BROADLY UNPATENTABLE: HOW BROAD METHOD CLAIMS HAVE LIMITED PATENTABILITY OF DIAGNOSTIC INVENTIONS

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Diagnostic tests are often patented using broad method claims, which allow inventors to secure the greatest possible protection for their inventions. However, several recent Supreme Court and Federal Circuit cases invalidated broad diagnostic method claims under 35 U.S.C. § 101, holding that the claims were directed to unpatentable abstract ideas, natural laws, or natural phenomena. In light of these decisions, the continued patentability of diagnostic inventions has been called into question. However, this Note argues that these invalidations were partially due to the breadth of the claims at issue and that diagnostic inventions may still survive § 101 challenges if they are claimed narrowly using machine, manufacture, or composition of matter claims rather than or in addition to method claims. Additionally, this Note endorses Judge Timothy B. Dyk's proposal for allowing patenting of diagnostic inventions that use conventional laboratory steps to detect novel analytes so long as the claims are narrowly tailored and actually reduced to practice.

INTRODUCTION

Recent Supreme Court and Federal Circuit cases invalidated several diagnostic method claims as being directed to unpatentable subject matter under 35 U.S.C. § 101, the federal statute that specifies which types of inventions can be claimed in a utility patent.[1] Specifically, the courts held that these diagnostic claims inappropriately attempted to monopolize the use of abstract ideas, natural phenomena, or natural laws such as: the relationship between the dose of a drug given to a patient

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1. 35 U.S.C. § 101 (2012) (defining the four categories of subject matter that can be patented using utility patents: processes, machines, manufactures, and compositions of matter). Process patents are frequently referred to as "method patents." See, e.g., 1 Ernest Bainbridge Lipscomb, III, Patent Claims § 6:1, at 231–32 (2017–2018 ed. 2017) ("The statutory definition making process, art and method equivalent to each other is a codification of doctrines enunciated in decisions of adjudicated cases."). For purposes of § 101 analysis, a process or method is defined as "a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing." Cochrane v. Deener, 94 U.S. 780, 788 (1876).

and the concentration of that drug's metabolites in the patient's blood;[2] the relationship between a patient's forehead temperature and core body temperature;[3] and the relationship between fetal DNA sequences and the characteristics of a fetus.[4] These court decisions have resulted in concern over the future of diagnostic research.[5] While some welcome stricter standards for diagnostic patents,[6] others fear that reducing patent protection for diagnostic inventions threatens the future of medical diagnostic innovation by removing an important incentive for invention.[7]

Utility patents protect the functionality of a claimed invention and can be granted for inventions that constitute a machine, manufacture, composition of matter, or process.[8] However, the Supreme Court has ruled that patents that claim "laws of nature, natural phenomena, and abstract ideas"—what this Note calls judicial exception subject matter—are invalid under 35 U.S.C. § 101.[9] These limitations are designed to prevent inventors from monopolizing subject matter that belongs to "the storehouse of knowledge of all men."[10] Essentially, the Court's concern is that allowing patents to monopolize the basic building blocks of

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2. Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66, 72 (2012).

3. Exergen Corp. v. Thermomedics, Inc., 132 F. Supp. 3d 200, 202–03 (D. Mass. 2015), aff'd sub nom. Exergen Corp. v. Sanomedics Int'l Holdings, Inc., 653 F. App'x 760, 760 (Fed. Cir. 2016) (mem.) (per curiam).

4. Ariosa Diagnostics, Inc. v. Sequenom, Inc. (*Sequenom I*), 788 F.3d 1371, 1373 (Fed. Cir. 2015).

5. See John R. Thomas, Cong. Research Serv., R42815, *Mayo v. Prometheus*: Implications for Patents, Biotechnology, and Personalized Medicine 2–3 (2012), https://fas.org/sgp/crs/misc/R42815.pdf [https://perma.cc/B6UX-M9NC]; Joseph P. Valentino, Medical Diagnostic Tests—Are They Patentable? Don't Count on It, Fish & Richardson: Patent Blog (Aug. 27, 2016), https://www.fr.com/fish-patent/medical-diagnostic-tests-are-they-patentable-dont-count-on-it/ [http://perma.cc/4ZKW-E4AT0].

6. See, e.g., Note, Diagnostic Method Patents and Harms to Follow-on Innovation, 126 Harv. L. Rev. 1370, 1370–71 (2013) [hereinafter Diagnostic Method Patents and Harms] (explaining that granting patent rights to broad diagnostic method claims will limit future innovation).

7. See, e.g., Alison M. Hill, Comment, Ambiguous Regulation and Questionable Patentability: A Toxic Future for In Vitro Companion Diagnostic Devices and Personalized Medicine?, 2013 Wis. L. Rev. 1463, 1463–67 ("Meanwhile, a recent United States Supreme Court decision threatens to eliminate the promise of patents on diagnostic devices, thereby eliminating the requisite incentive to invest in research and development.").

8. See 35 U.S.C. § 101 (2012) (granting utility patent protection to machines, manufactures, compositions of matter, and processes); U.S. Patent & Trademark Office, Manual of Patent Examining Procedure § 1502.01 (rev. ed. 2015), https://mpep.uspto.gov/RDMS/MPEP/current#/current/d0e150263.html [https://perma.cc/JF9Y-R8HC] (explaining the differences between utility and design patents).

9. See Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66, 70 (2012) (stating that 35 U.S.C. § 101 contains "an important implicit exception" prohibiting patenting of laws of nature, natural phenomena, and abstract ideas).

10. Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948) ("The 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. They are manifestations of laws of nature, free to all men and reserved exclusively to none.").

invention will slow the progress of science and therefore work counter to the ultimate goal of the constitutional grant of patent protection.[11]

Despite the recent string of cases invalidating diagnostic claims under § 101, patents that apply judicial exception subject matter can be valid if they do not improperly attempt to monopolize that subject matter.[12] The Supreme Court has established a two-part test—the *Mayo* test—to determine whether inventions relying on judicial exception subject matter are patent-eligible applications of a natural phenomenon, law of nature, or abstract idea.[13] Under the *Mayo* test, a court must first determine whether the patent claims are directed to one of the judicial exceptions.[14] If so, the court must then consider whether the elements of the patent claims transform the unpatentable subject matter into patentable subject matter.[15] While this test purports to allow for the patenting of inventions that apply judicial exception subject matter, it has been used repeatedly to invalidate claims for truly innovative diagnostic inventions.[16] Indeed, Federal Circuit judges have criticized the *Mayo* test's effects even while using it to invalidate patent claims.[17]

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11. See U.S. Const. art. I, § 8, cl. 8 ("To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writing and Discoveries."); see also Bilski v. Kappos, 561 U.S. 593, 649 (2010) (Stevens, J., concurring in the judgment) (explaining that laws of nature, natural phenomena, and abstract ideas are not patentable because such patents "would stifle the very progress that Congress is authorized to promote").

12. See Parker v. Flook, 437 U.S. 584, 590 (1978) ("Yet it is equally clear that a process is not unpatentable simply because it contains a law of nature or a mathematical algorithm.").

13. See *Mayo*, 566 U.S. at 77–80.

14. See id. at 77 (analyzing whether the claim at issue is directed toward a law of nature).

15. See id. ("The question before us is whether the claims do significantly more than simply describe these natural relations. . . . [D]o the patent claims add *enough* to their statements of the correlations to allow the processes they describe to qualify as patent-eligible processes that *apply* natural laws?").

16. See, e.g., *Sequenom I*, 788 F.3d 1371, 1377–78 (Fed. Cir. 2015) (invalidating claims for a noninvasive method of detecting chromosomal anomalies in a fetus); see also infra section II.B.

17. See Ariosa Diagnostics, Inc. v. Sequenom, Inc. (*Sequenom II*), 809 F.3d 1282, 1287 (Fed. Cir. 2015) (Lourie, J., concurring in the denial of the petition for rehearing en banc) (per curiam) (agreeing that the panel properly followed *Mayo*, but noting that "it is unsound to have a rule that takes inventions of this nature out of the realm of patent-eligibility on grounds that they only claim a natural phenomenon plus conventional steps, or that they claim abstract concepts"); id. at 1289 (Dyk, J., concurring in the denial of the petition for rehearing en banc) ("But, as I see it, there is a problem with *Mayo* insofar as it concludes that inventive concept cannot come from discovering something new in nature—*e.g.*, identification of a previously unknown natural relationship or property."); *Sequenom I*, 788 F.3d at 1380 (Linn, J., concurring) ("In my view, the breadth of the second part of the [*Mayo*] test was unnecessary to the decision reached in *Mayo*. This case represents the consequence—perhaps unintended—of that broad language in excluding a meritorious invention from the patent protection it deserves . . . .").

This Note argues that the recent increase in invalidation of diagnostic method claims is partially due to the well-established practice of claiming diagnostic inventions using broad method claims,[18] rather than because the inventions themselves are unpatentable subject matter under 35 U.S.C. § 101. Part I of this Note discusses the requirements of patentable subject matter under § 101, including the requirements of the *Mayo* test. It additionally presents an overview of modern diagnostic tests in order to provide perspective on the importance of diagnostic patents. Part II highlights the common patent prosecution strategy of patenting diagnostic inventions using broad method claims, which in turn has contributed to the Supreme Court's recent invalidation of diagnostic claims under § 101. Part III proposes patent prosecution strategies that may help ensure patent validity under § 101. Additionally, it analyzes a proposal for how to change the current § 101 framework to increase the patentability of important diagnostic inventions without granting patent protection to overbroad claims that could hinder future innovation.

I. DIAGNOSTIC DEVICES AND PATENTABILITY

This Part provides an overview of the legal status of diagnostic method patents. Specifically, section I.A will present an overview of the subject matter requirements for patentability under 35 U.S.C. § 101. Section I.B will provide an overview of modern diagnostic tests in order to demonstrate why diagnostic patent rights are important.

A. *Patentable Subject Matter*

Under 35 U.S.C. § 101, only inventions that constitute a machine, manufacture, process, or composition of matter can be claimed in a utility patent.[19] This section discusses the limitations § 101 places on what can receive utility patent protection. Section I.A.1 discusses the four categories of patentable subject matter listed in § 101. Section I.A.2 provides an overview of the judicial exceptions to patentable subject matter, which further limit the types of inventions that can be claimed in a utility patent.

1. *Statutory Subject Matter.* — Utility patents provide limited monopolies to creators of functional inventions in exchange for public disclosure of the inventions.[20] In order for an invention to be eligible for patent protection, it must meet several statutory requirements. For example, the

18. For a discussion of broad method claims, see infra section II.A.1. Briefly, broad patents cover many variants of a given invention, increasing the chance that competing products will infringe the patent. See Robert P. Merges & Richard R. Nelson, On the Complex Economics of Patent Scope, 90 Colum. L. Rev. 839, 839–44 (1990).

19. 35 U.S.C. § 101 (2012).

