

# NOTES

## *ILLUMINA, INC. V. ARIOSIA DIAGNOSTICS, INC.:* A MISGUIDED REDEFINING OF PATENTABLE SUBJECT MATTER UNDER THE *MAYO/ALICE* TEST\*

### I. INTRODUCTION

The issue of patentable subject matter has made a dramatic resurgence in patent litigation within the past decade.<sup>1</sup> The analysis of whether certain subject matter is patent eligible is governed by 35 U.S.C. § 101.<sup>2</sup> Section 101 carries with it the judicial constructions of patent eligibility that had evolved over the course of 160 years prior to the statute's enactment.<sup>3</sup> In developing their jurisprudence, courts were consistent in holding that laws of nature, physical phenomena, and abstract ideas constituted patent ineligible subject matter.<sup>4</sup> Inventor Albert Einstein could never successfully patent his famed equation  $E=mc^2$ , nor could Newton claim gravity.<sup>5</sup> The reason is simple: such discoveries are facets of nature belonging to the whole of society, not to any one individual.<sup>6</sup>

Throughout most of patent law's history, the validity of patents that involved ineligible subject matter was evaluated on a case-by-case basis with no explicit test or guidance from the Supreme Court of the United States. Much of the analysis involved an unguided determination of whether an invention's basis was an ineligible discovery, or whether the invention focused (more permissibly) on an application of that discovery.<sup>7</sup>

As patents became more intertwined with biological and technological advances, courts increasingly struggled to agree on a reliable framework to evaluate eligibility

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1. See Mark A. Lemley, Michael Risch, Ted Sichelman & R. Polk Wagner, *Life After Bilski*, 63 STAN. L. REV. 1315, 1318 (2011).

2. 35 U.S.C. § 101 (2018).

3. See *Bilski v. Kappos*, 561 U.S. 593, 636 (2010) (Stevens, J., concurring).

4. See *id.* at 601 (Kennedy, J., majority opinion).

5. *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980).

6. *Id.*

7. See, e.g., *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 130 (1948) (noting the inventive concept behind the patent was a law of nature, and that the only way an eligible patent could be derived from that law of nature was through a patented application of the natural phenomenon).

under § 101.<sup>8</sup> The Supreme Court recognized the need for clarity in the judicial assessment of patents involving ineligible subject matter. Between its two decisions in *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*<sup>9</sup> and *Alice Corp. v. CLS Bank International*,<sup>10</sup> the Supreme Court created a two-step test for courts to use in resolving § 101 disputes: (1) are the claims of the relevant patent directed towards an ineligible concept,<sup>11</sup> and, if answered affirmatively, (2) do the claims include an inventive concept aside from the ineligible discovery that amounts to significantly more than a claim of the ineligible concept itself?<sup>12</sup> This analysis has become known as the *Mayo/Alice* test.<sup>13</sup>

Lower courts immediately began to incorporate the newly articulated *Mayo/Alice* framework into their § 101 analyses of patentability. Patents involving laws of nature that used standard techniques in standard ways regularly failed step two of the *Mayo/Alice* framework and were thus invalid.<sup>14</sup> In 2020, the United States Court of Appeals for the Federal Circuit released a modified opinion in *Illumina, Inc. v. Ariosa Diagnostics, Inc.* concerning § 101 patentability.<sup>15</sup> The *Illumina* patents claim a method of separating different types of deoxyribonucleic acid (DNA) based on their difference in size using standard laboratory techniques.<sup>16</sup> The process—which stemmed from the discovery that DNA types vary in size—can be leveraged to diagnostically screen an unborn child’s risk of certain chromosomal problems, such as Down syndrome.<sup>17</sup>

A Federal Circuit panel held that the patents did not involve an underlying law of nature; instead, they involved a “method of preparation.”<sup>18</sup> As a result of that characterization, the court found that the patent was not directed towards patent ineligible subject matter under step one of the *Mayo/Alice* test, and thus claimed patent eligible subject matter under § 101.<sup>19</sup>

This Note argues that the Federal Circuit in *Illumina* improperly applied the *Mayo/Alice* test to the patents at issue. If properly applied, the court would have found the patents are directed towards patent ineligible subject matter under step one of the

8. See *Bilski*, 561 U.S. at 604 (stating that the Federal Circuit’s creation of a “machine-or-transformation test” for patent eligibility is improper and shall not be the sole test in determining whether an invention is a permissible process or application of an ineligible concept).

9. 566 U.S. 66 (2012).

10. 573 U.S. 208 (2014).

11. See *Alice*, 573 U.S. at 217–18.

12. *Id.*

13. See, e.g., *Athena Diagnostics, Inc. v. Mayo Collaborative Servs., LLC*, 915 F.3d 743, 753 (Fed. Cir. 2019) (“As we conclude that claims 7–9 are directed to a natural law, we turn to the second step of the *Mayo/Alice* test.”), *cert. denied*, 140 S. Ct. 855 (2020).

14. See, e.g., *Genetic Techs. Ltd. v. Merial L.L.C.*, 818 F.3d 1369, 1377 (Fed. Cir. 2016).

15. 967 F.3d 1319 (Fed. Cir. 2020), *cert. dismissed*, 141 S. Ct. 2171 (2021).

16. *Illumina*, 967 F.3d at 1322.

17. *Prenatal Cell-Free DNA Screening*, MAYO CLINIC, <http://www.mayoclinic.org/tests-procedures/noninvasive-prenatal-testing/about/pac-20384574#:~:text=During%20prenatal%20cell%2Dfree%20DNA,provide%20information%20about%20fetal%20sex> [http://perma.cc/6TF5-VP86] (last visited Feb. 1, 2022).

18. *Illumina*, 967 F.3d at 1325.

19. *Id.* at 1329. Because it determined the patents were not directed towards patent ineligible subject matter, the court did not evaluate the patents under step two of the *Mayo/Alice* test. *Id.*

*Mayo/Alice* test,<sup>20</sup> and their use of standard techniques fails to establish an inventive concept under step two.<sup>21</sup> *Illumina*'s decision has the potential to significantly shift the state of § 101 patentability. Successful patenting of subject matter involving laws of nature will no longer depend on the presence of a separate inventive concept but instead on the ability of competent draftsmen to characterize claims as “methods of preparation.”<sup>22</sup> The effect of *Illumina*'s decision will be an increased number of patents that ostensibly claim natural laws themselves, particularly in areas of study that involve advancements in human biology.

Section II of this Note lays out the facts and procedural history leading up to the *Illumina* decision. Section III walks through the evolution of § 101 case law, including the doctrine's constitutional and statutory roots,<sup>23</sup> the state of the case law before the *Mayo/Alice* framework,<sup>24</sup> the establishment of the *Mayo/Alice* framework,<sup>25</sup> and the most recent case law post-*Mayo/Alice*.<sup>26</sup> Section IV discusses the reasoning of the Federal Circuit's majority and dissenting opinions in *Illumina*. This Note's argument—that the *Illumina* court improperly applied the *Mayo/Alice* test and should have found the relevant patents invalid—is set forth in Section V. Section V also discusses the ramifications of the court's error, and how the *Illumina* opinion will impact the state of patent litigation.

## II. FACTS & PROCEDURAL HISTORY

In 1996, Doctors Dennis Lo and James Wainscoat discovered cell-free fetal DNA (cffDNA)<sup>27</sup> in maternal plasma and serum—a biological material that was routinely discarded by researchers in similar fields of study.<sup>28</sup> In 2001, Doctors Lo and Wainscoat obtained U.S. Patent No. 6,258,540 (“the '540 Patent”), which claimed a method for detecting paternally inherited cffDNA in a pregnant woman's plasma and serum.<sup>29</sup> The '540 Patent was subsequently invalidated by the Federal Circuit under 35 U.S.C. § 101 because it impermissibly sought to claim a natural phenomenon.<sup>30</sup>

In the years following the '540 Patent, researchers continued to explore the beneficial uses of cffDNA.<sup>31</sup> For example, if cffDNA could be properly extracted, the DNA could be diagnostically screened to assess an unborn child's risk of carrying certain

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20. See *infra* Part V.A.

21. See *infra* Part V.B.

22. See *infra* Part V.C.

23. See *infra* Part III.A.

24. See *infra* Part III.B.

25. See *infra* Part III.C.

26. See *infra* Part III.D.

27. “Cell-free fetal DNA (cffDNA) is extracellular DNA of fetal origin that is found in the maternal circulation in a fraction ranging between 3.4% and 6.2% of total cell-free DNA that increases with gestation.” Jason Phung, Jonathan Paul & Roger Smith, *Maintenance of Pregnancy and Parturition*, in *MATERNAL-FETAL AND NEONATAL ENDOCRINOLOGY: PHYSIOLOGY, PATHOPHYSIOLOGY, AND CLINICAL MANAGEMENT* 169, 180 (Christopher S. Kovacs & Cheri L. Deal eds., 2019).

28. *Illumina, Inc. v. Ariosa Diagnostics, Inc.*, 967 F.3d 1319, 1321 (Fed. Cir. 2020), *cert. dismissed*, 141 S. Ct. 2171 (2021).

29. *Id.*

30. *Id.* at 1321–22.

31. See *id.* at 1322.

chromosomal problems, such as Down syndrome.<sup>32</sup> In the midst of this research, a problem persisted:

[T]he major proportion (generally >90%) of the extracellular DNA in the maternal circulation is derived from the mother. This vast bulk of maternal circulatory extracellular DNA renders it difficult, if not impossible, to determine fetal genetic alternations [sic] . . . from the small amount of circulatory extracellular fetal DNA.<sup>33</sup>

In 2017, Illumina, Inc. (“Illumina”) and Sequenom, Inc. (“Sequenom”) obtained U.S. Patent No. 9,580,751 (“the ’751 Patent”) and U.S. Patent No. 9,738,931 (“the ’931 Patent”) (together, “the ’751 and ’931 Patents”).<sup>34</sup> The ’751 and ’931 Patents sought to improve upon the invalidated ’540 Patent and solve the aforementioned problem.<sup>35</sup> The patents incorporated the discovery that cell-free fetal DNA fragments were of sizes smaller than 500 base pairs.<sup>36</sup> This facet of nature differentiated the cell-free fetal DNA fragments from its surrounding maternal genetic material.<sup>37</sup> Based on this discovery, the patents claimed a method of separating the two types of DNA<sup>38</sup> by size.<sup>39</sup> Put differently, Illumina and Sequenom’s new patents ostensibly provided them the exclusive right to separate cell-free fetal DNA, a prerequisite in the screening of an expected child’s risk of certain chromosomal issues.<sup>40</sup>

Illumina and Sequenom sued Ariosa Diagnostics, Inc., Roche Sequencing Solutions, Inc., and Roche Molecular Systems, Inc. (together, “the defendants”), alleging infringement of the ’751 and ’931 Patents.<sup>41</sup> Before the United States District Court for the Northern District of California, the defendants moved for summary judgment, asserting that the claims at issue were invalid under 35 U.S.C. § 101.<sup>42</sup> Specifically, the alleged infringers argued the patents impermissibly claimed an ineligible natural phenomenon.<sup>43</sup> The district court ruled that the relevant claims of the ’751 and ’931 Patents were invalid because they were directed towards laws of nature while adding no new inventive concept.<sup>44</sup>

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32. See MAYO CLINIC, *supra* note 17.

