of the underlying subject matter—a "transformed host cell"—made the claim patent-eligible despite applying conventional growing and comparison steps.[155] The court did not apply a formal two-step test, perhaps because the case was decided so soon after *Mayo*,[156] but it seemed to find the claim eligible under step one by being directed to a "transformed, man-made" product.[157] Consistent with that analysis, the court held that merely appending conventional steps, which would fail step two, was irrelevant when those steps were applied to a patent-eligible composition.[158]

In contrast, *CellzDirect* was decided after the *Mayo/Alice* framework became standard. In both steps, the court found the claims patent-eligible because they applied the discovery that hepatocytes can be twice-frozen to

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method for discovering new protein-coding regions could apply to any technique relying on the location of coding DNA. 818 F.3d 1369, 1372–73 (Fed. Cir. 2016).

152. *See* Ariosa Diagnostics, Inc. v. Sequenom, Inc., 788 F.3d 1371, 1373–74 (Fed. Cir. 2015).

153. *See Merial,* 818 F.3d at 1372.

154. *See Merial*, 818 F.3d at 1372–73; *Ariosa,* 788 F.3d at 1373–74.

155. Ass'n for Molecular Pathology v. USPTO, 689 F.3d 1303, 1336 (Fed. Cir. 2012).

156. *See* Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289 (2012); *Ass'n for Molecular Pathology*, 689 F.3d at 1336–37.

157. *See Ass'n for Molecular Pathology*, 689 F.3d at 1336–37.

158. *Id.* at 1336.

achieve a new and useful preservation process.[159] Because the same language could be applied to any new and useful method, it is unclear whether this reasoning can distinguish *CellzDirect* from patent-ineligible cases.[160] Instead, a closer read of *CellzDirect* indicates that the Federal Circuit looked to the claimed method's production of a physical product, or "transformation" from once-frozen to twice-frozen hepatocytes. In step one, the court emphasized with italics that the claims recite a "*method of producing* a desired preparation of multi-cryopreserved hepatocytes,"[161] further noting that the method had a "*tangible* and useful result."[162] The court also analogized the claims to several patent-eligible examples of "processes to achieve a desired outcome," discussed in Part III, all of which would pass the machine-or-transformation test.[163]

In contrast, the diagnostic method claims that the Federal Circuit rejected gathered information without provoking change. In *PerkinElmer*, the court held that the claims failed the machine-or-transformation test because "assaying" the sample could be performed "without transforming the sample," and "measuring" the ultrasound scan produced no "tangible output."[164] In *Ariosa*, the Federal Circuit struggled to apply the machine-or-transformation test within the *Alice/Mayo* framework. To address step one, the court found that because the method "starts with cffDNA taken from a sample of maternal plasma or serum," and "ends with paternally inherited cffDNA," the claims were directed to cffDNA.[165] Despite the court's language, there is no difference between "cffDNA taken from a sample of maternal plasma or serum," and "paternally inherited cffDNA."[166] Thus, the court held that the claims were "directed to" cffDNA because they started and ended with steps involving cffDNA—*i.e.*, the claims were "directed to" ineligible subject matter because they involved ineligible subject matter.

Such a rule contrasts with the court's later holding in *CellzDirect* where the claimed method was not "directed to" an ineligible concept despite involving the law of nature that some hepatocytes survive multiple freeze-

159. Rapid Litig. Mgmt. v. CellzDirect, Inc., 827 F.3d 1042, 1048, 1050–51 (Fed. Cir. 2016).

160. For example, the ineligible method of detecting cffDNA in *Ariosa* could easily be described as an application of the discovery that cffDNA exists in maternal blood to achieve a new and useful detection process. *See Ariosa*, 788 F.3d at 1373–74.

161. *CellzDirect*, 827 F.3d at 1048.

162. *Id.* at 1050 (emphasis added).

163. *See id.* at 1049; *supra* note 132.

164. PerkinElmer, Inc. v. Intema Ltd., 496 F. App'x 65, 72 (Fed. Cir. 2012) (internal brackets omitted).

165. *Ariosa*, 788 F.3d at 1376.

166. *See id.* at 1373–76.

thaw cycles.[167] However, if the Federal Circuit's rationale in *Ariosa* is viewed in light of the machine-or-transformation test, it becomes clear that the court found the process patent-ineligible because it employed the same cffDNA from start to finish without alteration, meaning the method lacked transformation.[168] But tied to the *Mayo/Alice* framework, the court necessarily muddled its logic in order to find the claim "directed to" an ineligible concept.