20. See id. (requiring that inventions be "useful" in order to receive utility patent protection); id. § 112 (requiring that all patent applications contain a written description of the claimed invention in enough detail that the invention can be replicated by "any person skilled in the art to which [the patent] pertains").

invention must be novel—in other words, the invention cannot have been previously "described in a printed publication, or in public use, on sale, or otherwise available to the public."[21] Additionally, the invention cannot be obvious, which means an invention is not patentable if "the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious . . . to a person having ordinary skill in the art to which the claimed invention pertains."[22] Further, utility patents are granted only for inventions that constitute a manufacture, composition of matter, machine, or process;[23] inventions that cannot be claimed as one of these four subject matter categories cannot be patented under 35 U.S.C. § 101.[24]

To guide a § 101 analysis, the Supreme Court has developed definitions for each of the four statutory subject matter categories eligible for utility patent protection. First, the Court defines "manufacture" as "the production of articles for use from raw or prepared materials by giving to these materials new forms, qualities, properties, or combinations, whether by hand-labor or by machinery."[25] For example, a nanofiber mat used in a diagnostic device[26] could be patented as an article of manufacture because it consists of a polymer material that has been formed into fibers through a process called electrospinning.[27] Second, the Court defines "composition of matter" as "all compositions of two or more substances and . . . all composite articles, whether they be the results of chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids."[28] Thus, a fluorescent molecule used to visualize an analyte[29] can be claimed as a composition of matter because

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21. Id. § 102.

22. Id. § 103.

23. See id. § 101.

24. Ornamental designs, while not patentable under 35 U.S.C. § 101, can be patented using design patents under 35 U.S.C. § 171.

25. Diamond v. Chakrabarty, 447 U.S. 303, 308 (1980) (internal quotation marks omitted) (quoting Am. Fruit Growers, Inc. v. Brogdex Co., 283 U.S. 1, 11 (1931)).

26. Nanofibers are thin polymer fibers with diameters between one nanometer ($1x10^{9}$ meters) and one micrometer ($1x10^{-6}$ meters). See Lauren Matlock-Colangelo & Antje J. Baeumner, Recent Progress in the Design of Nanofiber-Based Biosensing Devices, 12 Lab on Chip 2612, 2612 (2012). They can be incorporated into diagnostic devices to allow for detection of a specific analyte or for improved sample concentration and purification. Id. at 2614–19.

27. See U.S. Patent No. 7,485,591 col. 5 l. 54–61 (claiming nonwoven electrospun nanofiber mats for use in diagnostic devices).

28. *Chakrabarty*, 447 U.S. at 308 (alteration in original) (internal quotation marks omitted) (quoting Shell Dev. Co. v. Watson, 149 F. Supp. 279, 280 (D.D.C. 1957)).

29. An analyte is the substance that is being detected or analyzed in a diagnostic test. See Steven A. Hardinger, Illustrated Glossary of Organic Chemistry, UCLA, http://www.chem.ucla.edu/~harding/IGOC/A/analyte.html [https://perma.cc/FXD4-GARQ] (last visited Oct. 18, 2018).

the molecule is the result of the union of different chemicals.[30] Third, the Court defines "machine" as "a concrete thing, consisting of parts, or of certain devices and combinations of devices."[31] Therefore, an apparatus used for detecting cancer in tissue cultures can be claimed as a machine.[32] Finally, the Court defines "process" as "a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing."[33] For example, the method of making nanofibers,[34] the method of making fluorescent materials,[35] and the method of cancer detection performed by the apparatus[36] can all be claimed as processes.

When assessing whether a utility patent claim is invalid, a court must first determine whether the claimed invention can be categorized as one of the four types of statutory subject matter.[37] For example, "transitory forms of signal transmission,"[38] companies,[39] and contractual agreements[40] are all inventions that cannot be patented with a utility patent because they do not constitute a machine, manufacture, composition of matter, or process. However, when diagnostic method claims are invalidated on § 101 grounds it is generally because the claims utilize subject matter that the courts have excluded from patent protection, not because the inventions cannot be classified as a machine, manufacture, composition of matter, or process.[41]

2. *Judicial Exceptions to Subject Matter.* — The standard for patentable subject matter set forth in 35 U.S.C. § 101 has been interpreted by the Supreme Court to additionally prohibit patenting of laws of nature, natural phenomena, and abstract ideas.[42] The policy behind these judicial exceptions to patentability is to keep the "basic tools" of scientific

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30. See U.S. Patent No. 9,085,728 col. 23 l. 50–52 ("A composition comprising a quantum dot fluorescent body which is dispersed in a concentration range of 0.01% by mass to 20% by mass in a cycloolefin (co)polymer.").

31. Burr v. Duryee, 68 U.S. (1 Wall.) 531, 570 (1863).

32. See U.S. Patent No. 3,789,832 col. 10 l. 53–col. 11 l. 12 (claiming an apparatus for analyzing a tissue sample).

33. Gottschalk v. Benson, 409 U.S. 63, 70 (1972) (internal quotation marks omitted) (quoting Cochrane v. Deener, 94 U.S. 780, 788 (1877)).

34. See U.S. Patent No. 9,370,096 col. 23 l. 31–47 (claiming a method for making conducting polymer nanofibers).

35. See U.S. Patent No. 5,194,300 col. 9 l. 45–52 (claiming "[a] method of forming a dyed microsphere").

36. See '832 Patent col. 9 l. 40–52 (claiming "[a] method for detecting cancer").

37. See In re Bilski, 545 F.3d 943, 950 (Fed. Cir. 2008) ("Whether a claim is drawn to patent-eligible subject matter under § 101 is a threshold inquiry, and any claim of an application failing the requirements of § 101 must be rejected . . . .").

38. In re Nuijten, 500 F.3d 1346, 1353 (Fed. Cir. 2007).

39. See In re Ferguson, 558 F.3d 1359, 1366 (Fed. Cir. 2009).

40. See id. at 1364.

41. See infra notes 42–44 and accompanying text.

42. See Diamond v. Diehr, 450 U.S. 175, 185 (1981).

and technological invention accessible to everyone.[43] Thus, even if an invention builds upon laws of nature, natural phenomena, or abstract ideas, it can be patented only so long as the patent does not prevent others from using the same laws of nature, natural phenomena, or abstract ideas.[44]

The current standard for evaluating the patentability of inventions claiming judicial exception subject matter was first articulated in the landmark case *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*[45] In *Mayo*, the Court looked at patents claiming a method of evaluating a patient's response to thiopurine drugs, which are used to treat autoimmune diseases.[46] In evaluating whether the patent "pre-empt[ed] the use of a natural law," the Court looked at whether the invention contained an "'inventive concept,' sufficient to ensure that the patent in practice amount[ed] to significantly more than a patent upon the natural law itself."[47] Further, the Court presented a framework for determining whether a patent claims unpatentable judicial exception subject matter or a patentable application of judicial exception subject matter.[48] Under *Mayo*, a court must first assess whether the patent describes subject matter that constitutes a natural law, natural phenomenon, or abstract idea.[49] If so, the second *Mayo* step requires the court to look at whether the claims contain an "inventive concept" that transforms the judicial exception subject matter into something more than the natural law, abstract idea, or natural phenomenon.[50] Using this two-part test, the Court in *Mayo* ultimately invalidated the thiopurine method claims because the steps of the claimed processes were not inventive, but rather "well-understood, routine, conventional activity previously engaged in by researchers in the field."[51] The Court noted that the impetus behind invalidating the claims was to avoid "tying up the use of the underlying

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43. See Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66, 70–71 (2012) (quoting Gottschalk v. Benson, 409 U.S. 63, 67 (1972)). For example, while Sir Isaac Newton's discovery of the law of gravity was groundbreaking, it would not be patentable because gravity is a law of nature. See Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980).

44. See Alice Corp. v. CLS Bank Int'l, 134 S. Ct. 2347, 2358–59 (2014).

45. See 566 U.S. at 71–80.

46. See id. at 66, 72.

47. Id. at 72–73 (quoting Parker v. Flook, 437 U.S. 584, 594 (1978)).

48. See id. at 70–80.

49. Id. at 71.

50. Id. at 72–73 (quoting *Flook*, 437 U.S. at 594). The Court has not explicitly defined what constitutes a sufficient "inventive concept," stating that a patentable application of a natural law must contain "elements or a combination of elements, sometimes referred to as an 'inventive concept,' sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the natural law itself." Id. (quoting *Flook*, 437 U.S. at 594).

51. Id. at 73.

natural laws, inhibiting their use in the making of further discoveries."[52] The two-part test developed in *Mayo* was further clarified in *Alice Corp. v. CLS Bank International*.[53] In *Alice*, the petitioner owned patents that described a method of limiting "settlement risk" in financial transactions.[54] In evaluating the methods at issue, the Supreme Court applied the *Mayo* test to determine whether the patents claimed a valid application of the abstract idea of hedging against financial risk.[55] After confirming that the methods claimed were directed toward an abstract idea, the Court determined that the steps recited in the claims were not sufficiently inventive because they consisted of "generic computer implementation" of the abstract idea.[56] In invalidating the claim, the Court stated that unpatentable subject matter is not rendered patentable by claiming the abstract idea and then "adding the words 'apply it.'"[57]

Following *Mayo* and *Alice*, the Supreme Court and Federal Circuit have progressively narrowed the types of method claims that are patentable under 35 U.S.C. § 101.[58] In particular, diagnostic method claims have been increasingly invalidated because courts dismiss them as simply measuring and reporting natural phenomena.[59] Consequently, many legal scholars have begun to claim that diagnostic methods may be largely unpatentable.[60]

B. *Diagnostic Devices*

Perhaps the most familiar diagnostic test is the at-home pregnancy test, which has been widely available to the public since the 1970s.[61] However, diagnostic devices are critical to many industries other than

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52. Id.

53. See 134 S. Ct. 2347, 2355 (2014).

54. See id. at 2351–52.

55. Id. at 2355–60.

56. Id. at 2357.

57. Id. (quoting *Mayo*, 566 U.S. at 72).

58. See infra section II.B.

59. See Hallie Wimberly, Comment, The Changing Landscape of Patent Subject Matter Eligibility and Its Impact on Biotechnological Innovation, 54 Hous. L. Rev. 995, 997 (2017) ("The Federal Circuit case *Ariosa Diagnostics, Inc. v. Sequenom, Inc.* illustrates the current bleak landscape of patent protection for biotechnological inventions and highlights the judiciary's frustration with the high threshold set by the Supreme Court."); see also infra section II.B.

60. See, e.g., Rebecca S. Eisenberg, Diagnostics Need Not Apply, 21 B.U. J. Sci. & Tech. L. 256, 256–57 (2015) (saying that it is "increasingly clear" that most advances in diagnostic testing "lie outside the boundaries of patent-eligible subject matter"); Hill, supra note 7, at 1467 ("[T]he future of personalized medicine depends upon patent protection for diagnostic devices, yet the Court's arguably invalid application of the patentability standard in *Prometheus* threatens to preclude this protection.").

61. See A Timeline of Pregnancy Testing, Office of NIH History, https://history.nih.gov/exhibits/thinblueline/timeline.html [https://perma.cc/YKJ4-28AL] (last visited Oct. 18, 2018).

medicine. For example, diagnostic tests are used to assess food safety standards in factories,[62] monitor environmental pollutants,[63] and assist with national defense.[64] Though diagnostic tests vary in design, from simple paper-based lateral flow assays (LFAs)[65] to complex computer-automated assays,[66] every diagnostic test requires a sensing element, such as an antibody, that allows for the detection of the analyte of interest.[67] Additionally, every diagnostic test must utilize a signal transducer that produces a measurable or observable signal when the analyte binds or interacts with the sensing element.[68] For example, the at-home pregnancy test works by measuring an analyte called human chorionic gonadotropin (hCG), a hormone produced by pregnant women.[69] The pregnancy test sensing element consists of antibodies that have been immobilized on the surface of the test.[70] These antibodies selectively bind any hCG contained in a patient's sample, which immobilizes the hormone to allow for detection.[71] The bound hCG can then be visualized using the test's transduction element: a second set of antibodies that have been tagged with colored colloidal metal particles.[72] These transduction antibodies also bind to the immobilized hCG, and become visible to the

62. See generally Jeong-Yeol Yoon & Bumsang Kim, Lab-on-a-Chip Pathogen Sensors for Food Safety, 12 Sensors 10713 (2012) (analyzing microfluidic assays for the detection of different pathogens in food samples).