33. U.S. Patent No. 9,580,751 col. 1 ll. 42–50 (issued Feb. 28, 2017).

34. *Id.*; U.S. Patent No. 9,738,931 (issued Aug. 22, 2017).

35. *Illumina*, 967 F.3d at 1322.

36. ’751 Patent col. 2 ll. 1–6. A base pair is the fundamental unit used to count the amount or length of DNA. See *Base Pair*, NAT’L HUM. GENOME RSCH. INST., <http://www.genome.gov/genetics-glossary/Base-Pair> [<http://perma.cc/9NCA-DJMJ>] (last visited Feb. 1, 2022).

37. See ’751 Patent col. 1 ll. 54–61.

38. The two types of DNA separated are cell-free fetal DNA and maternally derived sequences of DNA. See *id.*

39. *Illumina*, 967 F.3d at 1322.

40. See MAYO CLINIC, *supra* note 17. Although there are multiple players in the noninvasive prenatal genetic testing arena, Illumina and Sequenom remain the most prominent companies globally to offer this type of service. See Naomi Hawkins, Dianne Nicol, Subhashini Chandrasekharan & Robert Cook-Deegan, *The Continuing Saga of Patents and Non-Invasive Prenatal Testing*, 39 PRENATAL DIAGNOSIS 441, 442 (2019).

41. *Illumina*, 967 F.3d at 1323–24.

42. *Id.* at 1324.

43. *Id.* at 1321.

44. *Id.*

ILLUMINA and Sequenom appealed the Northern District of California’s decision to the Federal Circuit.<sup>45</sup> The Federal Circuit issued an opinion on March 17, 2020, reversing the district court’s ruling.<sup>46</sup> After the alleged infringers filed a petition for rehearing en banc, the court reissued a modified opinion on August 3, 2020, denying the petition for rehearing en banc and maintaining its reversal of the lower court’s ruling.<sup>47</sup>

### III. PRIOR LAW

This Section covers the case law undergirding § 101 subject matter eligibility. Part III.A briefly discusses the constitutional and statutory roots of § 101 validity. Part III.B walks through the judicially constructed exceptions to patent eligible subject matter—laws of nature, physical phenomena, and abstract ideas—before establishment of the *Mayo/Alice* framework. Part III.C details the Supreme Court’s creation of the *Mayo/Alice* test. Part III.D discusses § 101 eligibility after *Mayo* and *Alice*.

#### A. Constitutional and Statutory Roots of 35 U.S.C. § 101

At the Constitutional Convention, the framers gave Congress the power to grant “Authors and Inventors the exclusive Right to their respective Writings and Discoveries” in order to “promote the Progress of Science and useful Arts.”<sup>48</sup> Congress passed the Patent Act of 1790,<sup>49</sup> authorizing grants of patents for persons who “invented or discovered any useful art, manufacture, engine, machine, or device, or any improvement therein not before known or used.”<sup>50</sup> These inventions had to be “sufficiently useful and important.”<sup>51</sup> Three years later, the language in the statute outlining patent eligible subject matter was changed to cover “any new and useful art, machine, manufacture or composition of matter.”<sup>52</sup>

Congress retained the term “useful arts” for almost 160 years, entrusting the judiciary to construe the language in a manner consistent with the pace of industrial development.<sup>53</sup> Courts occasionally struggled to define patent eligible subject matter<sup>54</sup> but consistently held that laws of nature, physical phenomena, and abstract ideas were patent ineligible.<sup>55</sup>

In 1952, Congress adopted 35 U.S.C. § 101, which currently governs the definition of patent eligible subject matter.<sup>56</sup> Congress updated the law to include “any new and

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45. *Id.*

46. *See id.* at 1319.

47. *See id.*

48. U.S. CONST. art. I, § 8, cl. 8.

49. Ch. 7, 1 Stat. 109–12.

50. *Id.*

51. *Id.*

52. Patent Act of 1793, ch. 11, 1 Stat. 318–23.

53. *Bilski v. Kappos*, 561 U.S. 593, 636 (2010) (Stevens, J., concurring).

54. *Id.* at 637.

55. *See id.* at 601 (Kennedy, J., majority opinion).

56. *See* 35 U.S.C. § 101 (1952). In total Congress established five areas of analysis to determine the patentability of inventions. *See id.* §§ 101–105. While § 101 is discussed at length throughout this Note, §§ 102 and 103 are relevant to this Note’s analysis and may require some explication. Section 102 requires an invention

useful *process*, machine, manufacture, or composition of matter, or any new and useful improvement thereof.”<sup>57</sup> The revised statute replaced the term “art” with “process.”<sup>58</sup> However, the new language did not change the prevailing understanding of patent eligible subject matter; rather, it codified the judicially constructed definitions already in place.<sup>59</sup> Section 101 serves as the statutory basis of judicial rulings on whether an invention or discovery is patentable.<sup>60</sup>

*B. Section 101 Patent Ineligibility Pre-Mayo/Alice*

Before the Supreme Court created an explicit framework to assess § 101 patentability for claims that incorporate patent ineligible concepts—now commonly referred to as the *Mayo/Alice* test<sup>61</sup>—courts analyzed patents concerning laws of nature, physical phenomena, and abstract ideas on a case-by-case basis. In *Funk Brothers Seed Co. v. Kalo Inoculant Co.*,<sup>62</sup> the patent claims protected a soil inoculant<sup>63</sup> consisting of a mixture of different strains of bacteria.<sup>64</sup> Before the inventor’s discovery, separate species of bacteria could not be mixed into one soil inoculant due to their inhibitory effect on one another.<sup>65</sup> Kalo Inoculant Company discovered strains of each species of bacteria that did not produce this inhibitory effect and subsequently created a mixed soil inoculant that could be used on multiple types of plants instead of one.<sup>66</sup>

The Court invalidated the patent, holding that it did not disclose an inventive discovery within the meaning of the patent statutes.<sup>67</sup> In its opinion, the Court noted the qualities of the bacteria were a result of nature and stated that if invention were to come from the discovery, it would have to be through an application of that natural

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be novel to qualify for patent protection. *Id.* § 102. A claimed invention is not novel if it has been previously patented, in a printed publication, in public use, or otherwise available to the public prior to the filing date of the invention. *Id.* Section 103 requires a claimed invention to be nonobvious; that is, the claimed invention must be sufficiently different from the prior art. *Id.* § 103. If a person having ordinary skill in the art to which a patent pertains would find the claimed invention an obvious evolution of something that already exists, the patent fails a § 103 analysis. *See id.*

57. 35 U.S.C. § 101 (1952) (emphasis added).

58. *Bilski*, 561 U.S. at 639. Congress included a definition of “process” in their updated patent law, defining the term as a “process, art or method.” *Id.* (quoting 35 U.S.C. § 100(b) (2006)).

59. *Id.* at 639–40.

60. *See* 35 U.S.C. § 101 (2018).

61. *See, e.g.,* *Athena Diagnostics, Inc. v. Mayo Collaborative Servs., LLC*, 915 F.3d 743, 753 (Fed. Cir. 2019) (“As we conclude that claims 7–9 are directed to a natural law, we turn to the second step of the *Mayo/Alice* test.”).

62. 333 U.S. 127 (1948).

63. Soil inoculants are a type of bacteria added to the soil that capture atmospheric nitrogen in a form that can be used by the plant. *Soil Inoculants*, UNIV. GA. EXTENSION, <http://extension.uga.edu/publications/detail.html?number=C990&title=Soil%20Inoculants#Inoculants> [<http://perma.cc/M8RT-QHKF>] (last visited Feb. 1, 2022).

64. *Funk Bros.*, 333 U.S. at 128 n.1.

65. *See id.* at 129.

66. *See id.* at 130.

67. *See id.* at 132.

phenomenon.<sup>68</sup> The patentee's mere packaging of inoculants was not a sufficiently inventive concept for patent eligibility.<sup>69</sup>

Unlike the product patent at issue in *Funk Brothers*, the Court in *Gottschalk v. Benson*<sup>70</sup> was faced with process claims outlining a method for programming general-purpose computers.<sup>71</sup> The method utilized well-established mathematical formulas to efficiently store numbers in a computer's memory.<sup>72</sup> In holding the patent invalid, the Court invoked its long-standing principle that natural phenomena, mental processes, and abstract ideas are patent ineligible subject matter.<sup>73</sup> The *Gottschalk* Court believed holding the patent valid would allow the petitioner to patent an idea "so abstract and sweeping" that it would "wholly pre-empt the mathematical formula."<sup>74</sup> The majority concluded that transformation and reduction of an article to a different state was the touchstone of patentability.<sup>75</sup>

In *Parker v. Flook*,<sup>76</sup> the patent on a method for updating computer alarm limits was held invalid because once the relevant mathematical algorithm was considered to be known in the art, no inventive concept or invention remained to be patented.<sup>77</sup> The patent in *Parker* involved the use of a formula primarily used in computerized calculations that automatically adjusted alarm limits.<sup>78</sup> The patentee argued his patent was not a claim on the formula itself because his patent did not "wholly pre-empt the mathematical formula" like the patent at issue in *Gottschalk*.<sup>79</sup> The Court rejected the patentee's argument, reasoning that if his argument were correct, successful patenting of natural phenomena would require nothing more than competent draftsmanship—attaching some post-solution activity to otherwise ineligible subject matter.<sup>80</sup>

In the alternative, the patentee in *Parker* argued that considerations of inventiveness with respect to post-solution activity were concerns more properly addressed in 35 U.S.C. §§ 102<sup>81</sup> and 103<sup>82</sup> analyses.<sup>83</sup> Once more, the Court rejected his argument, insisting that simply implementing a principle in some fashion cannot be sufficient for purposes of § 101 because such a standard would make a determination of patent eligibility susceptible to "draftsman's art."<sup>84</sup> Additionally, the Court was clear that

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68. *Id.*

69. *See id.* at 131.