C. NO PLACE FOR DIAGNOSTICS

The machine-or-transformation test presents an incomplete picture for patentable subject matter doctrine because it is not designed to consider preemption.[169] Being bound to a particular machine or inducing physical transformation are adequate proxies for a claim's preemptive effect in some industries, but fall short in others such as medical diagnostics.[170] Diagnostic method claims are unlikely to pass the machine-or-transformation test because they aim to identify a condition *as it exists*, without prompting a "transformation."[171] Consistent with the test, the Federal Circuit has only found biotech method claims patentable when they involved a physical change—creating the "transformed host cell" in *Association for Molecular*

167. *See CellzDirect*, 827 F.3d at 1048.

168. *See Ariosa*, 788 F.3d at 1376.

169. Courts have used the machine-or-transformation test to limit patent scope since before it was even formalized in *Gottschalk* and *Diehr*, but the test is an incomplete proxy for excessive preemption as it does not directly consider either factor of impact on downstream innovation. *See* Gottschalk v. Benson, 409 U.S. 63, 73 (1972) (characterizing Corning v. Burden, 56 U.S. 252, 270–71 (1854), as having held a process for tanning, dyeing, etc., not tied to particular machinery, but still patent eligible due to changes in "articles or materials" sufficient to confine the patent monopoly "within rather definite bounds").

170. *See* Anna B. Laakmann, *An Explicit Policy Lever for Patent Scope*, 19 MICH. TELECOMM. & TECH. L. REV. 43, 65–72 (2012) (discussing how the machine-or-transformation test is ill suited for medical methods).

171. *See* Allen K. Yu, *Within Subject Matter Eligibility—A Disease and a Cure*, 84 S. CAL. L. REV. 387, 401 ("The thrust of much diagnostics research lies in looking to nature for better understandings about how different diseases and conditions manifest themselves and then making direct use of that knowledge to better track and diagnose those diseases and conditions, not inventing wholesale processes and products for use with the human body."). *But cf.* Laakmann, *supra* note 170, at 71 (arguing that on the other hand applying the machine-or-transformation test would allow all broad diagnostic claims so long as they are carefully crafted to include transformative steps, which also fails to address policy considerations).

Pathology and the shift from once-frozen to twice-frozen hepatocytes in *CellzDirect*.[172]

As discussed in Section IV.A, Federal Circuit decisions thus far have been consistent with preemption policy. The diagnostic cases—*PerkinElmer* and *Ariosa*—both involved claims so broad that they risked preempting all use of the underlying law of nature.[173] But under the machine-or-transformation test, even less preemptive claims would be ineligible. Thus, if the Federal Circuit continues on its current path, it will likely diverge from Supreme Court policy by creating a per se bar on diagnostic methods, regardless of their preemptive effect.

To illustrate, consider the USPTO's most recent exemplars for life sciences subject matter eligibility that appear consistent with a preemption-based approach.[174] The exemplars laid out several claim variations for a method of diagnosing a hypothetical disease.[175] The broadest claim—comprising obtaining a blood sample from a patient, detecting for the disease marker, and diagnosing the patient—was found patent ineligible.[176] However, the USPTO advised that the same claim would be eligible if limited by an unconventional reagent for detecting the disease marker.[177] Comparing the two claim variations, both seem to have low capacity to generate dependent technologies. Analogous to the claims in *PerkinElmer* and *Ambry*, the end goal is specific to diagnosing a particular disease and thus is only applicable to that narrow field of inventions.[178] However, the first claim is also broad enough that it likely preempts all use of the natural law relating the disease and disease marker.[179] In contrast, because the second claim is limited by use of a particular technique, namely an unconventional reagent[180] to detect the disease marker, it is unlikely to be

172. *See* Ass'n for Molecular Pathology v. USPTO, 689 F.3d 1303, 1336 (Fed. Cir. 2012); *CellzDirect*, 827 F.3d at 1048.

173. The same applies to *Ambry*, which was also a diagnostic case. BRCA1- & BRCA2-Based Hereditary Cancer Test Patent Litig. v. Ambry Genetics Corp., 774 F.3d 755, 756 (Fed. Cir. 2014); *see also supra* note 143.