63. See Honglun Wang et al., Computer-Readable DNAzyme Assay on Disc for ppb-Level Lead Detection, 83 Analytical Chemistry 1557, 1557 (2011) (describing a diagnostic device for detecting lead in environmental samples).

64. See generally J. Justin Gooding, Biosensor Technology for Detecting Biological Warfare Agents: Recent Progress and Future Trends, 559 Analytica Chimica Acta 137, 137–38 (2006) (discussing the different diagnostic devices available for the detection of biological warfare agents).

65. Lateral flow assays, such as the at-home pregnancy test, consist of porous paper membranes through which a liquid sample can flow to facilitate detection of specific analytes. See generally Katarzyna M. Koczula & Andrea Gallotta, Lateral Flow Assays, 60 Essays Biochemistry 111 (2016) (describing the components and uses of LFAs).

66. See, e.g., Aries® *C. difficile* Assay (RUO), Luminex, https://www.luminexcorp.com/clinical/ruo-products/aries-c-difficile-assay-ruo/ [https://perma.cc/GN8J-J2AJ] (last visited Oct. 18, 2018) (describing an automated diagnostic test for a pathogen).

67. See Anthony P.F. Turner, Preface to Biosensors: Fundamentals and Applications, at v, v (Anthony P.F. Turner, Isao Karube & George S. Wilson eds., 1987). Common examples of sensing elements include antibodies, enzymes, and other biological molecules. Leland C. Clark, Jr., The Enzyme Electrode, *in* Biosensors: Fundamentals and Applications, supra, at 3, 11 (describing antibody and enzyme membranes for detection of different analytes). An analyte is the substance being measured or detected in a diagnostic test. See Hardinger, supra note 29.

68. See Turner, supra note 67, at v.

69. J.H.W. Leuvering et al., Sol Particle Immunoassay (SPIA), 1 J. Immunoassay 77, 77 (1980) (describing the design of the lateral flow pregnancy test).

70. Id.

71. Id.

72. Id.

naked eye when enough of the colloidal metal particles are present on the surface of the test.[73]

Much of modern diagnostic research is focused on optimizing diagnostic tests so that they are simpler, faster, and more affordable to run than conventional diagnostic tests. For example, many laboratories have created so-called "lab-on-a-chip" (LOC) devices that allow for sample concentration, purification, and analyte detection to be performed on a single, portable microfluidic device.[74] These devices are advantageous because they are largely self-contained, as opposed to conventional diagnostic tests, which often require multiple pieces of expensive laboratory equipment to run.[75] Another focus of diagnostic research is the development of complementary or companion diagnostic tests that can assess a patient's individualized response to medical treatment in realtime as the patient is receiving treatment.[76] For example, the diagnostic test at issue in *Mayo* measured the concentration of specific drug metabolites in a patient's blood stream in order to assess how well a patient was responding to a specific treatment.[77] Because the metabolite test could be rapidly performed using a simple blood draw, a doctor could quickly adjust the patient's drug dose based on how the patient metabolized the thiopurine drug.[78] Other personalized diagnostic tests assess a patient's individual risk of developing certain diseases, such as breast cancer, based on the patient's genome.[79] Often, complementary diagnostic and personalized diagnostic tests are innovative not because the steps of the tests are novel, or because the tests utilize specialized equipment, but rather because the analytes being measured are newly discovered.[80]

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73. Id.

74. See, e.g., Vijay Srinivasan et al., An Integrated Digital Microfluidic Lab-on-a-Chip for Clinical Diagnostics on Human Physiological Fluids, 4 Lab on Chip 310, 310–11 (2004).

75. See Amir M. Foudeh et al., Microfluidic Designs and Techniques Using Lab-on-a-Chip Devices for Pathogen Detection for Point-of-Care Diagnostics, 12 Lab on Chip 3249, 3250 (2012) (comparing lab-on-a-chip sensors to standard methods of pathogen detection, such as cell culture, polymerase chain reaction, and immunoassays, which require extensive equipment and many hours to perform).

76. See generally H. Scheerens et al., Current Status of Companion and Complementary Diagnostics, 10 Clinical Translational Sci. 84 (2017) (explaining that companion and complementary diagnostics can help doctors develop patient-specific treatment plans); Penn Center for Personalized Diagnostics, Penn Med., https://www.pennmedicine.org/departments-and-centers/center-for-personalized-diagnostics [https://perma.cc/P2VB-6282] (last visited Oct. 18, 2018) (describing the development of personalized treatments for cancer patients).

77. Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66, 73–74 (2012).

78. See id.

79. For example, the patents at issue in *In re BRCA1– & BRCA2–Based Hereditary Cancer Test Patent Litigation v. Ambry Genetics Corp.* described a method for detecting the BRCA DNA mutations that are associated with increased risk of breast cancer. See 774 F.3d 755, 757–58 (Fed. Cir. 2014).

80. See, e.g., *Sequenom II*, 809 F.3d 1282, 1289 (Fed. Cir. 2015) (Dyk, J., concurring in the denial of the petition for rehearing en banc) ("In my view, *Mayo* did not fully take into

Diagnostic tests, like pharmaceutical drugs, are regulated by the U.S. Food and Drug Administration (FDA)[81] and getting a diagnostic test to market is a time-consuming and expensive process.[82] Generally, patents are viewed as a necessary incentive to justify a company's significant investment in getting a diagnostic test through the FDA approval process.[83] Therefore, limiting the ability of a company to secure patent protection of its diagnostic inventions could profoundly affect that company's willingness or ability to invest significant time or money into the development of future inventions.

II. DIAGNOSTIC METHOD PATENT CLAIMS ARE OFTEN WRITTEN BROADLY, INCREASING THE RISK OF 35 U.S.C. § 101 INVALIDATIONS

This Part argues that, because the diagnostic method claims recently challenged in the Supreme Court and Federal Circuit were so broadly drafted, the courts have responded by further restricting what is considered patentable subject matter under § 101 in an effort to prevent preemption of judicial exception subject matter. Consequently, diagnostic tests that deserve patent rights are much less likely to be able to meet the rigors of the *Mayo* test despite the fact that they constitute new and useful subject matter deserving of patent protection.[84] Section II.A describes common patent prosecution strategies that have contributed to the invalidity of diagnostic patents. Section II.B provides a summary of recent diagnostic patent cases that invalidated method patents under § 101 despite the fact that the inventions claimed were truly innovative. This section also

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account the fact that an inventive concept can come not just from creative, unconventional application of a natural law, but also from the creativity and novelty of the discovery of the law itself.").

81. Medical Devices, FDA, https://www.fda.gov/MedicalDevices/default.htm [https://perma.cc/UDM9-2FCM] (last updated Nov. 7, 2018).

82. See, e.g., Cambridge Consultants, The Future of Diagnostics: A Consumer Driven World? The US Perspective 9 (2007), http://www.medevien.com/landing/pdfs/US_Diagnostics_Report.pdf [https://perma.cc/MD4G-U4ED] (stating that FDA approval for diagnostic tests can take three to five years); Public Hearing on Genetic Diagnostic Testing, USPTO (Mar. 9, 2012), https://www.uspto.gov/sites/default/files/aia_implementation/120309-genetic_transcript.pdf [https://perma.cc/NH58-S9PY] [hereinafter Marsh Testimony] (explaining that Myriad spent $500 million over seventeen years to research, develop, and commercialize one of their BRCA tests).

83. Marsh Testimony, supra note 82 ("Myriad would not have been able to make this capital investment without the promise of exclusive patent rights and then hoped for, but unknown, positive return on investment.").

84. See *Sequenom II*, 809 F.3d at 1289 (Dyk, J., concurring in the denial of the petition for rehearing en banc) (per curiam) ("[T]here is a problem with *Mayo* insofar as it concludes that inventive concept cannot come from discovering something new in nature . . . ."). Judge Dyk further proposed that the real problem with the claims invalidated in *Sequenom* was that the claims were written too broadly. See id. at 1293 ("But the major defect is not that the claims lack inventive concept but rather that they are overbroad.").

discusses how patent prosecution choices impacted these patent validity determinations.

A. *Patent Prosecution*

The scope of a patent is dictated by its claims, and therefore a patent covers only the subject matter it claims, not the entirety of the invention actually developed.[85] When interpreting a patent, courts look first to intrinsic evidence of a claim's meaning found in the language of the claim itself, the description of the invention contained in the specification section of the patent, and the prosecution history.[86] Thus, because the claim language and specification largely dictate the scope of the patent,[87] patent prosecutors must carefully draft the patent application to cover the subject matter most important to their clients. A competitor that creates a similar product to the claimed invention will only be liable for infringement if the patent actually claims the product the competitor has developed.[88] For example, in *Chef America, Inc. v. Lamb-Weston, Inc.*, the Federal Circuit looked at a patent claiming a new process for heating dough in an oven.[89] The patent claim at issue stated that the oven would "[heat] the resulting batter-coated dough to a temperature in the range of about 400° F. to 850° F."[90] The court stated that the question of whether the patent was infringed by a competitor's oven hinged on the meaning of this claim language.[91] The meaning of the claim, in turn, centered on whether it was the dough or the oven that needed to be heated to the specified temperature range.[92] Looking at the language of the claim, the court concluded that the use of the word "to" rather than the word "at"

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85. See Phillips v. AWH Corp., 415 F.3d 1303, 1312 (Fed. Cir. 2005) ("It is a 'bedrock principle' of patent law that 'the claims of a patent define the invention . . . .'" (quoting Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc., 381 F.3d 1111, 1115 (Fed. Cir. 2004))).

86. See id. at 1314–17. The terms used in patent claims are typically given their "ordinary and customary meaning" within the technological field covered by the invention. Id. at 1312–13. However, a patentee can choose to specifically define claim terms in a manner that differs from the ordinary meaning of the terms. Id. at 1316. Therefore, the specification section of a patent serves to clarify the specific words used in the claims. Id. The specification also provides a full written description of the invention that must be detailed enough to enable a person of ordinary skill in the art to make and use the claimed invention and therefore plays a critical role in claim construction analysis. Id. at 1316–17.

87. The prosecution history of a patent also plays a role in interpreting patent claims. Id. at 1317. However, "because the prosecution history represents an ongoing negotiation between the PTO and the applicant . . . it often lacks the clarity of the specification and thus is less useful for claim construction purposes." Id.

88. See Richard V. Burgujian et al., Practical Considerations and Strategies in Drafting U.S. Patent Applications, Finnegan (Apr. 2009), https://www.finnegan.com/en/insights/practical-considerations-and-strategies-in-drafting-u-s-patent.html [https://perma.cc/2XTV-BDB2].

89. 358 F.3d 1371, 1371–72 (Fed. Cir. 2004); see also Burgujian et al., supra note 88.

90. *Chef America*, 358 F.3d at 1371.