70. 409 U.S. 63 (1972).

71. *Gottschalk*, 409 U.S. at 65, 67–68.

72. *See id.* at 65.

73. *Id.* at 67.

74. *Id.* at 68, 71–72.

75. *Id.* at 70.

76. 437 U.S. 584 (1978).

77. *Parker*, 437 U.S. at 594.

78. *Id.* at 586. Alarm limits are often used in process engineering as a means of alerting operators when certain process variables reach levels outside an acceptable range of values. *See id.*

79. *Id.* at 589 (quoting *Gottschalk*, 409 U.S. at 71–72).

80. *See id.* at 590.

81. 35 U.S.C. § 102 (1976).

82. 35 U.S.C. § 103 (1976).

83. *See Parker*, 437 U.S. at 593.

84. *Parker*, 437 U.S. at 593. The term "draftsman's art" refers to the practice of gaining a patent not on the merits of the underlying invention but on the competency of the patent drafter to artfully construe claims in

questions of patentability must come before questions of novelty and obviousness.<sup>85</sup> The Court found that respondent's patent contained no new invention.<sup>86</sup>

Twelve years after the *Parker* decision, the Supreme Court heard *Diamond v. Chakrabarty*<sup>87</sup> to determine if a living microorganism constitutes a "manufacture" or "composition of matter" within the meaning of § 101.<sup>88</sup> Respondent invented a process by which four different plasmids<sup>89</sup> could be stably transferred into a single bacterium.<sup>90</sup> The Court held that respondent's microorganism was patent eligible subject matter because it was a "product of human ingenuity" and not naturally occurring.<sup>91</sup>

In reaching its conclusion, the Court in *Chakrabarty* highlighted that Congress's decision to use expansive terms in § 101 such as "manufacture" and "composition of matter"—preceded by the modifier "any"—indicated an intent for a broad interpretation of what can be considered patentable.<sup>92</sup> The Court, however, warned its holding was not to be interpreted to mean that § 101 had no limits.<sup>93</sup> Laws of nature, physical phenomena, and abstract ideas remained patent ineligible subject matter.<sup>94</sup>

In his dissent, Justice Brennan urged the *Chakrabarty* majority to be careful in its extension of patent eligible subject matter.<sup>95</sup> He cautioned that in the absence of legislative direction, courts should leave to Congress the power of determining patentability for unanticipated technology.<sup>96</sup>

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a way that turns non-inventions into successful patents. *See id.* at 590 ("A competent draftsman could attach some form of post-solution activity to almost any mathematical formula; the Pythagorean theorem would not have been patentable, or partially patentable, because a patent application contained a final step indicating that the formula, when solved, could be usefully applied to existing surveying techniques."). The need to construe laws of the United States' patent system to protect against a system which rewards draftsman's art is a recurring motivation of courts. *See, e.g., id.* at 593.

85. *Id.*

86. *See id.* at 594 ("Here it is absolutely clear that respondent's application contains no claim of patentable invention. The chemical processes involved in catalytic conversion of hydrocarbons are *well known*, as are the practice of monitoring the chemical process variables, the use of alarm limits to trigger alarms, the notion that alarm limit values must be recomputed and readjusted, and the use of computers for 'automatic monitoring-alarming.'") (emphasis added).

87. 447 U.S. 303 (1980).

88. *Chakrabarty*, 447 U.S. at 307.

89. According to the National Human Genome Research Institute,

A plasmid is a small, often circular DNA molecule found in bacteria and other cells.

Plasmids are separate from the bacterial chromosome and replicate independently of it.

They generally carry only a small number of genes, notably some associated with antibiotic resistance. Plasmids may be passed between different bacterial cells.

*Plasmid*, NAT'L HUM. GENOME RSCH. INST., <http://www.genome.gov/genetics-glossary/Plasmid> [<http://perma.cc/KA6H-2PJ2>] (last visited Feb. 1, 2022).

90. *Chakrabarty*, 447 U.S. at 305 n.1.

91. *Id.* at 309.

92. *Id.* at 308.

93. *Id.* at 309.

94. *Id.*

95. *Id.* at 319 (Brennan, J., dissenting).

96. *Id.*

In *Diamond v. Diehr*,<sup>97</sup> the Court heard arguments to determine whether a process for curing rubber, which included the computerized use of a mathematical formula,<sup>98</sup> was patentable subject matter.<sup>99</sup> Respondents argued their claims were not directed to the formula itself but instead to their process for molding rubber.<sup>100</sup> Using *Gottschalk's* “transformed or reduced” test, the Court held respondent’s patent valid under § 101.<sup>101</sup>

The *Diehr* Court emphasized that process claims “must be considered as a whole” and not “dissect[ed] . . . into old and new elements.”<sup>102</sup> This approach becomes especially important for processes whose individual steps may be well known, but whose combination of steps is new.<sup>103</sup> Nonetheless, the Court warned against draftsman’s art, reiterating that insignificant steps added to ineligible concepts will not transform the unpatentable into something patent eligible.<sup>104</sup>

Throughout the 1980s, the Patent Office issued, and the Federal Circuit upheld, thousands of patents claiming business methods, computer software, human gene discoveries, and other biotechnological advancements.<sup>105</sup> The flurry of patent issuances attracted the attention of critics who argued the new classes of patents were overbroad and overgeneralized.<sup>106</sup> Experts in fields such as biotechnology warned that many new patents—which were granted in the early stages of the research process—were hindering the advancement of medicine.<sup>107</sup>

In *In re Bilski*,<sup>108</sup> the Federal Circuit attempted to address these concerns.<sup>109</sup> The court, sitting en banc, concluded that the “machine-or-transformation test” was the determinative test to evaluate § 101 patentability for process patents.<sup>110</sup> That is, a process is patent eligible “if: (1) it is tied to a particular machine or apparatus, or (2) it transforms a particular article into a different state or thing.”<sup>111</sup> The case resulted in five opinions, and the Supreme Court granted certiorari, hearing arguments under the case name *Bilski v. Kappos*.<sup>112</sup>

A primary issue before the Court in *Bilski* was whether the Federal Circuit was correct in holding the machine-or-transformation test as dispositive for patentability

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97. 450 U.S. 175 (1981).

98. The patent made use of the Arrhenius equation expressed as  $\ln(k) = -E/Z + x$  where  $E$  is the activation constant,  $Z$  is the temperature of the mold, and  $x$  is the pressure of the mold. *Diehr*, 450 U.S. at 177 n.2. Although commonly used in rubber-molding presses, the equation has many nonrubber applications. *See id.* at 177 n.2, 188.

99. *Id.* at 177.

100. *Id.* at 181. The process’s improvement was its constant measuring of the internal temperature of the rubber press. *Id.* at 209 n.31 (Stevens, J., dissenting).

101. *Id.* at 192–93 (majority opinion).

102. *Id.* at 188.

103. *Id.*

104. *Id.* at 191–92.

105. Paul R. Gugliuzza, *The Procedure of Patent Eligibility*, 97 TEX. L. REV. 571, 573 (2019).

106. *Id.*

107. *Id.*

108. 545 F.3d 943 (Fed. Cir. 2008), *aff’d but criticized sub nom.* *Bilski v. Kappos*, 561 U.S. 593 (2010).

109. *See In re Bilski*, 545 F.3d at 956.

110. *Id.*

111. *Bilski*, 561 U.S. at 600.

112. 561 U.S. 593 (2010).

under § 101.<sup>113</sup> The patent at issue instructed stock market traders how to hedge risk.<sup>114</sup> In its opinion, the Court reiterated its 150-year precedent of precluding laws of nature, physical phenomena, and abstract ideas from patent eligibility under § 101.<sup>115</sup> Simultaneously, it cautioned courts not to create limitations and conditions to patentability in the absence of congressional guidance.<sup>116</sup>

In keeping with these principles, the *Bilski* Court emphasized that § 101's purpose to encompass inventions not yet known would be frustrated by the adoption of a dispositive machine-or-transformation test.<sup>117</sup> The Court held petitioner's claims were broad descriptions of how hedging could be applied to certain sections of the economy, and as such, were ineligible abstract ideas.<sup>118</sup> Although the Court made clear the machine-or-transformation test was not the sole test for a patentable process, Justice Stevens maintained the inquiry was a "critical clue."<sup>119</sup>

### C. Establishing the Mayo/Alice Framework

The Supreme Court recognized lower courts' desires for an analytical framework to guide examination of patents that concerned the judicially developed exceptions of laws of nature, natural phenomena, and abstract ideas.<sup>120</sup> Construction of this framework started with the Supreme Court's decision in *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*<sup>121</sup> and ended with the Court's rearticulation of the framework in *Alice Corp. v. CLS Bank International*.<sup>122</sup>

The patent in *Mayo* involved a process that helped doctors determine if an administered dose of the drug thiopurine was too low or too high.<sup>123</sup> The claims incorporated natural law—the human body's metabolic response to thiopurine—and was challenged on the grounds that the claimed process did not transform unpatentable natural law into patentable subject matter.<sup>124</sup> In reviewing relevant legal precedent, the Court recognized a clear theme: patent statutes were not to be construed in ways which rewarded draftsman's art without adherence to the law's prohibition on claiming nature.<sup>125</sup>

Guided by precedent, the Court held that the steps claimed in the patent—aside from the natural law itself—involved "well-understood, routine, conventional activity previously engaged in by researchers in the field."<sup>126</sup> Thus, the claims were patent

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113. See *Bilski*, 561 U.S. at 597–98, 602.

114. *Id.* at 598–99.

115. *Id.* at 601–02.

116. *Id.* at 601–03.

117. *Id.* at 605.

118. *Id.* at 612.

119. *Id.* at 614 (Stevens, J., concurring).

120. See Michael Tezian, "Does it Smell Like Mayo?": The Federal Circuit's Oversimplification of the Mayo Framework in Method of Treatment/Diagnosis Cases, 24 UCLA J. L. & TECH. 1, 3 (2020).