174. USPTO, SUBJECT MATTER ELIGIBILITY EXAMPLES: LIFE SCIENCES 9–16 (May 2016), https://www.uspto.gov/sites/default/files/documents/ieg-may-2016-ex.pdf [https://perma.cc/6PXS-7EQW].

175. *Id.* at 11–14.

176. *Id.* at 11–12 (claim 2).

177. *Id.* at 13–14 (claims 3 or 4, using porcine antibodies for detection of human proteins, or using another specific antibody not routinely or conventionally used).

178. *See Ambry*, 774 F.3d at 761–62; PerkinElmer, Inc. v. Intema Ltd., 496 F. App'x 65, 66–68 (Fed. Cir. 2012).

179. *See Ambry*, 774 F.3d at 763–64; *PerkinElmer*, 496 F. App'x at 70–72.

180. An industry term for "a substance used (as in detecting or measuring a component or preparing a product) because of its chemical or biological activity." *Reagent*, MERRIAM-

similarly preemptive.[181] But because both variations are diagnostic methods, meaning neither induce a "transformation," there is no way to differentiate between them under the machine-or-transformation test.[182] As a result, both claims would be patent ineligible despite significant differences in their preemptive effects.

Thus, the machine-or-transformation test is ill-suited for methods of producing information or other nonphysical products.[183] The test applies well to biotechnology dealing with therapeutics, but diagnostic medicine is a newer field that relies on gene sequencing and detection.[184] The rise of diagnostics reflects the development of more efficient DNA sequencing methods, and unlike the concept of treating disease, gene-based diagnostics could not have been anticipated when section 101 was drafted.[185] Thus, diagnostic method claims exemplify the "unexpected" progression of technology, or the very reason why the Supreme Court rejected the machine-or-transformation test as definitive.[186]

WEBSTER, https://www.merriam-webster.com/dictionary/reagent (last visited Nov. 6, 2017) [https://perma.cc/Y9XX-U97H].

181. *See* USPTO, *supra* note 174, at 9, 13–14.

182. While one could argue that being tied to a specific marker is analogous to being tied to a particular "machine," thus satisfying the machine-or-transformation test, courts have traditionally treated machines as purely mechanical, rather than chemical. *See In re* Bilski, 545 F.3d 943, 955 (Fed. Cir. 2008) (describing a claim as not limited to any particular "chemical (or other) transformation" or "tied to any specific machine or apparatus for any of its process steps," implying that chemical interactions are different from use of machines). Thus, a biological marker is unlikely to be characterized as a "machine." Conversely, one could argue that the chemical interaction between the reagent and its target is itself a "transformation" satisfying the test. However, no court has yet taken that approach, perhaps because such a low standard for "transformation" would abrogate the test's utility. *See* Ariosa Diagnostics, Inc. v. Sequenom, Inc., 788 F.3d 1371, 1376 (Fed. Cir. 2015) (finding no transformation in the detection of cffDNA, which requires chemical transformation through the use of polymerase chain reaction to amplify the DNA to detectable levels, concluding that the method "begins and ends" with cffDNA).

183. Bilski v. Kappos, 561 U.S. 593, 605 (2010).

184. Eisenberg discusses the Court's deference to therapeutics over diagnostics. Rebecca S. Eisenberg, *Diagnostics Need Not Apply*, 21 B.U. J. SCI. & TECH. L. 256, 269–70 (2015). She also explains that the Human Genome Project provided a wealth of information, spurring new innovations in diagnostics. *Id.* at 260.

185. *See In re* Bilski, 545 F.3d at 966–76 (Dyk, J., concurring) (voicing dissent that the majority's opinion is not grounded in the statute and providing a historical review of section 101).

186. *See Bilski,* 561 U.S. at 605 ("It is true that patents for inventions that did not satisfy the machine-or-transformation test were rarely granted in earlier eras, especially in the Industrial Age . . . . But times change. Technology and other innovations progress in unexpected ways. For example, it was once forcefully argued that until recent times, 'well-established principles of patent law probably would have prevented the issuance of a valid patent on almost any conceivable computer program.'").

A per se bar on diagnostic method claims is inconsistent with section 101 policy as there is no reason to believe that all diagnostic methods unduly stifle downstream innovation. Furthermore, diagnostics play a key role in the future of "personalized medicine,"[187] which can improve both efficacy and efficiency of treatments by moving away from a "one-size-fits-all" approach.[188] Thus, there is ample reason to promote innovation of new diagnostic techniques. But under current Federal Circuit jurisprudence, motivation to develop diagnostic methods must come from outside the patent system.