91. See id. at 1371, 1373.

92. Id. at 1373.

required that the dough be heated to at least 400 degrees.[93] Therefore, an oven that operated within the temperature range specified by the patent was found not to infringe the patent because the dough itself did not reach the temperature range.[94] The court noted that its claim interpretation applied even though heating the dough to the specified temperature range would be illogical, as it would burn the dough and make it inedible.[95]

Cases like *Chef America* illustrate the importance of a patent prosecutor's choices in how to word and construct patent claims. A patent prosecutor who wants to ensure complete coverage of her client's invention can include multiple claims in a single patent or write multiple patents claiming different components of the same invention. However, the more claims contained within a patent, the more expensive that patent is to prosecute.[96] And, of course, writing multiple patents requires paying all of the prosecution fees for each patent submitted to the United States Patent and Trademark Office (USPTO). Therefore, patent prosecutors must balance the cost of prosecuting a patent with the number and type of claims to include. For example, if a patent contains more than three independent claims,[97] the USPTO charges an additional $460 fee to prosecute the patent.[98] Similarly, the inclusion of a multiple dependent claim[99] in a patent

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93. Id. at 1372–73 ("[T]he claim requires 'heating the . . . dough to a temperature . . . of about 400° F. to 850° F.' These are ordinary, simple English words whose meaning is clear and unquestionable.").

94. Id. at 1375–76.

95. Id. at 1373–74 ("Rather, where as here, claims are susceptible to only one reasonable interpretation and that interpretation results in a nonsensical construction of the claim as a whole, the claim must be invalidated." (internal quotation marks omitted) (quoting Process Control Corp. v. Hydreclaim Corp., 190 F.3d 1350, 1357 (Fed. Cir. 1999))).

96. See USPTO Fee Schedule, USPTO, https://www.uspto.gov/learning-and-resources/fees-and-payment/uspto-fee-schedule [https://perma.cc/J9L8-ZB5M] [hereinafter USPTO Fee] (reflecting updates as of Oct. 1, 2018) (listing several additional fees charged for patents containing more than twenty claims).

97. An independent patent claim does not reference another claim in the patent. See U.S. Patent & Trademark Office, Manual of Patent Examining Procedure § 1824 (rev. ed. 2018), https://mpep.uspto.gov/RDMS/MPEP/current#/current/d0e169611.html [https://perma.cc/423L-NRBG] [hereinafter MPEP § 1824]. A dependent claim is one that references other claims in the patent. See id. Therefore, if claim 1 states "A chair with a rectangular back" and claim 2 states "The chair of claim 1 but with round legs," then claim 1 is an independent claim, whereas claim 2 is a dependent claim.

98. USPTO Fee, supra note 96 (listing fees as of Oct. 1, 2018).

99. A multiple dependent claim is a dependent claim that refers to more than one other claim in the patent. See MPEP § 1824, supra note 97. For example, a claim that states "A gadget as in claims 2 or 3, further comprising . . ." is a multiple dependent claim because it is necessary to refer to claims 2 *and* 3 to determine what the claim covers. See U.S. Patent & Trademark Office, Manual of Patent Examining Procedure § 608.01(n) (rev. 2015), https://mpep.uspto.gov/RDMS/MPEP/current#/current/d0e45256.html [https://perma.cc/4XQV-LH3U].

costs an extra $820 during prosecution.[100] Finally, the longer the patent, the more effort is required on the part of the attorney or patent agent drafting the patent, which will translate into increased fees unless a flat fee is charged for patent prosecution.[101] Even if a flat fee is involved, it is not an efficient use of a lawyer or patent agent's time to draft every conceivable claim that could relate to a client's invention.

To balance the need for comprehensive patent protection with the economic requirements of their clients, patent prosecutors have developed strategies to make their patents more effective and efficient. These strategies include: obtaining the broadest possible claims; strategically using the different § 101 subject matter categories to increase chances of infringement; and claiming inventions that have not yet been actually reduced to practice.

1. *Broad Versus Narrow Claims.* — Patent prosecutors often prefer broad patent claims over narrow claims because broad claims cover more variations of a given invention.[102] Generally, the less specific a claim is, the broader it will be.[103] This is desirable because competitors trying to make a similar product to the claimed invention will have more difficulty creating a product that doesn't infringe a broadly written claim.[104] While patents can be written to contain both broad and narrow claims,[105] economic and time considerations can limit the number of claims included in a patent.[106] Consequently, many attorneys choose to claim their clients'

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100. USPTO Fee, supra note 96.

101. Though patent lawyers can charge for their services using the conventional hourly rate model, alternative fee arrangements such as flat fee or contingency fee billing are common in patent prosecution. See, e.g., Alternative Fee Arrangements, Fish & Richardson, https://www.fr.com/alternative-fee-arrangements/ [https://perma.cc/5HMV-GY7S] (last visited Oct. 18, 2018) (describing alternative billing strategies, including a flat monthly fee, available at an intellectual property firm); Marla R. Butler, Move Over Billable Hour, There's a New IP Fee Arrangement in Town, Robins Kaplan LLP (Sept. 11, 2014), http://www.robinskaplan.com/resources/articles/move-over-billable-hour-theres-a-new-ip-fee-arrangement-in-town [https://perma.cc/Z8BF-RAXZ] (describing alternative fee arrangements available in an IP practice).

102. See Joseph E. Root, Rules of Patent Drafting: Guidelines from Federal Circuit Case Law 46–55 (2011) (discussing how to write claims to "ensure the broadest supportable scope").

103. See Corrine Langinier & GianCarlo Moschini, The Economics of Patents: An Overview 9 (Iowa State Univ. Ctr. for Agric. & Rural Dev., Working Paper 02-WP 293, 2002), https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1317&context=card_workingpapers (on file with the *Columbia Law Review*).

104. See Merges & Nelson, supra note 18, at 839–44.

105. Daniel A. Wilson, Narrow Patent Claims Can Have Broad Appeal, Bos. Bus. J. (July 25, 2005), https://www.bizjournals.com/boston/blog/mass-high-tech/2005/07/narrow-patent-claims-can-have-broad-appeal.html (on file with the *Columbia Law Review*).

106. See Cost-Effective Strategies for Patent Prosecution, McCarter & English Att'ys at Law, https://www.mccarter.com/Cost-Effective-Strategies-For-Patent-Prosecution-12-14-2010/ (on file with the *Columbia Law Review*) (last visited Oct. 18, 2018) (describing how the claim scope can be tailored to be more cost-effective).

inventions broadly, with the goal of efficiently protecting as much of their clients' IP rights as possible.[107]

While broadly claiming inventions is often a successful prosecution strategy, several recent cases rejecting diagnostic claims under § 101 have specifically noted that the claims they are invalidating were broadly drafted. For example, in *Sequenom*, the majority opinion stated that "[t]he dependent claims are broad examples of how to detect cffDNA in maternal plasma,"[108] while Judge Lourie's concurrence to the denial of rehearing en banc stated that the claims might be invalid "not because they recite natural laws or abstract ideas, but because they may be indefinite or too broad."[109] Similarly, in *In re BRCA1– & BRCA2–Based Hereditary Cancer Test Patent Litigation*, the court noted that "[c]laims 7 and 8 are significantly broader and more abstract" than the other claims in the patent before invalidating claims 7 and 8.[110] Finally, in *Parker v. Flook*, the Supreme Court noted that "the claims cover a broad range of potential uses of the method" and subsequently declared the subject matter at issue unpatentable.[111] Further, the Federal Circuit has explicitly indicated that it considers the breadth of claims when performing its § 101 subject matter analysis, stating that patents claiming judicial exception subject matter must have claims "tailored narrowly enough to encompass only a particular application of a fundamental principle rather than to pre-empt the principle itself."[112] Indeed, because broadly drafted claims are easier to infringe than narrow claims,[113] it follows that patents broadly claiming judicial exception subject matter are more likely to preempt said subject matter and thus be unacceptable under current § 101 case law. Therefore, it may no longer be desirable to draft diagnostic method claims as broadly as possible unless the patent also contains narrower, more specific claims.

2. *Choice of 35 U.S.C. § 101 Subject Matter.* — The scope of the subject matter covered by a patent can also be increased by claiming as many

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107. See, e.g., Quality Patents: Claiming What Counts, WIPO Mag., Jan.–Feb. 2006, at 17, 17, http://www.wipo.int/export/sites/www/wipo_magazine/en/pdf/2006/wipo_pub_121_2006_01-02.pdf [https://perma.cc/S5ST-EWWC] ("Most patent agents would prefer to draft claims that are as broad as possible to cover all aspects of the invention found in the detailed description, its equivalents or likely future versions."); Russ Krajec, Claiming Strategy: Broad or Narrow? Strategies Come Full Circle, Krajec Patent Offices, https://krajec.com/claiming-strategy-broad-or-narrow-strategies-come-full-circle/ [https://perma.cc/W6ZM-EGHA] (last visited Oct. 18, 2018) ("[B]ut I think a prudent strategy may be to write a very good specification, claim broadly, and use divisional applications as an insurance policy.").

108. *Sequenom I*, 788 F.3d 1371, 1378 (Fed. Cir. 2015).

109. *Sequenom II*, 809 F.3d 1282, 1285 (Fed. Cir. 2015) (Lourie, J., concurring in the denial of the petition for rehearing en banc) (per curiam).

110. 774 F.3d 755, 765 (Fed. Cir. 2014).

111. 437 U.S. 584, 586 (1978).

112. In re Bilski, 545 F.3d 943, 954 (Fed. Cir. 2008).

113. See supra note 104 and accompanying text.

different embodiments and variations of the invention as possible.[114] However, once again, efficiency concerns can limit the number and type of claims that can reasonably be included.[115] Therefore, it is sometimes necessary to claim an invention as only one of the four categories of § 101 subject matter. Generally, process patents provide broader patent protection than device claims,[116] which is likely why many diagnostic tests are claimed as methods rather than, or in addition to, as devices.[117] The breadth of process claims comes from the fact that the claims have fewer structural limitations than other claim types—that is, the claims are generally not restricted to a single physical embodiment of the invention claimed in the patent.[118] For example, a process patent claiming a method of measuring blood glucose[119] is infringed if each step of the patented method is performed by the infringing invention.[120] Therefore, an invention infringes a diagnostic method patent if it performs all of the claimed process steps, even if the infringing invention consists of different equipment or technology than the claimed invention. In contrast, a machine patent for a blood glucose monitoring system[121] can only be

114. See, e.g., Gene Quinn, Tricks & Tips to Describe an Invention in a Patent Application, IP Watchdog (Dec. 26, 2015), http://www.ipwatchdog.com/2015/12/26/tricks-tips-for-describe-an-invention-in-a-patent-application-2/id=64133/ [https://perma.cc/JR9U-JZUW] ("[T]ake care to appropriately describe the invention you have and the variations of that invention to create a buffer around the invention, a moat of protection that surrounds your innovation.").

115. See supra notes 96–101 and accompanying text.

116. See Steven Katz, Do's and Don'ts for Claim Drafting, Fish & Richardson P.C. 16, www.fr.com/files/Uploads/attachments/muenchen/presentation8.pdf [https://perma.cc/7BU4-KSLN] (last visited Oct. 18, 2018).

117. See, e.g., U.S. Patent No. 6,047,205 (containing method claims for detecting temperature); U.S. Patent No. 6,056,435 (containing both method and machine claims for temperature measurement). Indeed, many diagnostic patents include only method claims even though their specification sections describe how the claimed method can be incorporated into a test kit or device. See, e.g., U.S. Patent No. 5,695,930 col. 4 l. 23–42, col. 15 l. 26–col. 16 l. 56 (describing a test kit for detecting HIV but actually claiming only the method for HIV detection); U.S. Patent No. 7,439,026 col. 2 l. 30–44, col. 22 l. 38–col. 24 l. 27 (describing diagnostic kits in the specification but claiming only methods for performing the described assay).