121. 566 U.S. 66 (2012).

122. 573 U.S. 208 (2014).

123. *Mayo*, 566 U.S. at 72.

124. *Id.*

125. *Id.* (quoting *Parker v. Flook*, 437 U.S. 584, 593 (1978)).

126. *Id.* at 73.

ineligible.<sup>127</sup> The claims did not contain any additional features showing that the patent was not a “drafting effort designed to monopolize the law of nature itself.”<sup>128</sup>

In an amicus curiae brief, the government argued that any step beyond a statement of the law of nature itself should pass a § 101 analysis, insisting other statutory provisions—such as § 102—would properly reject those claims that add merely conventional steps.<sup>129</sup> The Court disagreed, stating that such a philosophy would make § 101’s law-of-nature limitation dead letter.<sup>130</sup>

One of the Federal Circuit’s first opportunities to apply the framework introduced in *Mayo* was in *Association for Molecular Pathology v. Myriad Genetics, Inc.*<sup>131</sup> The principal contribution claimed by the relevant patents was Myriad Genetics’ discovery of the precise location of two human genes whose mutations increase the risk of breast and ovarian cancer.<sup>132</sup> After their discovery, Myriad Genetics sought to patent the isolated segments of DNA where these genes were located, as well as the synthetically created DNA segments (known as complementary DNA or cDNA<sup>133</sup>) of that same gene region.<sup>134</sup>

On remand, the Federal Circuit held that both the isolated DNA and cDNA were patent eligible under § 101.<sup>135</sup> Notably, Judge Lourie—who wrote the *Illumina* opinion on which this Note focuses—wrote that the chemical alterations made in breaking bonds were dispositive in holding the isolated DNA segments patent eligible.<sup>136</sup> Judge Lourie found that “[t]he claimed isolated DNA molecules [were] distinct from their natural

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127. *Id.*

128. *Id.* at 77–80.

129. *Id.* at 89.

130. *Id.*

131. 569 U.S. 576 (2013). The Supreme Court had granted the petition for certiorari for *Myriad*’s 2011 Federal Circuit decision. *Myriad*, 569 U.S. at 586. The Court then vacated judgement and remanded the case back to the Federal Circuit in light of its then-recent *Mayo* decision. *Id.*

132. *Id.* at 580, 585.

133. The Court in *Myriad* gave an informative explanation of cDNA—more succinct than any attempt of mine—providing the following:

It is . . . possible to create DNA synthetically through processes similarly well known in the field of genetics. One such method begins with an mRNA molecule and uses the natural bonding properties of nucleotides to create a new, synthetic DNA molecule. The result is the inverse of the mRNA’s inverse image of the original DNA, with one important distinction: Because the natural creation of mRNA involves splicing that removes introns, the synthetic DNA created from mRNA also contains only the exon sequences. This synthetic DNA created in the laboratory from mRNA is known as complementary DNA (cDNA).

*Id.* at 582. For purposes of this Note, what is important to understand about the relevant genetic material in *Myriad* is that the isolated DNA is no different from its naturally occurring segment in the human genome, whereas the cDNA segment *is* structurally different from its naturally occurring counterpart. *See id.* at 580–82.

134. *Id.* at 579–80.

135. *Id.* at 586.

136. *Id.* at 587.

existence as portions of larger entities, and their informational content [was] irrelevant to that fact.”<sup>137</sup>

The Supreme Court disagreed with Judge Lourie’s reasoning, holding that the act of severing chemical bonds when isolating DNA segments did not sufficiently constitute a nonnaturally occurring molecule.<sup>138</sup> Because isolating the DNA segment did not alter the DNA sequence in any way, the Court found the patent fell squarely within the natural-law exception.<sup>139</sup> The Court emphasized that holding Myriad Genetics’ patents valid would be to grant the company an exclusive right to isolate the relevant gene segments.<sup>140</sup> Simply put, the Court was clear that isolation of genetic material from its surrounding environment was not enough to make that isolated material patent eligible under § 101.<sup>141</sup>

In light of remaining confusion about its *Mayo* holding, the Supreme Court restated the *Mayo* framework in *Alice Corp. v. CLS Bank International*.<sup>142</sup> In *Alice*, the Court held that a patent claiming a computer-executed process for mitigating settlement risk impermissibly covered an abstract idea, and therefore was invalid.<sup>143</sup> In its analysis, the Court recharacterized its holding in *Mayo*:

In *Mayo*, we set forth a framework for distinguishing patents that claim laws of nature, natural phenomena, and abstract ideas from those that claim patent-eligible applications of those concepts. First, we determine whether the claims at issue are directed to one of those patent-ineligible concepts. If so, we then ask, “[w]hat else is there in the claims before us?” To answer that question, we consider the elements of each claim both individually and “as an ordered combination” to determine whether the additional elements “transform the nature of the claim” into a patent-eligible application. We have described step two of this analysis as a search for an “inventive concept”—i.e., an element or combination of elements that is “sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself.”<sup>144</sup>

Applying the newly articulated *Mayo/Alice* framework, the Court found the claims were directed towards the concept of intermediate settlement, a fundamental and abstract economic principle.<sup>145</sup>

Having established Alice Corporation’s patent was directed towards ineligible subject matter, the Court moved to step two of the *Mayo/Alice* framework.<sup>146</sup> The relevant question before the Court was whether the patent claimed more than mere

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137. *Ass’n for Molecular Pathology v. U.S. Pat. & Trademark Off.*, 689 F.3d 1303, 1330 (Fed. Cir. 2012), *aff’d in part, rev’d in part sub nom.* *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576 (2013).

138. *Myriad*, 569 U.S. at 593.

139. *Id.* at 591.

140. *Id.* at 585.

141. *Id.* at 596.

142. 573 U.S. 208 (2014).

143. *See Alice*, 573 U.S. at 212.

144. *Id.* at 217–18 (alteration in original) (citations omitted).

145. *Id.* at 220–21.

146. *Id.* at 221.

instructions to implement the abstract idea.<sup>147</sup> The Court found that the elements of the individual claims were all “[p]urely conventional.”<sup>148</sup> When considered as a whole, the patent did nothing more than outline that which was ineligible—the concept of intermediate settlement.<sup>149</sup> The Court in *Alice* rejected the validity of one patent, and, in doing so, solidified a framework which became *the* test for patentability under § 101 when issues of laws of nature or abstract ideas were present—the *Mayo/Alice* test.<sup>150</sup>

#### D. Section 101 Patent Ineligibility Post-Mayo/Alice

The Federal Circuit immediately began to incorporate the rearticulated *Mayo/Alice* framework into its § 101 analyses of patentability. As technologies in patents became increasingly tied to biological advances, the Federal Circuit’s ability to faithfully execute step one of the *Mayo/Alice* framework diminished. Particularly, the Federal Circuit’s opinion in *Vanda Pharmaceuticals Inc. v. West-Ward Pharmaceuticals International Ltd.*<sup>151</sup> demonstrates a recent shift in the Federal Circuit to discount a patent’s involvement of natural law in the *Mayo/Alice* framework. The *Vanda* decision stands in contrast to the line of case law applying the *Mayo/Alice* test that came before it. In order to understand *Vanda*’s departure from Federal Circuit practice, a discussion of the case law leading up to *Vanda*’s decision is instructive.

In *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*,<sup>152</sup> the court held that a patent was directed towards laws of nature and did not sufficiently claim inventive steps to transform the natural phenomenon into a patentable invention.<sup>153</sup> The patent disclosed a multistep method of taking the starting substance of maternal cffDNA and ending with paternally inherited cffDNA.<sup>154</sup> Because both substances were naturally occurring phenomena, the court concluded the patent was directed towards patent ineligible subject matter under the first step of the *Mayo/Alice* test.<sup>155</sup> Under the second step of the *Mayo/Alice* test, the court held that the method at issue amounted to nothing more than general instructions to apply “routine, conventional techniques when seeking to detect cffDNA.”<sup>156</sup> In holding the patent invalid per § 101, the court stated that method patents, which start and end with naturally occurring phenomena, are invalid if the methods themselves are already understood in the relevant field.<sup>157</sup>

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147. *See id.*

148. *Id.* at 222, 225.

149. *Id.* at 225–27.

150. *See, e.g.,* *Endo Pharms. Inc. v. Teva Pharms. USA, Inc.*, 919 F.3d 1347 (Fed. Cir. 2019) (reviewing a district court’s analysis under the *Alice/Mayo* test).

151. 887 F.3d 1117 (Fed. Cir. 2018), *cert. denied*, 140 S. Ct. 911 (2020).

152. 788 F.3d 1371 (Fed. Cir. 2015).

153. *Ariosa*, 788 F.3d at 1373.

154. *Id.* at 1376. The benefit provided by isolating paternally inherited cffDNA is that its properties, when properly analyzed, can be used to determine fetal characteristics such as gender or certain genetic defects. *See id.* at 1373.

155. *Id.* at 1376.

156. *Id.* at 1377.

157. *Id.* at 1378.

Building off of its decision in *Ariosa*, the Federal Circuit rejected a patent under § 101 in *Genetic Technologies Ltd. v. Merial L.L.C.*<sup>158</sup> because the claims were directed towards laws of nature and did not add any additional elements that sufficiently established an inventive concept beyond that of the natural-law discovery.<sup>159</sup> The relevant technology in *Genetic Technologies* involved genetic material.<sup>160</sup> Specifically, the patent at issue sought to protect a method of detecting certain coding regions in DNA by amplifying and analyzing noncoding regions of that DNA—regions that, before issuance of the patent, were thought to be useless.<sup>161</sup>

The court analogized the *Genetic Technologies* patent to those in *Mayo* and *Ariosa*, finding that the focus of the claim was new discoveries in human biology.<sup>162</sup> The court determined that the patent's physical steps of DNA amplification and analysis did not provide the public with an inventive concept, whether those steps were considered in isolation or in combination.<sup>163</sup> Rather, the patent merely detailed “well-understood, routine, conventional activity” already practiced by researchers in the field.<sup>164</sup>

In *Rapid Litigation Management Ltd. v. CellzDirect, Inc.*,<sup>165</sup> the Federal Circuit held that a patent was not directed towards a law of nature because the claims prescribed a *method* utilizing a newly discovered natural law, but did not solely focus on that law.<sup>166</sup> The patent in *CellzDirect* involved a method of cryopreservation of liver cells.<sup>167</sup> The method leveraged the discovery that a fraction of liver cells are capable of surviving multiple freeze-thaw cycles.<sup>168</sup> In short, the method instructed an individual to (1) separate previously frozen and thawed cells into viable and nonviable collections, (2) recover the viable cells, and (3) refreeze the viable cells.<sup>169</sup>

158. 818 F.3d 1369 (Fed. Cir. 2016).