Some have argued that diagnostics are less deserving of patent protection because they may be developed as a byproduct of therapeutics and face comparatively minimal FDA regulation.[189] The first argument is weak in light of personalized medicine; the innovation may lie in finding a particular marker to know when to apply an existing therapeutic, rather than finding a particular marker to develop a new therapeutic. The latter argument holds more weight; a significant portion of R&D costs for pharmaceuticals come from FDA-mandated clinical trials.[190] In contrast, the FDA regulates diagnostic tests[191] under the same framework it uses for medical devices, a much lower standard.[192] However, both diagnostic and

187. A field tailoring medical treatment to individual patient needs. *See Paving the Way for Personalized Medicine: FDA's Role in a New Era of Medical Product Development*, U.S. FOOD & DRUG ADMIN. (Oct. 2013), http://www.fda.gov/downloads/ScienceResearch/SpecialTopics/PersonalizedMedicine/UCM372421.pdf [http://perma.cc/34F9-3AFX]; *Personalized Medicine and Companion Diagnostics Go Hand-in-Hand*, U.S. FOOD & DRUG ADMIN. (July 31, 2014), http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm407328.htm [https://perma.cc/W9D6-JHV6].

188. *See FACT SHEET: President Obama's Precision Medicine Initiative*, THE WHITE HOUSE, OFFICE OF THE PRESS SEC'Y (Jan. 30, 2015), http://www.whitehouse.gov/the-press-office/2015/01/30/fact-sheet-president-obama-s-precision-medicine-initiative [http://perma.cc/5HJN-3KMU].

189. Eisenberg, *supra* note 184, at 284–86.

190. PHARMACEUTICAL RES. & MFRS. AM., 2015 PROFILE BIOPHARMACEUTICAL RESEARCH INDUSTRY 26 (Apr. 2015), http://phrma-docs.phrma.org/sites/default/files/pdf/2015_phrma_profile.pdf [https://perma.cc/C2W9-M77Q]. Pharmaceuticals have been the poster child for high-cost, high-risk innovation, requiring valuable exclusive patent rights to balance out the enormous costs of failed ventures and FDA approval. DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 143 (2009).

191. Specifically, in vitro diagnostic tests, called "in vitro diagnostic devices" (IVDs). *Overview of IVD Regulation,* U.S. FOOD & DRUG ADMIN. (Mar. 19, 2015), http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/IVDRegulatoryAssistance/ucm123682.htm [https://perma.cc/5D59-GRRG].

192. *See* Jeffrey Shuren, *Examining the Regulation of Diagnostic Tests and Laboratory Operations*, U.S. FOOD & DRUG ADMIN. (Nov. 17, 2015), http://www.fda.gov/NewsEvents/Testimony/ucm473922.htm [https://perma.cc/PT2B-D7PX]; *What Is the Approval Process for a New Prescription Drug?*, U.S. FOOD & DRUG ADMIN. (last updated

drug development rely on discovering biological relations, which itself carries significant R&D costs.[193] Further, medical devices are still eligible for patent despite their lighter regulation; if all the Patent Act requirements are met, having lower barriers to innovation should not strip a patentee of their rights. Thus, having lower regulatory costs alone does not justify a per se bar on diagnostic method claims.

D. POTENTIAL SOLUTION: DIRECT PREEMPTION ANALYSIS IN THE *MAYO/ALICE* TEST

The *Mayo/Alice* two-step test leaves many questions unanswered, but the Federal Circuit has the opportunity to refine the test for both clarity and better fit with section 101 policy goals. Of the most pressing doctrinal issues, the Federal Circuit may be best-placed to address what is meant by an "inventive concept" in step two. Rather than reviving the machine-or-transformation test, which unjustifiably bars diagnostic methods, the Federal Circuit should overtly analyze claims for their preemptive effect.[194] Specifically, the court can use *Mayo/Alice* step two to consider both a claim's breadth and capacity to generate dependent technologies.

The purpose of the "inventive concept" requirement is to "ensure that the patent in practice amounts to significantly more than a patent upon the

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May 12, 2016), http://www.fda.gov/AboutFDA/Transparency/Basics/ucm194949.htm [https://perma.cc/LB79-B6NE].