118. See Katz, supra note 116, at 16.

119. See, e.g., U.S. Patent No. 5,971,922 col. 9 l. 61–col. 10 l. 17 (claiming a method for predicting blood glucose levels). Claim 2 of this patent is a method claim that contains no limitations on how the specific steps of the method are to be performed or which types of equipment must be used to perform the steps. See id. For example, one of the steps requires "preparing blood glucose level data" but does not specify how this should be done. See id. Therefore, this step would be infringed by an invention that prepares blood glucose level data, regardless of whether the data are prepared using the same equipment as the claimed invention.

120. See Muniauction, Inc. v. Thomson Corp., 532 F.3d 1318, 1328–29 (Fed. Cir. 2008).

121. See, e.g., U.S. Patent No. 4,953,552 col. 6 l. 28–54 (claiming a testing system comprising a patch, needle, electrodes, and display, which could therefore be infringed only by an invention containing components equivalent to the patch, needle, electrodes, and display).

infringed by a competitor's product that has structural equivalents of the specific technical components listed in the patent claims.[122]

Because machine or manufacture diagnostic claims are typically drafted more narrowly than diagnostic method claims, they seem to generally fare better during § 101 analysis.[123] For example, Exergen developed devices for measuring a patient's core temperature based on the patient's forehead temperature[124] and received several patents covering this invention, ranging from narrow device claims to broad method claims.[125] These claims have had varied success in court; many of Exergen's broad method claims have been invalidated under § 101, while some of its device claims and narrow method claims have been upheld.[126] Looking at the claims in U.S. Patent No. 7,787,938 (the '938 Patent) sheds light on the possible reason behind these different § 101 outcomes: Exergen's device claims are generally narrower in scope than their method claim counterparts.[127] Further, the method claims that have been upheld contain the same narrowing claim limitations found in the device claims.[128] Therefore, the well-established practice of claiming

122. See Frank's Casing Crew & Rental Tools, Inc. v. Weatherford Int'l, Inc., 389 F.3d 1370, 1378 (Fed. Cir. 2004) ("[L]iteral infringement requires that each and every limitation set forth in a claim appear in an accused product."). For a device to infringe an apparatus claim, the components of the infringing device must perform the same function performed by the equivalent component of the patented invention. See id.

123. Michael Cottler & David Zimmer, The CAFC Split Non-Precedential Decision in *Exergen v. Kaz* Raises Interesting Issues About Eligibility Determinations, IP Watchdog (Apr. 9, 2018), https://www.ipwatchdog.com/2018/04/09/cafc-split-non-precedential-decision-exergen-kaz-eligibility/id=95542/ [https://perma.cc/BC5z-HKPE] ("[C]ourts seem to uphold claims when they incorporate natural laws into specific devices, but not when they simply tell a practitioner to apply a natural law.").

124. Products, Exergen Corp., http://www.exergen.com/consumer-medical-products/product-info [https://perma.cc/BUZ3-9Y4S] (last visited Oct. 18, 2018).

125. See, e.g., U.S. Patent No. 5,012,813 (containing "radiation detector" machine claims); U.S. Patent No. 6,047,205 (containing method claims for detecting temperature); U.S. Patent No. 6,056,435 (containing both method and machine claims for temperature measurement).

126. Compare Exergen Corp. v. Sanomedics Int'l Holdings, Inc., 653 F. App'x 760, 761 (Fed. Cir. 2016) (upholding a district court's invalidation of method patents), with Exergen Corp. v. Kaz U.S.A., Inc. (*Kaz I*), 172 F. Supp. 3d 366, 371 (D. Mass. 2016) (finding a device patent valid under § 101).

127. Compare U.S. Patent No. 7,787,938 claim 51 (claiming a method of detecting human body temperature involving measuring temperature on the forehead and processing the measured temperature to yield body temperature), with id. claim 48 (claiming a body temperature detector that takes at least three radiation readings per second over an artery, and then processes the measured radiation to provide a body temperature).

128. The Federal Circuit recently upheld the validity of several device and method claims in the '938 Patent, as well as several claims from U.S. Patent No. 6,292,685, a related patent. See Exergen Corp. v. Kaz USA, Inc. (*Kaz III*), 725 F. App'x 959, 972 (Fed. Cir. 2018). The district court below found the claims patentable because they all contained a subset of three claim limitations that "transformed the underlying natural laws into inventive methods and useful devices": (1) moving the temperature reader while laterally

diagnostic inventions using method claims may inadvertently contribute to the § 101 invalidity of diagnostic claims simply by producing claims that are naturally broader than a similar device claim would be.

Further, even when method claims contain narrowing limitations, they may still be found unpatentable under § 101, suggesting that significant attention should be paid to the *types* of claim limitations that will render a diagnostic method claim patentable. As an illustration, claim 27 of the '938 Patent was found unpatentable even though it contained several limitations that narrowed the scope of the claim.[129] The claim covered:

> [A method of detecting human body temperature comprising, with a radiation detector, measuring radiation as target skin surface over an artery is viewed, the artery having a relatively constant blood flow, and electronically determining a body temperature approximation, distinct from skin surface temperature, from the radiation detector as the target skin surface over the artery is viewed;] wherein the body temperature approximation corresponds to an oral measurement.[130]

A Massachusetts court rejected this claim, stating that the limitation of the claim ("wherein the body temperature approximation corresponds to an oral measurement") did not prevent the claim from expressly claiming an unpatentable heat flow model used by the device.[131] Indeed, the court concluded that the limitation was itself directed to unpatentable subject matter consisting of the correlation between body temperature and oral temperature.[132] Finally, the court concluded that the claim was not valid despite limiting the temperature measurement to use of a radiation detector because "the recitation of a generic piece of equipment does not materially alter the validity analysis."[133] Thus, even somewhat

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scanning, (2) obtaining a peak temperature reading, and (3) obtaining at least three radiation readings per second. See id. at 964 (internal quotation marks omitted) (quoting Joint Appendix at 110, 113–14, *Kaz III*, 725 F. App'x 959 (2018) (Nos. 2016-2315, 2016-2341)). On the other hand, other method claims in the '938 Patent have been found unpatentable under § 101. See *Sanomedics*, 653 F. App'x at 761; Exergen Corp. v. Thermomedics, Inc., 132 F. Supp. 3d 200, 207–08 (D. Mass. 2015), aff'd sub nom. Exergen Corp. v. Sanomedics Int'l Holdings, Inc., 653 F. App'x 760, 760 (Fed. Cir. 2016) (mem.) (per curiam). These method claims were much broader than the method claims upheld in *Kaz III* because they lacked claim limitations restricting the method to a specific application. See, e.g., '938 Patent claim 51 (claiming "[a] method of detecting human body temperature comprising: measuring temperature of a region of skin of the forehead; and processing the measured temperature to provide a body temperature approximation based on heat flow from an internal body temperature to ambient temperature").

129. Exergen Corp. v. Kaz USA, Inc. (*Kaz II*), No. 13-10628-RGS, 2015 WL 8082402, at *5–6 (D. Mass. Dec. 7, 2015).

130. '938 Patent claim 27.

131. *Kaz II*, 2015 WL 8082402, at *5.

132. Id.

133. Id. at *6.

narrow method claims may fail under § 101 if the narrowing limitations are directed toward "generic piece[s] of equipment."[134]

The results in the Exergen cases indicate that the validity of diagnostic patents depends not only on the inventive merit of the diagnostic test claimed in the patent but also on *how* that test is claimed in the patent being challenged. It is possible that device claims are more likely to withstand § 101 scrutiny than method claims because diagnostic device claims tend to be less broad than diagnostic method claims. Alternately, it is possible that courts believe devices (even broadly claimed devices) generally present less of a preemption problem than methods because they are discrete and identifiable embodiments of the judicial exception subject matter.[135]

3. *Reduced to Practice.* — Patent prosecutors sometimes draft claims to cover more than the specific embodiment of the invention that has been actually reduced to practice, or built, by their clients.[136] Claiming more embodiments of an invention than have been currently developed allows the inventor to protect versions of the invention she may want to develop in the future.[137] This type of defensive claiming is possible because patent filers do not need to show that they have actually made an invention in order to patent it.[138] Instead, patent filers can demonstrate that they have invented the claimed invention simply by filing a patent application which describes the invention in sufficient detail that someone working

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134. See id.

135. One complaint the Federal Circuit and Supreme Court have against method claims is that they often utilize "well-understood, routine, and conventional activity" in order to detect novel analytes. See, e.g., *Sequenom I*, 788 F.3d 1371, 1378 (Fed. Cir. 2015). One possible concern with method claims that use conventional steps is that they, unlike device claims, are not restricted to one concrete application of the natural phenomenon used. For example, if a method claim requires a doctor to "perform DNA analysis," the court cannot identify exactly what DNA analysis method is envisioned by the patent. On the other hand, a device claim will necessarily have to explain what DNA analysis method can be performed by the device's hardware. See also Cottler & Zimmer, supra note 123 ("What could be driving cases like *CellzDirect* and *Exergen* is the court's sense that the additional claim limitations sufficiently narrow the claim to avoid monopolizing the natural phenomenon itself; courts seem to uphold claims when they incorporate natural laws into specific devices . . . .").

136. See Katz, supra note 116, at 36–37 ("There is likely considerable patentable subject matter around your 'core' technology.").

137. See Mark Jolly et al., Editorial, Ten Simple Rules to Protect Your Intellectual Property, PLOS Computational Biology, Nov. 2012, at 1, 2, https://journals.plos.org/ploscompbiol/article/file?id=10.1371/journal.pcbi.1002766&type=printable [https://perma.cc/BW47-6D3K] ("[T]he term 'defensive IP' has been used to describe IP obtained, not to stop other people from competing, but to stop a competitor from patenting something you may wish to use in the future.").

138. See U.S. Patent & Trademark Office, Manual of Patent Examining Procedure § 2138.05 (rev. ed. 2018), https://mpep.uspto.gov/RDMS/MPEP/current#/current/d0e207753.html [https://perma.cc/27Q3-C4AC] [hereinafter MPEP § 2138.05].

in the same technical field could build and use the claimed invention.[139] Filing a patent application is thus called "constructive reduction to practice" because the detailed description of the invention contained in the application demonstrates that the inventor has conceived of the invention.[140]

Because actual reduction to practice[141] of the invention is not required, patents can contain claims that describe specific iterations of the invention that the inventor predicts she or a competitor will physically build in the future.[142] This strategy, like broad claiming, allows a patent to more effectively keep competitors out of the marketplace by anticipating what types of inventions competitors will develop in the future and preemptively claiming, but not developing, them.[143] Specifically, constructive reduction to practice allows an inventor to block every variation of her invention that she can conceive of, which could effectively allow the inventor to monopolize a given field of research. For example, claim 5 of the '282 Patent at issue in *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*,[144] covers every DNA sequence at least fifteen nucleotides long that codes for part of the BRCA1 gene.[145] The short sequences of DNA claimed in the patent are used to develop synthetic DNA that detects the BRCA1 gene in patients.[146] As the *Myriad* Court pointed out, upholding claim 5 would grant Myriad an effective monopoly on BRCA1 detection because all tests for the mutation would need to use a DNA sequence coding for BRCA1.[147] Part of the reason why Myriad was able to write such a broad patent was that it did not have to actually reduce to practice each DNA sequence claimed in claim 5, a feat that would have been made difficult, if not impossible, by the fact that the BRCA1 mutation is over 80,000 base pairs long.[148] Thus, like overly

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139. See id.; see also 35 U.S.C. § 112(a) (2012) (describing the requirement that a patent contain a sufficient written description of the invention to enable a person of ordinary skill in the art to make and use the invention claimed in the patent).