159. *Genetic Techs.*, 818 F.3d at 1376–77.

160. *See id.* at 1371.

161. *Id.* at 1372–73. A brief explanation of the science undergirding the patent is as follows:

An individual's complete set of DNA is known as his genome, and a particular sequence of DNA within the genome that codes for a given protein (or functional RNA molecule) is referred to as a gene. . . . Genes typically contain both coding regions, called exons, and non-coding regions, called introns. Exons are regions of the DNA sequence of the gene that are expressed, i.e., ultimately “decoded” and translated into the protein sequence. Introns are regions that are not expressed; these regions do not code for protein.

*Id.* at 1371–72. The advantage of analyzing noncoding regions of DNA instead of coding regions is that analysis of noncoding segments requires shorter sequence regions while simultaneously providing more information than previous analysis methods. *Id.* at 1372–73.

162. *Id.* at 1376.

163. *Id.* at 1377.

164. *Id.* at 1376 (quoting *Mayo Collaborative Servs. v. Prometheus Lab'ys, Inc.*, 566 U.S. 66, 73 (2012)).

165. 827 F.3d 1042 (Fed. Cir. 2016).

166. *See CellzDirect*, 827 F.3d at 1049.

167. *Id.* at 1045.

168. *Id.* Before the disclosure of the patent at issue, the prevailing wisdom surrounding cryopreservation of liver cells was that they could only be frozen once before having to be discarded. *Id.*

169. *Id.*

Under the first step of the *Mayo/Alice* test, the court found the patent was not directed at the liver cells' ability to survive multiple freezing processes.<sup>170</sup> Instead, the court found the patent protected a new "laboratory technique" of cryopreservation involving both multiple freeze-thaw cycles and pooling the cells from various donors.<sup>171</sup> Seeking to differentiate *CellzDirect* from recent decisions, the Federal Circuit emphasized that the patents in *Genetic Technologies, Inc.* and *Ariosa* focused on "methods for detecting" natural laws, and thus impermissibly claimed laws of nature as end results.<sup>172</sup> Conversely, the court found the *CellzDirect* patent focused on a method whose end result was cryopreserved liver cells.<sup>173</sup>

The idea that methods of detection are patent ineligible subject matter was considered again in the Federal Circuit's decision in *Cleveland Clinic Foundation v. True Health Diagnostics LLC*.<sup>174</sup> In *True Health Diagnostics*, the court invalidated Cleveland Clinic's patent, which claimed a method that measured and analyzed levels of myeloperoxidase (MPO) to determine an individual's risk of cardiovascular disease.<sup>175</sup> The correlation between the level of MPO detected and the magnitude of an individual's risk of cardiovascular disease was based on the inventors' compiled MPO data from statistical research of healthy and sick populations.<sup>176</sup>

In evaluating the patent under the *Mayo/Alice* framework, the court found the patent was directed towards a law of nature and that it did not add any inventive steps in the law's application.<sup>177</sup> As such, it was invalid.<sup>178</sup> Notably, the court rejected the patentee's attempts to analogize their invention to the patent in *CellzDirect*.<sup>179</sup> The court emphasized that unlike in *CellzDirect*, the patentee's invention was directed towards the levels of MPO in a bodily sample and its correlation to heart problems, not towards a laboratory technique for detecting the relationship.<sup>180</sup>

In a subsequent case, the Cleveland Clinic argued that similar patents of theirs—which disclosed several methods of measuring a patient's blood level of MPO—claimed patentable subject matter.<sup>181</sup> Cleveland Clinic's primary argument in differentiating the relevant patent from its previous case was that the claims at issue were directed towards techniques of detection of MPO in the blood, not towards assessing an associated cardiovascular risk.<sup>182</sup>

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170. *Id.* at 1048.

171. *Id.* at 1048–49.

172. *Id.* at 1048 (“[I]n *Genetic Technologies*, the claim recited *methods for detecting* a coding region of DNA based on its relationship to non-coding regions. . . . [I]n *Ariosa*, the claims recited *methods for detecting* paternally inherited cfDNA in the blood or serum of a pregnant female.” (emphasis added)).

173. *Id.*

174. 859 F.3d 1352 (Fed. Cir. 2017).

175. *True Health Diagnostics*, 859 F.3d at 1355. When an artery is damaged or inflamed—symptoms of cardiovascular disease—the body releases the enzyme myeloperoxidase. *Id.*

176. *Id.* at 1355–56.

177. *Id.* at 1361–63.

178. *Id.*

179. *Id.* at 1361.

180. *Id.*

181. *Cleveland Clinic Found. v. True Health Diagnostics LLC*, 760 Fed. App'x 1013, 1018 (Fed. Cir. 2019).

182. *Id.*

The court rejected the argument, finding that the distinction was “overly superficial.”<sup>183</sup> The court found the patents covered known methods of detecting MPO.<sup>184</sup> It did not matter how the Cleveland Clinic rephrased the patent; the conclusion under step one of the *Mayo/Alice* test remained the same: the patent was an articulation of natural law and therefore directed towards ineligible subject matter.<sup>185</sup>

In 2018, the Federal Circuit took a more liberal approach in its evaluation of a patent under step one of the *Mayo/Alice* test. In *Vanda Pharmaceuticals Inc.*, the court held that a patent—which teaches a method of treating schizophrenia with a drug based on a patient’s genotype—was not directed towards a law of nature under step one of the *Mayo/Alice* test.<sup>186</sup> Writing for the majority, Judge Lourie found the patent’s “treatment steps,” directed towards methods of treatment for specific patients, were different from the claims in *Mayo*, which did not recognize the need to modify an administered dose.<sup>187</sup> The *Vanda* patent’s direction to *administer* the drug, coupled with its incorporation of a genotype test and result, led the majority to hold that the patent was not directed towards a law of nature under the *Mayo/Alice* test.<sup>188</sup>

Chief Judge Prost dissented, stating that the majority conflated steps one and two of the *Mayo/Alice* analysis.<sup>189</sup> She reasoned that once the natural law was identified according to *Mayo*, the remaining steps prescribed by the patent failed to produce an inventive concept to overcome § 101’s natural-law limitation.<sup>190</sup> Moreover, the dissent pointed out that *Mayo*’s discussion regarding a drug administration step was in the context of the second step of the *Mayo/Alice* framework—not in the first step, where the majority based its argument.<sup>191</sup> The dissent emphasized that *Mayo* clearly instructed courts to reject draftsman’s art to monopolize natural law.<sup>192</sup> Chief Judge Prost found that neither the patent’s requirement to administer the drug, nor the patent’s requirement of a conventional genotype test, made the invention’s subject matter patent eligible.<sup>193</sup>

In *Roche Molecular Systems, Inc. v. CEPHEID*,<sup>194</sup> the court held that a patent teaching a method for detecting pathogenic bacterium *Mycobacterium tuberculosis* (MTB) was invalid because it was directed towards the scientific relationship between naturally occurring nucleotides and the presence of MTB in a test sample.<sup>195</sup> The court found the focus of the patent was clear—the inventors discovered that specific nucleotides served as “finger-prints” of the presence of MTB.<sup>196</sup> In other words,

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183. *Id.* (quoting *Cleveland Clinic Found. v. True Health Diagnostics, LLC*, No. 1:17-CV-198(LMB/IDD), 2017 WL 3381976, at \*8 (E.D. Va. Aug. 4, 2017)).

184. *Id.*

185. *Id.* at 1018–19.

186. *Vanda Pharms. Inc. v. W.-Ward Pharms. Int’l Ltd.*, 887 F.3d 1117, 1134 (Fed. Cir. 2018).

187. *Id.* at 1135.

188. *See id.*

189. *Id.* at 1140 (Prost, C.J., dissenting).

190. *Id.*

191. *Id.* at 1142.

192. *See id.* at 1141.

193. *Id.* at 1142.

194. 905 F.3d 1363 (Fed. Cir. 2018).

195. *CEPHEID*, 905 F.3d at 1371.

196. *See id.* at 1366.

detection of these specific nucleotides correlated with the presence of MTB.<sup>197</sup> Under step two of the *Mayo/Alice* framework, the court determined that the patent's use of common techniques to extract and amplify genetic material for analysis was not sufficiently inventive to render the subject material patentable.<sup>198</sup> Thus, the court differentiated *CEPHEID* from *CellzDirect* on the basis that *CellzDirect* was directed towards *new* laboratory techniques.<sup>199</sup>

*Athena Diagnostics, Inc. v. Mayo Collaborative Services, LLC*<sup>200</sup> confirmed *CEPHEID*'s reasoning, holding that “performing standard techniques in a standard way to observe a newly discovered natural law” cannot suffice as an inventive concept.<sup>201</sup> The patent at issue in *Athena* involved diagnosing neurological disorders through detection of certain antibodies in a sample.<sup>202</sup> The *Athena* court explained that whether a claimed invention improves technological processes or merely seeks to capture an ineligible concept informs the court's decision on patentability.<sup>203</sup>

Having found that the patent was directed towards ineligible concepts, the court moved to step two of the *Mayo/Alice* test, concluding that the patent's techniques—which were specified in the patent as “known per se in the art”<sup>204</sup>—were insufficiently inventive to constitute patentable subject matter.<sup>205</sup> The dissent in *Athena* pointed out the Federal Circuit's growing inconsistencies across its rulings utilizing the *Mayo/Alice* test, emphasizing the need for consistency to protect incentives for the development of new diagnostic methods.<sup>206</sup> For example, the dissent argued that the majority opinion in *Athena* is not consistent with *CellzDirect*, which found that a patent's claim of conventional methods to manipulate specific cells was eligible under §101.<sup>207</sup>

Demonstrating the intra-court disagreement discussed in Judge Newman's dissent above, the Federal Circuit produced a forty-one-page per curiam order with eight different opinions, denying *Athena Diagnostics*' petition for rehearing en banc.<sup>208</sup> The opinions differed greatly in their analysis of *Athena*, the reach of the *Mayo/Alice* framework, and the state of the Federal Circuit's current jurisprudence in applying the *Mayo/Alice* framework. However, there was one common thread among the fractured

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197. *Id.*

198. *See id.* at 1372. The process used to amplify the genetic material is polymerase chain reaction (PCR). It was undisputed that the technique of PCR amplification was “routine” at the time of the patent's filing. *Id.* (quoting *Roche Molecular Sys., Inc. v. CEPHEID*, No. 14-CV-03228-EDL, 2017 WL 6311568, at \*16 (N.D. Cal. Jan. 17, 2017), *aff'd*, 905 F.3d 1363 (Fed. Cir. 2018)). Indeed, the relevant patent itself stated that “[t]he methods of the present invention use *standard PCR techniques*.” *Id.* (citation omitted).