193. Dan L. Burk, *Biotechnology and Patent Law: Fitting Innovation to the Procrustean Bed*, 17 RUTGERS COMPUTER & TECH. L.J. 1, 16–17 (1991) ("Biotechnology products are exceptionally expensive to develop. The basic research necessary to isolate, characterize, and express genes of interest has in many instances proved to be more time-consuming than expected. Industrial scale-up for manufacture of biotechnology products has also posed formidable obstacles of bioprocess engineering."); Christopher M. Holman, *The Critical Role of Patents in the Development, Commercialization and Utilization of Innovative Genetic Diagnostic Tests and Personalized Medicine*, 21 B.U. J. SCI. & TECH. L. 297, 301 (2015) ("For the vast majority of human diseases that have a genetic component, the correlation between biomarker and clinically relevant information is much less straightforward, and substantial investment is necessary to support the lengthy and labor-intensive research efforts required to discern and validate the clinical significant of novel biomarkers.").

194. Many scholars have argued for a more policy-focused approach to section 101. *See, e.g.*, Laakmann, *supra* note 170 (arguing for use of patentable subject matter as an explicit policy lever for calibrating patent scope); Amy L. Landers, *Patentable Subject Matter as a Policy Driver*, 53 HOUS. L. REV. 505, 505 (2015) (proposing section 101 be used to address four policy goals: fostering scientific creativity, encouraging creation of infrastructure, balancing patent rights with free competition, and social needs); Lemley et al., *supra* note 7, at 1339–41 (encouraging direct analysis of claim scope as a means of addressing the invention's "real-world contribution" based on five policy based factors: potential to generate many kinds of new inventions, nature of the industry, nature of technological field, patentee disclosure, patentee contribution relative to prior art).

ineligible concept itself."[195] Despite this misleading use of "inventive," the Supreme Court has explicitly held that novelty is irrelevant to a section 101 analysis.[196] Thus, the question under step two is not whether the claim is novel, but rather whether it is "significantly more" than a claim on an ineligible concept itself. The trouble comes in applying this standard because the Court has not provided much guidance on how to determine whether a claim is on an ineligible concept. This Note suggests that a more structured approach can be developed by considering the driving purpose of section 101 as protecting against unduly preemptive patents.

The bar on laws of nature and the like can be understood as establishing a line across which claims are per se overly preemptive.[197] The Court justified this bright line rule as a "somewhat more easily administered proxy for the underlying 'building block' concern"—*i.e.*, undue preemption understood as excessive impact on downstream innovation—as the judiciary is not well suited for distinguishing between different laws of nature.[198] Thus, a claim that fails to be "significantly more than a patent upon the ineligible concept itself" would be per se overly preemptive.[199] Consistent with the Court's preemption-based policy,[200] this characterization reflects a direct relationship between a claim's preemptive effect and whether it is patent ineligible. In other words, the more preemptive a claim, the greater the chance it is overly preemptive, and the greater the chance it fails to amount to "significantly more than a patent upon the ineligible concept itself."[201]

Per Part II, a claim's preemptive effect can then be understood as determined by two factors: (1) breadth, and (2) capacity to generate dependent technologies, where breadth reflects a claim's limitations such as application of specific materials, and capacity to generate dependent technologies considers potential uses for a claim's end goal. While a preemption-based approach still requires substantial analysis from the court, these factors act as sign posts along the spectrum of eligibility, ranging from merely a patent on the ineligible concept itself to a patent on

195. *See* Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2355 (2014) (internal brackets omitted); Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1294 (2012).

196. Diamond v. Diehr, 450 U.S. 175, 188–89 (1981).

197. *See Mayo*, 132 S. Ct. at 1303.

198. *See id*.

199. *See id*. at 1294, 1303.

200. *See Alice*, 134 S. Ct. at 2354 ("We have described the concern that drives this [subject matter eligibility] exclusionary principle as one of pre-emption.").

201. *See id.* at 2355 (internal brackets omitted).

"significantly more." As such, this approach improves upon the existing framework, which provides no guidance for distinguishing between claims within *Mayo/Alice* step two.