140. See MPEP § 2138.05, supra note 138.

141. Actual reduction to practice occurs when the invention is actually made or when an inventive method or process is carried out. See Actual Reduction to Practice, Dawsey IP (Sept. 2002), https://www.invention-protection.com/actual-reduction-to-practice/ (on file with the *Columbia Law Review*).

142. See Jolly et al., supra note 137, at 2 ("[A] patent application may be filed . . . with no intention of ever enforcing it, simply because . . . it will anticipate the competitor's application.").

143. See id.

144. 569 U.S. 576 (2013).

145. U.S. Patent No. 5,747,282 col. 153 l. 66–67.

146. See *Myriad*, 569 U.S. at 583, 585.

147. See id. at 585–86 ("Myriad's patent would, if valid, give it the exclusive right to isolate an individual's BRCA1 and BRCA2 genes . . . [and] isolation is necessary to conduct genetic testing . . . .").

148. See Nat'l Insts. of Health, BRCA1 Gene, Genetics Home Reference, https://ghr.nlm.nih.gov/gene/BRCA1# [https://perma.cc/ST9U-L6N5] (last updated Oct. 18,

broad patent claims, allowing constructive reduction to practice also results in possibly improper preemption of judicial exception subject matter, such as the BRCA1 sequence.

Allowing for constructive reduction to practice has been criticized. In his concurrence to the *Sequenom* denial for rehearing en banc Judge Dyk proposed that the discovery of a new natural law should qualify as an inventive concept so long as claims are subjected to an actual reduction to practice requirement[149] in order to reduce the risk of the patent preempting future applications of the natural law.[150] He stated that:

> [I]f the breadth of the claim is sufficiently limited to a specific application of the new law of nature discovered by the patent applicant and reduced to practice, I think that the novelty of the discovery should be enough to supply the necessary inventive concept. My proposed approach would require that the claimed application be both narrow in scope and actually reduced to practice, not merely "constructively" reduced to practice by filing of a patent application replete with prophetic examples.[151]

Following Judge Dyk's logic, method patent claims would present less of a preemption risk if they were both narrowly claimed and actually developed prior to patenting. Because the main motivation behind § 101 judicial exception patent invalidations is preventing patents that would unfairly preempt an abstract idea, natural phenomenon, or natural law, requiring actual reduction to practice and narrowly drafted claims could eliminate concern over unfair monopolies of judicial exception subject matter. Similarly, at least one legal commentator advocates requiring actual reduction to practice as a way of preventing inventors from unfairly preempting subject matter that they do not plan to commercially develop.[152]

B. *Recent Decisions Invalidating Diagnostic Claims Under § 101*

Recent Supreme Court and Federal Circuit cases have invalidated several method claims describing truly innovative diagnostic tests. In each case, the invalidated claims were broadly written and therefore threatened to monopolize more than one specific embodiment of the test disclosed. Additionally, the invalidated claims were primarily method claims rather than machine or manufacture claims. Consequently, even though the courts' stated reasoning for invalidating the claims was because they

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2018) (stating that the mutation occurs from base pair 43,044,295 to base pair 43,125,482 on chromosome 17).

149. See supra note 141.

150. See *Sequenom II*, 809 F.3d 1282, 1291 (Fed. Cir. 2015) (Dyk, J., concurring in the denial of the petition for rehearing en banc) (per curiam).

151. Id.

152. See Christopher A. Cotropia, The Folly of Early Filing in Patent Law, 61 Hastings L.J. 65, 120–28 (2009).

improperly monopolized § 101 judicial exception subject matter, the courts' concern about preempting natural phenomena may stem in part from how the patents were written.[153] This section looks at several Supreme Court and Federal Circuit cases to illustrate how broad method claim cases have led to an evolution of the *Mayo* test, which in turn has resulted in an increasingly harsh § 101 standard being applied to diagnostic method patents.[154]

1. Association for Molecular Pathology v. Myriad Genetics *(2013).* — In *Myriad*, the Supreme Court looked at patent claims for the sequence of the BRCA1 and BRCA2 gene mutations, which are associated with an increased risk of breast and ovarian cancer.[155] Myriad spent over $500 million on research and development during the seventeen years it took to discover the BRCA mutations and develop a commercial test capable of predicting a patient's future cancer risk.[156] Consequently, the company sought to protect its considerable investment in BRCA research by filing multiple patents claiming the components and methods of its diagnostic tests.[157]

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153. See, e.g., *Sequenom II*, 809 F.3d at 1293 (Dyk, J., concurring in the denial of the petition for rehearing en banc) ("But the major defect is not that the claims lack inventive concept but rather that they are overbroad."); see also Mark A. Lemley et al., Life After *Bilski*, 63 Stan. L. Rev. 1315, 1317 (2011) (stating that the "rule against patenting abstract ideas is best understood as an effort to prevent inventors from claiming their ideas too broadly" and advocating that the judicial exception doctrine be interpreted as a means of preventing overclaiming).

154. See, e.g., *Sequenom II*, 809 F.3d at 1289 (Dyk, J., concurring in the denial of the petition for rehearing en banc) ("[T]here is a problem with *Mayo* insofar as it concludes that inventive concept cannot come from discovering something new in nature . . . . I worry that method claims that apply newly discovered natural laws and phenomena in somewhat conventional ways are screened out by the *Mayo* test."); see also Jared Koch, Note, The "Inventive Concept" After *Mayo*: Where *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371 (Fed Cir. 2015), Went Wrong, 96 Neb. L. Rev. 221, 222–23 (2017) ("By implementing an overwhelmingly strict standard for inventive concepts, the Federal Circuit expanded *Mayo* to be as broad as the justices feared its 'sweeping language' to be." (quoting *Sequenom I*, 788 F.3d 1371, 1380 (Fed. Cir. 2015) (Linn, J., concurring))); Naira Rezende Simmons, Note, Why the Supreme Court Should Use *Ariosa v. Sequenom* to Provide Further Guidance on 35 U.S.C. § 101 Patent Eligibility, 16 Chi.-Kent J. Intell. Prop. 112, 118–30 (2016) ("*Ariosa v. Sequenom* is a case that clearly illustrates why the newly created judicial framework fails to protect many inventions in biotechnology." (footnote omitted)).

155. Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576, 582–83 (2013); Hereditary Breast Cancer, Myriad, https://myriad.com/patients-families/disease-info/breast-cancer/ [https://perma.cc/65T4-4BMV] [hereinafter Myriad, Hereditary Breast Cancer] (last visited Oct. 18, 2018).

156. See Marsh Testimony, supra note 82.

157. See Pete Meldrum, Myriad Genetics, the Supreme Court, Gene Patents, and Saving Lives, Myriad Matters Blog (Apr. 11, 2013), https://myriad.com/myriad-genetics-the-supreme-court-gene-patents-and/ [https://perma.cc/TC9N-7NPP] ("[W]e think it is right for a company to be able to own its discoveries, earn back its investment, and make a reasonable profit. . . . [Our] work was only possible because of the patents that we are now defending in court."); see also U.S. Patent No. 5,693,473 (claiming isolated DNA

The patents at issue in *Myriad* demonstrate how diagnostic patents are often written to cover a larger range of subject matter than the diagnostic test actually commercialized by the inventor. Though Myriad had developed specific commercial tests for the detection of the BRCA1 and BRCA2 genes,[158] the company sought to patent not just its specific tests but also the full sequences of the genetic mutations it had discovered.[159] For example, claim 1 of the '282 Patent covered any "isolated DNA coding for a BRCA1 polypeptide, said polypeptide having the amino acid sequence set forth in SEQ ID NO:2."[160] Similarly, claim 5 covered any "isolated DNA having at least 15 nucleotides of the DNA in claim 1."[161] Because the BRCA1 gene is over 80,000 nucleotides long, these claims encompassed an incredibly broad range of DNA sequences.[162] Further, because the claims covered the BRCA DNA sequence, the claims effectively granted Myriad a monopoly on BRCA testing. In order to test for the BRCA genes, doctors would need to use small segments of DNA called primers,[163] which correspond to specific DNA nucleotide sequences in the BRCA genes.[164] By patenting the specific sequence of the BRCA gene, Myriad prevented other researchers from being able to make their own primers for the detection of the

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sequences and nucleic acid probes used in detection of BRCA mutations); '282 Patent (claiming isolated DNA sequences for BRCA detection, a test kit for detecting BRCA mutations, and a method for screening cancer therapeutics); U.S. Patent No. 5,837,492 (claiming isolated DNA sequences and methods for producing BRCA2 polypeptides, among other inventions); U.S. Patent No. 6,033,857 (claiming methods for diagnosing predisposition to breast cancer and methods for identifying a mutant BRCA2 nucleotide sequence).

158. Myriad, Hereditary Breast Cancer, supra note 155.

159. See, e.g., '282 Patent col. 153 l. 66–67 (claiming any isolated DNA sequence of at least fifteen nucleotides that comes from the large DNA sequence that codes for the BRCA1 polypeptide, rather than the specific nucleotide sequences used in the Myriad genetic tests).

160. Id. at col. 153 l. 57–59.

161. Id. at col. 153 l. 66–67.

162. See supra note 148 and accompanying text.

163. Primers are short strands of DNA used to synthesize and detect DNA. See Nature Educ., Glossary Entry for "Primer," Scitable, https://www.nature.com/scitable/definition/primer-305 [https://perma.cc/5933-CK6D] (last visited Oct. 18, 2018). DNA is composed of four different types of nucleotide bases: adenine (A), cytosine (C), guanine (G), and thymine (T). See Nature Educ., Glossary Entry for "DNA," Scitable, https://www.nature.com/scitable/definition/dna-107 [https://perma.cc/4PDB-9Z49] (last visited Oct. 18, 2018). Each of these nucleotide bases will bind to another one of the bases—A binds with T and C binds with G. Id. Therefore, primers are composed of the DNA base pairs that are complementary to the DNA base pairs in the sequence of DNA being detected (the analyte). For example, if the test is designed to detect a DNA sequence of AAGCGT, the primer sequence will be TTCGCA.