199. *Id.* at 1373 (quoting *Rapid Litig. Mgmt., Ltd. v. CellzDirect, Inc.*, 827 F.3d 1042, 1052 (Fed. Cir. 2016)).

200. 915 F.3d 743 (Fed. Cir. 2019), *cert. denied*, 140 S. Ct. 855 (2020).

201. *Athena*, 915 F.3d at 754.

202. *Id.* at 746. The patent leveraged the discovery that patients with neurological disorders generate autoantibodies to a membrane protein called tyrosine kinase. *Id.* at 746–47.

203. *Id.* at 750.

204. *Id.* at 748 (citation omitted) (internal quotation marks omitted).

205. *Id.* at 754.

206. *See id.* at 763 (Newman, J., dissenting).

207. *Id.* at 762.

208. *See Athena Diagnostics, Inc. v. Mayo Collaborative Servs., LLC (“Athena IP”)*, 927 F.3d 1333 (Fed. Cir. 2019) (per curiam).

court's opinions: it was time the Supreme Court accepted an opportunity to weigh in on how patents covering laws of nature should be adjudicated.<sup>209</sup>

Judge Hughes bluntly pointed to the numerous opinions in the court's denial to hear the case en banc as evidence of the Federal Circuit's ongoing issues with § 101 eligibility, particularly in the field of medical diagnostics.<sup>210</sup> Judge Dyk—although concurring in the court's denial of a rehearing en banc—agreed with the viewpoint expressed in the dissenting opinions: the *Mayo/Alice* test as applied leaves little to no room for “sufficiently specific diagnostic patents” and other developments in life sciences and complex biological systems.<sup>211</sup> Judge Chen echoed Judge Dyk's opinion, believing a revival of the *Diehr* standard of evaluating “the claim as a whole” for purposes of § 101 could leave room for diagnostic, law-of-nature patents.<sup>212</sup>

#### IV. COURT'S ANALYSIS

##### A. Majority Opinion

In *Illumina, Inc. v. Ariosa Diagnostics*, the majority reversed the district court's finding of invalidity, holding that the relevant patents were directed towards patent eligible concepts.<sup>213</sup> At the outset of his majority opinion, Judge Lourie concluded that the case did not involve diagnostic patents or method-of-treatment patents; rather, it involved patents for methods of preparation.<sup>214</sup> By characterizing the patents as methods of preparation, Judge Lourie was able to avoid common § 101 pitfalls experienced by patents of detection or treatment.<sup>215</sup> Nonetheless, because the patents did involve a facet of nature, Judge Lourie recognized that the § 101 eligibility of the patents had to be considered under the *Mayo/Alice* framework.<sup>216</sup>

In evaluating the patents under step one of the *Mayo/Alice* test, the majority found the claims were not directed to the underlying natural phenomenon—that cell-free fetal DNA is shorter in length than cell-free maternal DNA.<sup>217</sup> Instead, the majority characterized the patents as covering a patent eligible method which merely utilized a

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209. *See id.* at 1337 (Hughes, J., concurring) (“I, for one, would welcome further explication of eligibility standards in the area of diagnostics patents. . . . Such an explication might come from the Supreme Court.”); *Id.* at 1340 (Dyk, J., concurring) (“[I]t would be desirable for the Supreme Court to refine the *Mayo* framework to allow for sufficiently specific diagnostic patent claims with proven utility.”); *Id.* at 1344 (Chen, J., concurring) (“While I believe our court would benefit from the Supreme Court's guidance as to whether it intended to override central tenets of *Diehr*, *Mayo*'s reasoning is clear and we are bound by it.”); *Id.* at 1352 (Moore, J., dissenting) (stating the multitude of opinions makes clear there is disagreement in the Federal Circuit regarding application of the *Mayo* framework).

210. *Id.* at 1337 (Hughes, J., concurring).

211. *Id.* at 1339–40 (Dyk, J., concurring).

212. *See id.* at 1351 (Chen, J., concurring).

213. *See Illumina, Inc. v. Ariosa Diagnostics, Inc.*, 967 F.3d 1319, 1321 (Fed. Cir. 2020), *cert. dismissed*, 141 S. Ct. 2171 (2021).

214. *Id.* at 1325.

215. *See Athena II*, 927 F.3d at 1336 (Lourie, J., concurring) (discussing how diagnostic patents are invalid under *Mayo* and how method-of-treatment patents require unconventional combinations of steps to survive § 101 analysis).

216. *See Illumina*, 967 F.3d at 1325.

217. *Id.* at 1326.

phenomenon of nature.<sup>218</sup> In making this characterization, Judge Lourie highlighted that the size thresholds claimed in the patents were not dictated by nature, but instead were a product of “human-engineer[ing].”<sup>219</sup>

The majority further emphasized that the patents did more than merely observe the difference in size between DNA types.<sup>220</sup> Instead, the methods contained processes that resulted in a cell-free fetal DNA fraction that was different from that which occurs in nature.<sup>221</sup> Thus, the patents claimed discrete steps that exploited the difference in DNA sizes in order to achieve a biological mixture enriched in fetal DNA.<sup>222</sup>

The defendants attempted to analogize Illumina and Sequenom’s patents to the patent invalidated in *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, asserting the patents at issue were no less directed at laws of nature than the claims of the previously invalidated patent.<sup>223</sup> The court rejected defendants’ argument, stating that the previous patent’s invalidity was predicated on claims of detection and diagnosis.<sup>224</sup> The *Illumina* court found the patents at issue claimed methods which leveraged size discrimination during sample preparation.<sup>225</sup>

In the alternative, defendants argued that the patents’ claimed product—a mixture of biological material enriched in fetal DNA—was nonetheless naturally occurring and thus could not be patent eligible on the sole basis that its constituent elements had been isolated.<sup>226</sup> In rejecting this assertion, the majority relied on the Supreme Court’s decision in *Myriad*, stating that the Court expressly declined to bring innovative method claims of DNA isolation within the ambit of its holding.<sup>227</sup>

Because the majority believed the patents covered a process of removing nonfetal DNA to enrich a mixture in fetal DNA, it found the holding in *Myriad* did not control.<sup>228</sup> Rather, the majority found that *CellzDirect* was most analogous and thus most instructive in resolving the case before the court.<sup>229</sup> Judge Lourie reasoned that, just as the inventors in *CellzDirect* claimed a *method* of cryopreservation that exploited a liver cell’s ability to freeze without damage, the relevant patents claim a *method* of separation exploiting human-engineered size parameters.<sup>230</sup> The court found that the defendants—who held the burden of proof—failed to demonstrate that the size thresholds claimed in the patents were conventional for separating different types of cell-free DNA.<sup>231</sup> Absent such proof,

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218. *Id.*

219. *Id.*

220. *Id.*

221. *Id.*

222. *Id.* at 1327.

223. *See id.*

224. *Id.*

225. *Id.*

226. *Id.*

227. *Id.*

228. *Id.* at 1328.

229. *Id.*

230. *Id.*

231. *Id.*

the majority believed the patent's research-based size thresholds brought the patent out of the realm of nature and into the patent eligible world of human ingenuity.<sup>232</sup>

Because the majority found under step one of the *Mayo/Alice* framework that the patent was not directed towards patent ineligible subject matter, step two was not considered.<sup>233</sup> The court reversed the district court's ruling of invalidity under § 101.<sup>234</sup> In concluding its opinion, the majority signaled its disappointment with the impact of the *Mayo/Alice* jurisprudence, to which it was bound.<sup>235</sup>

### B. Dissenting Opinion

Judge Reyna issued a dissenting opinion in which he stated that the asserted claims were impermissibly directed towards a natural phenomenon, and that any application steps included in the patents were "conventional procedures . . . well known in the art."<sup>236</sup> Because the patent failed to cover patent eligible subject matter under steps one and two of the *Mayo/Alice* framework, the dissent believed the lower court's ruling of invalidity under § 101 should have been affirmed.<sup>237</sup> Central to the dissent's reasoning was its focus on what the patents defined as the inventors' discovery.<sup>238</sup> Judge Reyna emphasized that it was the written description that stated the difference in size "*forms the basis of the present invention.*"<sup>239</sup>

Judge Reyna explained that *Alice's* articulation of the *Mayo* standard made clear that at step one of the analysis, patents are directed towards patent ineligible concepts when they *involve* those concepts.<sup>240</sup> Guided by that standard, the dissent found that the relevant patents were directed towards a law of nature because they involved the size differences between types of DNA—a product of nature.<sup>241</sup> The fact that the patents included process steps to produce a mixture of naturally occurring genetic material did not impact the "directed towards" analysis.<sup>242</sup> Indeed, Judge Reyna highlighted that the

232. *See id.*

233. *Id.* at 1329.

234. *See id.* at 1329–30.

235. *See id.* at 1329 ("We acknowledged the profound impact that the discovery had on the field of prenatal medicine . . . . Nevertheless, under guidance from the Supreme Court, we determined that the discovery of that natural phenomenon, no matter how significant . . . was not itself patentable.").

236. *Id.* at 1330 (Reyna, J., dissenting).

237. *See id.*

238. *See id.* ("The patent informs us that the problem was overcome when the inventors made a 'surprising' discovery[:] . . . [cell-free fetal] DNA tends to be shorter than cell-free maternal DNA in a mother's blood." (citation omitted)).

239. *Id.* (quoting U.S. Patent No. 9,580,751 col. 2 ll. 1–2 (issued Feb. 28, 2017)).

240. *Id.* at 1330–31.