For example, consider the USPTO exemplar discussed in Section IV.C, which claimed a method of diagnosing a hypothetical disease relying on the natural relationship between the disease and its biological marker.[202] The patent-ineligible claim variation was broad because it comprised "obtaining," "detecting," and "diagnosing" steps only limited to use with the disease and its marker, or "conventional steps, specified at a high level of generality."[203] The patent-eligible claim variation was narrower because the "detecting" step required a specific detection technique via use of an unconventional reagent.[204] It is important that the reagent is unconventional not because that makes it novel and thus "inventive," but because the addition of a conventional reagent fails to narrow the claim.[205] The general procedure of most diagnostics is highly standardized.[206] Thus, while a claim may seem limited to specific techniques and materials, a claim only limited by conventional elements effectively preempts all use of the natural law, as a practitioner is unlikely to have options beyond those conventional approaches.

Now imagine, instead of requiring use of a single unconventional reagent, a claim was limited by a class of reagents. What about a claim limited to several classes of reagents? What if a claim covered almost all possible reagents? Where that line should be drawn is not an easy question to answer, but it may roughly depend on the claim's capacity to generate dependent technologies. For the USPTO exemplar, which was determined to have low capacity for dependent technologies in Section IV.C, it is arguable that a claim may be quite broad and still patent eligible. However,

202. USPTO, *supra* note 174.

203. *Alice*, 134 S. Ct. at 2350; USPTO, *supra* note 174, at 11–12 (claim 2).

204. USPTO, *supra* note 174, at 13–14 (claim 3 or 4).

205. *See* Eric J. Rogers, *Patenting Medical Diagnostic Methods: The MorT Strikes Back*, 17 J. TECH. L. & POL'Y 111, 169–70 (2012) (arguing that in a diagnostic method exemplar comprising steps of (1) collecting body tissue from subject, (2) processing and analyzing tissue to quantitate factor X, and (3) making diagnosis of disease Y based on X, steps (1) and (2) should be excluded because they are "requisite steps" to apply the underlying law of nature).

206. *See, e.g.*, Eisenberg, *supra* note 184, at 260 ("Diagnostic tests typically involve measuring one or more variables in a patient (e.g., body temperature, white blood cell count)," done via well-established standard techniques.); *Types of Blood Tests*, NAT'L HEART, LUNG, & BLOOD INST. (Jan. 6, 2012), https://www.nhlbi.nih.gov/health/health-topics/topics/bdt/types [https://perma.cc/N5VZ-SL7U] (examples of common blood tests, often done as part of "routine checkup").

consider a different scenario, in which the claims cover a method for diagnosing a broad class of diseases, rather than a single disease, relying on a previously unknown relationship to a biological marker. Such a claim would have applications in significantly more dependent technologies as the end goal of diagnosis extends over a much broader range of diseases. Thus, weighing both breadth and capacity to generate dependent technologies in determining the claim's overall preemptive effect, a patent-eligible claim here should be narrower than in the previous hypothetical.

Since the Supreme Court denied certiorari to *Ariosa*, the Federal Circuit has been in a unique position to shape patentable subject matter doctrine.[207] By encouraging analysis, via *Mayo/Alice* step two, of claim breadth and capacity to generate dependent technologies, the court can improve both the test's administrability and consistency with section 101 preemption policy. Further, by moving away from the machine-or-transformation test, the court would encourage innovations in personal medicine by maintaining patent incentives for diagnostic methods.

IV. CONCLUSION

The Supreme Court has identified preemption, specifically as it relates to downstream innovation, as the primary policy driver for patentable subject matter doctrine. To date208, Federal Circuit treatment of biotech method claims has been consistent with Supreme Court policy. However, the court's continued reliance on the machine-or-transformation test raises questions of future policy misalignment. Because the machine-or-transformation test does not directly consider preemption, it creates a per se bar on diagnostic methods. Thus, the Federal Circuit threatens to eliminate patent incentives for valuable innovations in personal medicine, without appropriate policy justifications. Instead, the Federal Circuit should seize this opportunity to provide much-needed clarification of the *Mayo/Alice* test. Working with *Mayo/Alice* step two, the court should consider claim breadth and capacity to generate downstream technologies as a measure of whether "the patent in practice amounts to significantly more than a patent upon the ineligible concept itself." Such an approach would not only help lower courts to apply the *Mayo/Alice* test but also better promote the purposes of patentable subject matter doctrine.

207. Ariosa Diagnostics, Inc. v. Sequenom, Inc., 136 S. Ct. 2511 (2016) (denying certiorari); Rantanen, *supra* note 13.

208. As of early 2017.