164. See Liying Zhang et al., A Rapid and Reliable Test for BRCA1 and BRCA2 Founder Mutation Analysis in Paraffin Tissue Using Pyrosequencing, 11 J. Molecular Diagnostics 176, 177 (2009) (describing how primers are used to detect BRCA genes).

genes, thereby eliminating the ability of other researchers or doctors to test for the BRCA genes without using Myriad's test.[165]

Objecting to the subject matter of Myriad's patents, the Association for Molecular Pathology and other medical associations sued.[166] In a unanimous decision, the Supreme Court found that the patents claiming the BRCA genes claimed a naturally occurring phenomenon (specific sequences of DNA) and were therefore unpatentable under § 101.[167] A primary concern of the Court was that the claims might "inhibit future innovation" by improperly monopolizing the DNA sequence of the BRCA mutations.[168] However, though the Court held that DNA sequences are not patentable, they did not invalidate all of Myriad's claims—the Court concluded that the synthetic complementary DNA (cDNA) sequences claimed were not naturally occurring and therefore could be patented under § 101.[169] Thus, following *Myriad*, inventors of diagnostic inventions can still obtain valid patents that contain composition of matter claims for the man-made components of the test.[170]

Interestingly, though the Court invalidated Myriad's composition of matter claims for naturally occurring DNA, it specifically noted that it was not evaluating any of Myriad's method claims in its decision.[171] Further, the Court explicitly acknowledged that it would be possible to claim patentable methods for "an innovative method of manipulating genes while searching for the BRCA1 and BRCA2 genes."[172] Therefore, *Myriad* seems to indicate that valid BRCA method patents could be written despite § 101 limitations. Nonetheless, method claims employing the BRCA technology were later invalidated on § 101 grounds as well.[173]

2. In re BRCA1– and BRCA2–Based Hereditary Cancer Test Patent Litigation *(2014).* — The patentability of BRCA diagnostic tests was again

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165. The Supreme Court noted the impact of the patent claims on the ability of other researchers to detect BRCA genes, stating:

> [T]he practical effect of claim 5 is to assert a patent on any series of 15 nucleotides that exist in the typical BRCA1 gene. Because the BRCA1 gene is thousands of nucleotides long, even BRCA1 genes with substantial mutations are likely to contain at least one segment of 15 nucleotides that correspond to the typical BRCA1 gene.

Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576, 584 (2013).

166. Id. at 586.

167. Id. at 592–94.

168. Id. at 589 (quoting Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 US. 66, 86 (2012)).

169. Id. at 595.

170. See infra section III.A.2 (discussing the strategic choices behind manufacture, composition of matter, or machine claims).

171. *Myriad*, 569 U.S. at 595.

172. Id. at 595–96.

173. See infra note 182 and accompanying text.

evaluated in *In re BRCA*.[174] Unlike in *Myriad*, in which no method claims were at issue,[175] *In re BRCA* concerned both composition of matter claims for primers used to detect specific BRCA mutations and method claims for the detection of these mutations.[176] In rejecting more of Myriad's patent claims, the Federal Circuit held that diagnostic tests that utilized a natural law or phenomenon were not rendered patentable by inclusion of standard laboratory techniques in the claim language.[177]

The Federal Circuit applied the *Mayo* test to determine whether Myriad's method claims were directed to judicial exception subject matter.[178] Under step one of the *Mayo* test, the court found that the method claims covered an abstract idea: comparing DNA sequences.[179] Under step two of *Mayo*, the court held that the additional elements of the method claims were insufficient to transform the abstract idea into patentable subject matter because the steps recited by the claims were "well-understood, routine, and conventional techniques that a scientist would have thought of when instructed to compare two gene sequences."[180]

Although the Federal Circuit rejected the method claims under § 101, much of the court's analysis focused on the breadth of the claim language.[181] For example, the majority opinion noted:

> The methods, directed to identification of alterations of the gene, require merely comparing the patient's gene with the wild-type and identifying any differences that arise. The number of covered comparisons is unlimited. The covered comparisons are not restricted by the purpose of the comparison or the alteration being detected. Because of its breadth, the comparison step covers detection of yet-undiscovered alterations, as well as comparisons for purposes other than detection of cancer.[182]

The court concluded that allowing such broad claims would be "antithetical" to the goals of patent law because it would allow patent holders to monopolize the building blocks of research and thus hinder future scientific innovation.[183] Therefore, Myriad may have been able to avoid invalidation of its method claims by including more specific claim language limiting the method to specific primers, BRCA sequences, and experimental techniques. Though the resulting patent claims would be

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174. In re BRCA1– and BRCA2–Based Hereditary Cancer Test Patent Litig., 774 F.3d 755 (Fed. Cir. 2014).

175. See supra note 171 and accompanying text.

176. See *In re BRCA*, 774 F.3d at 758–59.

177. See id. at 763–64.

178. See id. at 760–64.

179. See id. at 763–64.

180. See id.

181. See id.

182. Id. (citation omitted).

183. Id. at 764.

less effective at barring competitors from creating their own BRCA tests, they also would not have monopolized the field of BRCA research and therefore may have been compatible with the court's interpretation of § 101 jurisprudence.

3. Ariosa Diagnostics, Inc. v. Sequenom, Inc. *(2015).* — In *Sequenom*, the Federal Circuit considered method claims for the detection of cell-free fetal DNA (cffDNA).[184] Specifically, the diagnostic test developed by the patent owners, MaterniT21, could be used to determine whether a fetus had Down Syndrome without the mother having to endure an invasive and possibly dangerous amniocentesis procedure.[185] *Sequenom* reaffirmed the idea that truly innovative diagnostic inventions may not be entitled to patent protection if they utilize conventional laboratory techniques.[186] The court further rejected Sequenom's argument that the patent's inventive concept stemmed from the discovery of a novel analyte.[187]

The Federal Circuit applied the *Mayo* framework to determine whether the method claims at issue were directed toward unpatentable subject matter. The court began by asserting that it is "undisputed" that the existence of cffDNA in a pregnant woman's blood is a natural phenomenon under part one of the *Mayo* test.[188] The court then focused on whether the claims contained an inventive concept that could render them patentable under step two of *Mayo,* concluding that the contested claims lacked an inventive concept because they consisted of "appending routine, conventional steps to a natural phenomenon, specified at a high level of generality."[189] For example, the polymerase chain reaction step used to amplify DNA[190] in the claims was commonly employed in scientific research at the time the patent was filed.[191] In reaching this conclusion, the court rejected Sequenom's argument that the discovery of a use for cffDNA was itself an innovative step because cffDNA had previously been discarded as waste by laboratories analyzing blood

184. See *Sequenom I*, 788 F.3d 1371, 1373 (Fed. Cir. 2015).

185. Id. at 1381 (Linn, J., concurring). Amniocentesis is a procedure that carries a miscarriage rate as high as one percent. See Richard S. Olney et al., Chorionic Villus Sampling and Amniocentesis: Recommendations for Prenatal Counseling, CDC (July 21, 1995), https://www.cdc.gov/mmwr/preview/mmwrhtml/00038393.htm [https://perma.cc/3NMU-GVDV].

186. See *Sequenom I*, 788 F.3d at 1379–80.

187. See id. at 1379.

188. Id. at 1376.

189. Id. at 1378.

190. Polymerase chain reaction (PCR) is a laboratory technique that can make multiple copies of a sequence of DNA. See Nature Educ., Glossary Entry for "Polymerase Chain Reaction," Scitable, https://www.nature.com/scitable/definition/polymerase-chain-reaction-pcr-110 [https://perma.cc/4NGE-2FLE] (last visited Oct. 18, 2018).

191. *Sequenom I*, 788 F.3d at 1377–78.

samples.[192] Indeed, the court asserted that even though noninvasive detection of Down Syndrome and other fetal abnormalities without amniocentesis was a significant medical innovation, "[g]roundbreaking, innovative, or even brilliant discovery does not by itself satisfy the § 101 inquiry."[193]

The Federal Circuit's insistence that the *Mayo* inventive concept cannot be supplied by use of common laboratory techniques has been interpreted as further limiting the *Mayo* framework.[194] Following *Sequenom*, it is unclear how the '540 Patent could be written to preserve its patentability. While under previous decisions simply specifying the types of experimental techniques used to detect the cffDNA would likely have sufficiently narrowed the scope of the claims to render them patentable, the *Sequenom* Court seemed to indicate that this would not be enough so long as the experimental techniques were not themselves novel. Indeed, though several of the Federal Circuit judges felt compelled by *Mayo* to invalidate the '540 Patent, they disagreed with the ultimate conclusion that the invention of cffDNA fetal screenings was not patent eligible.[195] Instead, some of the judges maintained that the claims were invalid because they were too broad.[196]

4. Genetic Techs. Ltd. v. Merial L.L.C. *(2016).* — In *Merial*, the Federal Circuit looked at the validity of a patent claiming a novel method of using noncoding sequences of DNA to detect mutations associated with various diseases.[197] Prior to this invention, it was known that DNA contains sequences that code for proteins, called exons,[198] and noncoding sequences, called introns.[199] However, introns had previously been thought of as "junk DNA" and were believed to be completely nonfunctional.[200] The invention described in the '179 Patent allowed for easier detection of mutations for various diseases through testing for

192. See id. at 1379 (stating that Sequenom's "argument implies that the inventive concept lies in the discovery of cffDNA" but that "[e]ven so, this is not the invention claimed by the '540 patent").

193. Id. (alteration in original) (internal quotation marks omitted) (quoting Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576, 591 (2013)).

194. See supra note 154.

195. See *Sequenom II*, 809 F.3d 1282, 1284–87 (Fed. Cir. 2015) (Lourie, J., concurring in the denial for rehearing en banc) (per curiam); id. at 1287–93 (Dyk, J., concurring in the denial for rehearing en banc).

196. Id. at 1285 (Lourie, J., concurring in the denial for rehearing en banc) ("The claims in this case perhaps should be in jeopardy, not because they recite natural laws or abstract ideas, but because they may be indefinite or too broad. But they should not be patent-ineligible on the ground that they set forth natural laws or are abstractions."); id. at 1293 (Dyk, J., concurring in the denial for rehearing en banc).

197. Genetic Techs. Ltd. v. Merial L.L.C., 818 F.3d 1369 (Fed. Cir. 2016). The patent at issue was U.S. Patent No. 5,612,179.

198. *Merial*, 818 F.3d at 1371–72.

199. Id.

200. Id. at 1372.

specific introns associated with the mutated gene. Using introns rather than exons for DNA analysis was discovered to have several advantages over conventional DNA testing because introns are relatively small DNA regions, which can more simply be amplified and detected than larger exon sequences.[201] In invalidating the method claims in the '179 Patent, the Federal Circuit frequently referenced the patent's broad claim language, despite basing its invalidation on § 101 subject matter eligibility.[202]

The Federal Circuit's *Mayo* analysis began by concluding that the claim was unpatentable because it was directed to a law of nature: "the relationship between non-coding and coding sequences in linkage disequilibrium and the tendency of such non-coding DNA sequences to be representative of the linked coding sequences."[203] Under step two of *Mayo*, the claimed elements of the intron detection method did not provide a sufficient "inventive concept" to make the patent valid.[204] Again, though the court framed its holding as resulting from a § 101 subject matter analysis, much of its focus was on the broad claim language of Claim 1.[205] For example, the court noted that the claim's scope had not been limited by restricting detection to the alleles of a specific intron–exon pair.[206] Additionally, the claim contains a broad "amplifying" step, which could be accomplished through a variety of analytical techniques.[207] Based on the court's objection to the lack of specific limitations in the claim language, it is possible that the invalidated claims

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201. Id. at 1373.

202. Id. at 1374–75 ("Claim 1 broadly covers essentially all applications, via standard experimental techniques, of the law of linkage disequilibrium to the problem of detecting coding sequences of DNA.").

203. Id. at 1374.

204. Id. at 1377.

205. Id. at 1372–73 ("Claim 1 is thus broad in scope; it encompasses methods of detecting a coding region allele by amplifying and analyzing any linked non-coding region . . . within a different gene . . . ."). Claim 1, a method claim, covered:

> A method for detection of at least one coding region allele of a multi-allelic genetic locus comprising:
>
> a) amplifying genomic DNA with a primer pair that spans a non-coding region sequence, said primer pair defining a DNA sequence which is in genetic linkage with said genetic locus and contains a sufficient number of non-coding region sequence nucleotides to produce an amplified DNA sequence characteristic of said allele; and
>
> b) analyzing the amplified DNA sequence to detect the allele.