241. *See id.* at 1331–32. To bolster his argument that the relevant patents involved patent ineligible subject matter, Judge Reyna cited a string of cases demonstrating that the operative fact in a step one *Mayo/Alice* inquiry is the patent's "claimed advance." *Id.* at 1332; *see also* *Athena Diagnostics, Inc. v. Mayo Collaborative Servs., LLC*, 915 F.3d 743, 750 (Fed. Cir. 2019) ("To determine whether a claim is directed to an ineligible concept, we have frequently considered whether the *claimed advance* improves upon a technological process or merely an ineligible concept, based on both the written description and the claims." (emphasis added)); *Genetic Techs. Ltd. v. Merial L.L.C.*, 818 F.3d 1369, 1375 (Fed. Cir. 2016) ("[T]he focus of the *claimed advance* over the prior art was allegedly newly discovered information about human biology." (emphasis added)).

242. *See Illumina*, 967 F.3d at 1331 (Reyna, J., dissenting).

end product analyzed in isolation still involved natural substances which were present in the original sample.<sup>243</sup> The dissent explained that no matter how you slice it, the patent involves—and therefore is directed towards—natural law.<sup>244</sup>

Of significant import to the dissent was the fact that the patents’ beginning and end products were naturally occurring substances. This, in turn, supported the conclusion that the claimed advance was also naturally occurring.<sup>245</sup> Judge Reyna dismissed the majority’s attempt to inject human ingenuity into the patent when it used the term “human engineered,” highlighting that the turn of phrase is found only in attorney arguments, not in the patent’s specifications.<sup>246</sup> The dissent criticized the majority’s position that “method of preparation” patents require a different analysis than diagnostic or detection patents under Federal Circuit jurisprudence.<sup>247</sup> Judge Reyna explained that the majority’s fixation on the patents as methods—or collections of steps—improperly conflated steps one and two of the *Mayo/Alice* test.<sup>248</sup> The dissent reminded the court that step one concerns only whether ineligible concepts are involved; analysis of process claims and whether additional processes sufficiently transform the patent into an application of natural law are more properly analyzed under step two of the *Mayo/Alice* framework.<sup>249</sup>

Unlike the majority, Judge Reyna found the patents were directed towards natural law and, therefore, the court was required to proceed to step two of the *Mayo/Alice* inquiry.<sup>250</sup> The dissent found that because size separation techniques were widely practiced in DNA manipulation, the patents disclosed no new or useful improvement beyond that which was already conventional practice.<sup>251</sup> Judge Reyna found *Roche Molecular* analogous to the relevant patents, reasoning the size thresholds—like the human generated approximations used in *Roche Molecular*—were nothing more than conventional separation practices used in conjunction with the newly discovered natural phenomenon.<sup>252</sup>

## V. PERSONAL ANALYSIS

The majority opinion in *Illumina* incorrectly applied step one of the *Mayo/Alice* framework, leading to an inaccurate finding of § 101 patent eligibility, based upon its misguided conclusion that the patents in question were not directed towards laws of nature. *Illumina* and Sequenom’s patents are directed towards the size difference between DNA types—a product of nature—and claim nothing more than conventional procedures well known and widely practiced in biology labs. Because the patents provide

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243. *Id.*

244. *Id.*

245. *Id.* at 1332.

246. *Id.* at 1335–36.

247. *Id.* at 1333 (“A ‘method of preparation’ is treated no differently than any other process claim under our law.”).

248. *Id.*

249. *Id.*

250. *See id.* at 1337.

251. *Id.* at 1338.

252. *Id.*

no inventive concept beyond the discovery of nature itself, the patents should have failed step two of the *Mayo/Alice* test and consequently been ruled invalid. The majority's opinion departs from Federal Circuit and Supreme Court precedent and makes patent protection of biomedical discoveries vulnerable to draftsman's art. In a world where bioengineered medical solutions are growing in prevalence,<sup>253</sup> the *Illumina* opinion could have a significant impact, providing protection to patents that should be invalidated under the *Mayo/Alice* framework.

Part V.A explains why the *Illumina* patents are directed towards a law of nature under step one of the *Mayo/Alice* test. Part V.B argues that a proper analysis of the *Illumina* patents under step two of the *Mayo/Alice* test results in a finding of patent ineligibility. The relevant patents use common separation techniques and add no inventive concept beyond the naturally occurring size difference between different types of DNA. Part V.C discusses the impact the *Illumina* holding will have on the future of § 101 validity.

#### A. *The Relevant Patents Are Directed Towards a Law of Nature Under Step One of the Mayo/Alice Test*

Under step one of the *Mayo/Alice* test, *Illumina* and *Sequenom's* patents are "directed to a patent-ineligible concept"<sup>254</sup>—the naturally occurring size difference between extracellular fetal DNA and extracellular maternal DNA. The '751 and '931 Patents are not shy about their inventive bases. Both claim that research has "shown that, surprisingly, the majority of the circulatory extracellular fetal DNA has a relatively small size of approximately 500 base pairs or less, whereas the majority of circulatory extracellular maternal DNA in maternal plasma has a size greater than approximately 500 base pairs."<sup>255</sup> The patents later confirm natural law as the crux of their claims by stating that it was "[t]his surprising finding [that] forms the basis of the present invention."<sup>256</sup>

Previous case law requires a finding in *Illumina* that the patents are directed towards natural law under step one of *Mayo/Alice*. As with the claims in *Genetic Technologies*, *Mayo*, and *Ariosa*, the claims of the relevant patents in *Illumina* focus on newly discovered information about human biology.<sup>257</sup> The beginning and end products of claim one in the '751 and '931 Patents are both naturally occurring phenomena and thus demonstrate that the patents involve a claim of natural law.<sup>258</sup>

The majority's emphasis on the enriched nature of the end product was misguided. Isolation of biological material to a nonnaturally occurring level does not make a patent any less directed towards a law of nature. Although the *Illumina* majority quoted a

253. See *Athena Diagnostics, Inc. v. Mayo Collaborative Servs., LLC* ("*Athena IP*"), 927 F.3d 1333, 1356 (Fed. Cir. 2019) (per curiam).

254. *Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208, 218 (2014).

255. U.S. Patent No. 9,580,751 col. 1 ll. 56–61 (issued Feb. 28, 2017); U.S. Patent No. 9,738,931 col. 2 ll. 1–6 (issued Aug. 22, 2017).

256. '751 Patent col. 2 ll. 1–2; '931 Patent col. 2 ll. 13–14.

257. See *Genetic Techs. Ltd. v. Merial L.L.C.*, 818 F.3d 1369, 1376 (Fed. Cir. 2016).

258. See *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371, 1378 (Fed. Cir. 2015) ("Where claims of a *method patent* are directed to an application that starts and ends with a naturally occurring phenomenon, the patent fails to disclose patent eligible subject matter . . ." (emphasis added)).

lengthy passage from *Association for Molecular Pathology v. Myriad Genetics, Inc.*, it seemingly forgot a main conclusion of that holding: isolation of genetic material from its surrounding environment is not enough to make that isolated material patent eligible under § 101.<sup>259</sup> Indeed, the *Myriad* passage quoted by the majority would have been better used as a guide in analyzing the claims under step two of the *Mayo/Alice* framework, rather than a justification of the majority's step one conclusion.<sup>260</sup> *Myriad*'s language about "innovative method[s]" and whether processes are "well understood, widely used, and fairly uniform" concerns *Mayo/Alice*'s step two "conventional activity" inquiry, not step one's "directed to" evaluation.<sup>261</sup>

Judge Lourie's reasoning in his *Illumina* opinion is reminiscent of his earlier *Myriad* opinion which was later reversed by the Supreme Court.<sup>262</sup> In *Myriad*, he reasoned that the act of severing chemical bonds when isolating DNA segments was sufficient to create a nonnaturally occurring molecule.<sup>263</sup> In rebuffing his argument, the Supreme Court made clear that accepting such a premise would be to grant the company the exclusive right to isolate relevant gene segments.<sup>264</sup> And yet, in *Illumina*, Judge Lourie found patentees' use of common techniques to separate DNA types sufficient to create a nonnaturally occurring "enriched mixture," granting Illumina and Sequenom the exclusive right to isolate cell-free fetal DNA.

The majority's repeated assertion that the size thresholds were "human-engineered"<sup>265</sup> has no bearing on whether the claims are directed towards natural law. The fact that a scientist determined that 500 base pairs was the optimal discrimination length to separate fetal from maternal DNA does not bring the invention outside the realm of natural law. The case law supports this argument. Human-calculated alarm limits in *Parker v. Flook* did not detract from the fact that the patent required the Arrhenius equation in making those calculations.<sup>266</sup> Human-calculated correlations derived from statistical research between the level of MPO detected and the magnitude of an individual's cardiovascular risk did not suddenly make the *Cleveland Clinic Foundation v. True Health Diagnostics LLC* patent any less dependent on natural, biological relationships.<sup>267</sup> To find that Illumina and Sequenom's patents focus on "human-engineered" parameters instead of the underlying natural occurrence of size

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259. *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576, 596 (2013).

260. *See Illumina, Inc. v. Ariosa Diagnostics, Inc.*, 967 F.3d 1319, 1327 (Fed. Cir. 2020) ("Had Myriad created an *innovative method* of manipulating genes . . . it could possibly have sought a method patent. But the processes used by Myriad to isolate DNA . . . were *well understood, widely used, and fairly uniform* insofar as any scientist engaged in the search for a gene would likely have utilized a similar approach . . ." (emphasis added) (internal quotation marks omitted) (quoting *Myriad*, 569 U.S. at 595–96)).

261. *See Vanda Pharms. Inc. v. W.-Ward Pharms. Int'l Ltd.*, 887 F.3d 1117, 1142 (Fed. Cir. 2018) (Prost, C.J., dissenting) (stating that discussions regarding process steps that surround the natural law relevant to a patent are better analyzed under the second step of the *Mayo/Alice* framework, not the first step).

262. *See Myriad*, 569 U.S. at 593.

263. *Id.* at 587.

264. *Id.* at 585.

265. *See, e.g., Illumina*, 967 F.3d at 1328 ("Thus, the claims are directed to a human-engineered method rather than the natural size distributions of cell-free DNA.").

266. *See Parker v. Flook*, 437 U.S. 584, 594 (1978).

267. *See Cleveland Clinic Found. v. True Health Diagnostics LLC*, 859 F.3d 1352, 1355, 1361–63 (Fed. Cir. 2017).

differences is to make patent eligibility “depend simply on the draftsman’s art without reference to the . . . prohibition against patents for [natural laws]”—a practice the Supreme Court explicitly and repeatedly rejected.<sup>268</sup>

Finally, the majority made a false analogy to *Rapid Litigation Management, Ltd. v. CellzDirect, Inc.*<sup>269</sup> Judge Lourie was correct in asserting that the inventors in *CellzDirect* claimed a specific method of cryopreservation which exploited a liver cell’s ability to survive freezing temperatures.<sup>270</sup> The analogy turned sour in the majority’s equating of *CellzDirect*’s specific method claims to Illumina and Sequenom’s broad claims of an enriched mixture. The *CellzDirect* patent was explicit in its statement of invention: “the invention concerns *methods of processing preparations of cells*, especially hepatocytes, so as to permit their *repeated* cryopreservation and thawing while retaining substantial viability.”<sup>271</sup>

Conversely, the Illumina and Sequenom patents do not articulate the inventive concept to be a method of separation.<sup>272</sup> Instead, their emphasis on invention is in relation to the product—“a fraction of a sample of the blood plasma or serum . . . consist[ing] of DNA comprising 500 base pairs or less” that “can be brought about by a variety of [size separation] methods.”<sup>273</sup> It is clear the substance of the relevant patents are not directed towards a specific separation technique, but instead an enriched mixture of biological material, attained through any separation method which utilizes nature’s size differential between DNA types.<sup>274</sup> The patents must be read as directed to natural law.

#### B. *The Relevant Patents Contain No Inventive Concept Under Step Two of the Mayo/Alice Framework*

The Illumina and Sequenom patents do not disclose any new or inventive size-discrimination techniques in their proposed separation of DNA types. Instead, the patents broadly claim any separation “brought about by a variety of methods.”<sup>275</sup> The listed methods—which are bookended with “including but not limited to” and “and the like”<sup>276</sup>—merely state “‘well-understood, routine, conventional activity’ already engaged in by those in the field.”<sup>277</sup> Such a restatement of known principles cannot

268. *Mayo Collaborative Servs. v. Prometheus Lab’ys, Inc.*, 566 U.S. 66, 72 (2012) (alteration in original) (internal quotation marks omitted) (quoting *Parker*, 437 U.S. at 593).

269. *See Illumina*, 967 F.3d at 1328.

270. *See id.*

271. U.S. Patent No. 7,604,929 col. 4 ll. 12–15 (issued Oct. 20, 2009) (emphasis added). It is important that the *CellzDirect* patent emphasized repetition of freezing cycles in its statement of invention. Before then, repeated freeze cycles had not been employed. *See Rapid Litig. Mgmt. Ltd. v. CellzDirect, Inc.*, 827 F.3d 1042, 1045 (Fed. Cir. 2016) (stating that “prevailing wisdom was that hepatocytes could be frozen only once and then had to be either used or discarded”).

272. *See U.S. Patent No. 9,580,751 col. 2 ll. 31–38* (issued Feb. 28, 2017).

273. ’751 Patent col. 2 ll. 31–32, 35–36, 50–51.

274. *Cf. CellzDirect*, 827 F.3d at 1049 (stating that it was the claimed process’s involvement of *multiple* freeze-thaw cycles and pooling from various donors that yielded a focus not on a law of nature but on a unique and inventive process).

275. ’751 Patent col. 2 ll. 50–51.

276. *Id.* col. 2 ll. 51, 67.

277. *Genetic Techs. Ltd. v. Merial L.L.C.*, 818 F.3d 1369, 1377 (Fed. Cir. 2016) (quoting *Mayo Collaborative Servs. v. Prometheus Lab’ys, Inc.*, 566 U.S. 66, 73 (2012)).

constitute an “inventive concept” under step two of the *Mayo/Alice* framework. The Federal Circuit affirmed this understanding in its statement that standard techniques performed in standard ways to observe natural law require a finding of § 101 invalidity under *Mayo/Alice*.<sup>278</sup>

Here, Illumina and Sequenom’s use of standard size-discrimination techniques to separate the “surprising finding”<sup>279</sup> of DNA size differentials cannot suffice as the patents’ inventive concepts. Because the patents are directed towards a natural phenomenon and no other inventive concept is present in the claims, Illumina and Sequenom’s patents should have been found invalid. Thus, the Federal Circuit should have affirmed the district court’s ruling.

### C. *Impact of Illumina, Inc. v. Ariosa Diagnostics, Inc.*

The court’s decision in *Illumina* will impact patent prosecution and litigation practices in the United States. In fact, the holding of *Illumina* is already being relied upon by district courts to analyze § 101 patentability under the *Mayo/Alice* framework.<sup>280</sup> The majority’s opinion has breathed new life into the patentability of diagnostic and detection patents—subject matter previously considered per se unpatentable.<sup>281</sup> Now, the patentability of a diagnostic patent will depend not on the substance of a claim but rather the ability of draftsmen to phrase disclosures in a manner that characterizes inventions as “methods of preparation.”

For example, the invalidated patent in *Genetic Technologies Ltd. v. Merial L.L.C.* could have been saved by recharacterizing its claims not as a method for detection but as a method for preparation of amplified genomic DNA in noncoding regions.<sup>282</sup> What once was a patent directed towards ineligible subject matter suddenly becomes directed towards a patent eligible method of preparation under the *Illumina* opinion.

*Illumina* itself demonstrates this danger perfectly. The patents do not disclose a different or innovative separation technique; instead, they claim protection of the “variety of methods” already practiced in the field of science.<sup>283</sup> No new mechanism to separate types of DNA has been provided to the public; the only inventive concept disclosed in return for patent protection is the natural-law discovery. The claims are so abstract and sweeping that they wholly preempt separation of fetal and maternal DNA.<sup>284</sup>

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278. *Athena Diagnostics, Inc. v. Mayo Collaborative Servs., LLC*, 915 F.3d 743, 754 (Fed. Cir. 2019).

279. ’751 Patent col. 2 l. 1.

280. *See, e.g., Natera, Inc. v. ArcherDX, Inc.*, No. 20-125-LPS, 2020 WL 6043929, at \*5 (D. Del. Oct. 13, 2020) (stating that “if the claim at issue in *Illumina* was patent eligible, the claim being challenged here today also must be patent eligible”), *aff’d sub nom. Ameranth, Inc. v. Olo Inc.*, No. 2021-1211, 2021 WL 4699180 (Fed. Cir. Oct. 8, 2021); *Abbott Lab’s v. Grifols Diagnostic Sols. Inc.*, No. 19 C 6587, 2020 WL 7042891, at \*6 (N.D. Ill. Dec. 1, 2020) (invoking *Illumina* in its characterization of the patent’s claim as directed towards a *method of preparation*, not a natural phenomenon, and therefore escaping step two of *Mayo/Alice*).

281. *See, e.g., Athena Diagnostics, Inc. v. Mayo Collaborative Servs., LLC (“Athena IP”)*, 927 F.3d 1333, 1351–52 (Fed. Cir. 2019) (per curiam) (Chen, J., concurring with denial of the petition for rehearing en banc) (“[T]he claims here [directed to methods for diagnosing medical conditions] can[not] withstand *Mayo*’s scrutiny. . . . The most recent Supreme Court opinions are clear . . . on how to address claims like *Athena*’s.”).

282. *Cf. Genetic Techs.*, 818 F.3d at 1372–73.

283. *See U.S. Patent No. 9,580,751 col. 2 ll. 50–51* (issued Feb. 28, 2017).

284. *See Gottschalk v. Benson*, 409 U.S. 63, 71–72 (1972).

If left uncorrected by the Supreme Court<sup>285</sup> or Congress, *Illumina*'s holding will usher in an era of monopolization of biological relationships and discoveries of the human anatomy. Such an era would go directly against decades of case law which consistently cautioned against finding validity based upon draftsman's art.<sup>286</sup>

Important to mention is what this Note does *not* argue. It offers no analysis on whether the *Mayo/Alice* test is still appropriate in light of recent advances,<sup>287</sup> nor does it attempt to debate whether conventional applications to discoveries like DNA size differences should be patentable. But—assuming *Mayo/Alice* is no longer a useful tool of analysis in light of today's advancements in technology, or that applications of discoveries like DNA size differences should be patentable to encourage innovation—the required changes to § 101 patentability jurisprudence cannot come from the Federal Circuit. Abrupt changes to the interpretation of *Mayo/Alice* and what is inventive must come from Congress or the Supreme Court.

## VI. CONCLUSION

*Illumina*'s decision that “methods of preparation” patents are not directed towards laws of nature under step one of the *Mayo/Alice* framework goes against § 101 patentability jurisprudence and conflates the analyses of steps one and two. *Illumina*'s holding will lead to more drafters, seeking to claim protections on newly discovered natural phenomena, characterizing patent claims as methods of preparation. By doing so, an effective workaround to the *Mayo/Alice* framework has been established: characterize the patent similar to *Illumina*'s claims, and step two of the *Mayo/Alice* framework will not be engaged. Inventors will no longer need to provide society with sufficiently inventive processes outside of those techniques already known in their field of study; instead, the natural-law discovery itself can serve as the patent's inventive basis.

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285. The Supreme Court would not be able to correct *Illumina* directly as the time period for parties to petition the Court has elapsed. As such, the Court's only course of action to correct the newly created “method of preparation” category is by taking up a future case that is decided using similar reasoning as the *Illumina* majority.

286. See, e.g., *Parker v. Flook*, 437 U.S. 584, 593 (1978) (“It would make the determination of patentable subject matter depend simply on the draftsman's art and would ill serve the principles underlying the prohibition against patents for ‘ideas’ or phenomena of nature.”); *Diamond v. Diehr*, 450 U.S. 175, 191–92 (1981) (“[I]nsignificant post-solution activity will not transform an unpatentable principle into a patentable process. To hold otherwise would allow a competent draftsman to evade the recognized limitations on the type of subject matter eligible for patent protection.” (citation omitted)); *Mayo Collaborative Servs. v. Prometheus Lab'ys, Inc.*, 566 U.S. 66, 77 (2012) (“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.”).

287. See, e.g., Kristy J. Downing, *Patent Eligibility's Doctrinal Exclusions . . . Lately, a Scary Movie Too Difficult To Watch: Concrete Solutions and Suggestions*, 22 MARQ. INTELL. PROP. L. REV. 231, 261–78 (2018) (discussing how the *Mayo/Alice* standard is not an appropriate test for § 101 eligibility, especially in light of human advances and the judiciary's inability to fit those advances into the vague prongs of the *Mayo/Alice* test).