'179 Patent col. 59 l. 55–67.

206. *Merial*, 818 F.3d at 1374–75. The specification section of the patent did provide examples of detecting cystic fibrosis and muscular dystrophy with this method, but this was insufficient to make the claim valid. Id.

207. For example, PCR is frequently used to amplify DNA. See supra note 190. However, there are several additional techniques that can be used. See DNA Amplification, PCR & qPCR, New Eng. BioLabs Inc., https://www.neb.com/applications/dna-amplification-pcr-and-qpcr [https://perma.cc/4NRZ-K5F5] (last visited Oct. 18, 2018).

could have been saved by specifying which amplification method should be used and which alleles should be detected. However, following *Sequenom*, it is unclear whether this would be sufficient if the claims referenced conventional amplification methods.

5. Cleveland Clinic Foundation v. True Health Diagnostics LLC *(2017).* — In *Cleveland Clinic*, the Federal Circuit looked at several claims for detecting a patient's individual risk of developing cardiovascular disease by measuring the enzyme myeloperoxidase in the patient's blood.[208] In striking down these method claims under § 101, the Federal Circuit affirmed the *Sequenom* Court's conclusion that claim limitations reciting conventional laboratory techniques are not sufficient to render claims patentable under § 101.[209] Further, the court rejected Cleveland Clinic's argument that the claims were narrowly preemptive and therefore patent eligible, indicating that the *Mayo* test has now evolved such that even diagnostic method claims that present little risk of preempting an abstract idea, natural law, or natural phenomenon may still be unpatentable under § 101.[210]

The Federal Circuit's *Mayo* analysis largely relied on its earlier decision in *Sequenom*. Significantly, the court noted that "just like [*Sequenom*], the method starts and ends with naturally occurring phenomena with no meaningful non-routine steps in between—the presence of MPO in a bodily sample is correlated to its relationship to

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208. Cleveland Clinic Found. v. True Health Diagnostics LLC, 859 F.3d 1352, 1355 (Fed. Cir. 2017). For example, claim 11 of the '552 Patent read:

> A method of assessing a test subject's risk of having atherosclerotic cardiovascular disease, comprising
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> comparing levels of myeloperoxidase in a bodily sample from the test subject with levels of myeloperoxidase in comparable bodily samples from control subjects diagnosed as not having the disease, said bodily sample being blood, serum, plasma, blood leukocytes selected from the group consisting of neutrophils, monocytes, sub-populations of neutrophils, and sub-populations of monocytes, or any combination thereo[f];
>
> wherein the levels of myeloperoxidase in the bodily from the test subject relative to the levels of [m]yeloperoxidase in the comparable bodily samples from control subjects is indicative of the extent of the test subject's risk of having atherosclerotic cardiovascular disease.

U.S. Patent No. 7,223,552 col. 30 l. 48–62.

209. See *Cleveland Clinic*, 859 F.3d at 1360 (noting that "[e]ach limitation Cleveland Clinic raises, however, merely recites known methods of detecting MPO or MPO derivatives and applies the correlation between these biomarkers and cardiovascular health"); id. at 1361 ("Indeed, Cleveland Clinic has not created a new laboratory technique; rather, it uses well-known techniques to execute the claimed method.").

210. See id. at 1363 ("Cleveland Clinic argues that its invention is narrowly preemptive and thus should be patent eligible. However, '[w]here a patent's claims are deemed only to disclose patent ineligible subject matter under the *Mayo* framework . . . preemption concerns are fully addressed and made moot.'" (alteration in original) (quoting *Sequenom I*, 788 F.3d 1371, 1379 (Fed. Cir. 2015))).

cardiovascular disease."[211] Thus, the court concluded that the claims were directed toward a natural law.[212] The court's analysis of the second step of *Mayo* similarly relied on *Sequenom*.[213] Of particular importance to the court was the fact that the Cleveland Clinic claims relied on conventional laboratory techniques, such as colorimetric assays, flow cytometry, and ELISA tests.[214] Thus, following *Sequenom* and *Cleveland Clinic,* it is clear that narrowing diagnostic method claims by including claim limitations directing the use of standard laboratory techniques will not render claims patentable under § 101.

Further, the court's unwillingness to consider Cleveland Clinic's preemption argument is also significant in that it highlights how the *Mayo* test has evolved over time. Under *Cleveland Clinic*, a claim's risk of preempting the natural law or natural phenomenon upon which it relies does not even need to be considered.[215] This is particularly interesting given the fact that the Supreme Court's analysis in *Mayo* relied so heavily on a determination of whether the claimed process was "more than a drafting effort designed to monopolize the law of nature itself."[216] If preemption no longer need be considered, this leaves room for courts to invalidate even narrowly tailored diagnostic method claims that rely on detection of a naturally occurring analyte. In light of this decision, and the many others invalidating method patent claims, it is harder than ever to determine whether a diagnostic method claim is valid under 35 U.S.C. § 101.[217] Consequently, some worry that future diagnostic innovation may be stifled as academic and industry researchers decide not to invest in diagnostic research out of concern that their inventions cannot be patented.[218]

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211. Id. at 1361.

212. Id.

213. See id. at 1361–62 (discussing *Sequenom I*).

214. See id. at 1362.

215. See id. at 1363 (dismissing the preemption argument).

216. See Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66, 77–80 (2012).

217. See Shai Jalfin, 6 Years Later: The Effects of the *Mayo* Decision on Diagnostic Methods, IP Watchdog (July 19, 2018), https://www.ipwatchdog.com/2018/07/19/6-years-later-effects-mayo-decision-diagnostic-methods/id=99206/ [https://perma.cc/UQK2-LEVL].

218. See, e.g., Thomas, supra note 5, at 2–3 ("If changes in regulation lead to insufficient protection for biotechnology patents, [venture capital] firms may reduce investments in biotechnology and shift their focus to other, less risky industries."); Jeffrey A. Lefstin et al., Final Report of the Berkeley Center for Law & Technology Section 101 Workshop: Addressing Patent Eligibility Challenges, 33 Berkeley Tech. L.J. 551, 582–83 (2018) ("While these shifts have had negative impacts on all of life science research and development, they have been particularly severe for the diagnostics sector.").

III. PATENT PROSECUTION STRATEGIES TO INCREASE PATENTABILITY OF DIAGNOSTIC PATENTS

Following recent Federal Circuit and Supreme Court cases in which broad method claims were invalidated, there is growing concern that courts have become biased against diagnostic tests in general.[219] Fueling this speculation is the apparently disparate way in which the Federal Circuit has treated diagnostic inventions and nondiagnostic inventions. For example, in *Rapid Litigation*, the Federal Circuit looked at a patent claiming the process of freezing liver cells (hepatocytes) for use in laboratory studies.[220] Prior to the invention of the patented process, labs were able to freeze hepatocytes, although scientists believed that the cells could only be frozen once because they would not survive multiple freeze–thaw cycles.[221] Although the patent at issue in *Rapid Litigation* claimed the process for repeatedly freezing the cells, the patent's method claims applied conventional laboratory steps (previously used in the single freezing of hepatocytes) to get the cells to freeze multiple times.[222] The Federal Circuit applied the *Mayo* test, and unlike in *Sequenom*, found that the claims were valid. The court stated:

> It is enough in this case to recognize that the claims are simply not directed to the ability of hepatocytes to survive multiple freeze-thaw cycles. Rather, the claims of the '929 patent are directed to a new and useful laboratory technique for preserving hepatocytes. This type of constructive process,

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219. See, e.g., Aaron S. Kesselheim & Jason Karlawish, Biomarkers Unbound—The Supreme Court's Ruling on Diagnostic-Test Patents, 366 New Eng. J. Med. 2338, 2340 (2012) ("Excluding some medical discoveries from the possibility of patenting has led some observers to worry about the implications for private investment. . . . Justice Breyer suggested that Congress could consider whether innovation in diagnostic methods needed special market-exclusivity protection."); Barbara Rigby, "Breakthrough" Diagnostic Invention Deemed Unpatentable—Where Is US Patent Law Heading?, Dehns (Oct. 14, 2015), http://www.dehns.com/site/information/industry_news_and_articles/Breakthrough_diagnostic_invention_deemed_unpatentable.html [https://perma.cc/6UYH-DULF] ("If *Ariosa* is followed, then it is difficult to see how any inventions in the medical diagnostics field could be patent eligible in the US, unless they involve a non-conventional detection method (such as detection via a novel antibody)."); Jenny Shmuel & Megan Chacon, Diagnostics Patent Eligibility: A Turning Point Approaches, Life Sci. Intell. Prop. Rev. (Jan. 27, 2016), https://www.fr.com/wp-content/uploads/2016/02/Diagnostics-patent-eligibility_-a-turning-point-approaches-FINAL.pdf [https://perma.cc/FQ8V-7JQS] ("The patent eligibility landscape under 35 U.S.C. § 101 has shifted in the past few years . . . . The application of this law in one particular area—screening and diagnostic testing during and after pregnancy—highlights the unprecedented difficulty faced by those seeking patent protection in the life sciences arena . . . .").

220. Rapid Litig. Mgmt. Ltd. v. CellzDirect, Inc., 827 F.3d 1042, 1045 (Fed. Cir. 2016).

221. Id.

222. See id. at 1045–46 (showing that the patent claimed conventional laboratory techniques, such as density gradient centrifugation, which were also used by prior art cryopreservation methods).

> carried out by an artisan to achieve a "new and useful end," is precisely the type of claim that is eligible for patenting.[223]

The court distinguished the case from *Sequenom* by stating that "identifying" the presence of cffDNA in a maternal blood sample was "merely claiming the natural phenomena itself" and was therefore not patent eligible.[224] However, the court's analysis overlooked the fact that "identifying" the cffDNA was a new and useful laboratory technique for detecting fetal chromosomal anomalies. Indeed, the court specifically stated that the hepatocyte freezing process is patentable because it is "not simply an observation or detection."[225] Some commentators have expressed confusion over the seemingly different § 101 standards applied in *Sequenom* and *Rapid Litigation*.[226] One possible interpretation of the two cases is that the court has more concern about preemption when it comes to diagnostic patents than when it comes to other method patents and thus applies a more stringent *Mayo* test. Another possible interpretation of *Rapid Litigation* is that the representative claim was more narrowly tailored than the claims at issue in *Sequenom*. For example, the representative claim in *Rapid Litigation* required that hepatocytes be subjected to density gradient centrifugation to separate viable hepatocytes and only claimed hepatocyte cultures with more than seventy percent viability after the final thaw.[227] However, density gradient centrifugation likely qualifies as a standard laboratory technique,[228] which after *Sequenom* would likely not be sufficient to render the claim patentable under § 101. Thus, only the limitation requiring seventy percent hepatocyte viability should have influenced the court's determination.

This Part looks at how patent prosecutors can adapt their prosecution strategies to increase the likelihood that their patents withstand § 101 challenges. Additionally, this Part analyzes one proposal for how Congress and the Supreme Court could modify the § 101 standard to better incentivize diagnostic research without allowing overbroad method claims.

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223. Id. at 1048 (quoting Alice Corp. v. CLS Bank Int'l, 134 S. Ct. 2347, 2354 (2014)).

224. Id.

225. Id.

226. See, e.g., Oyvind Dahle, The Absurdity of Patent Ineligible Categories: The Discrepancy Between the *Ariosa* and *Cellzdirect* Decisions Highlights the Problems Created by Formalistic Adjudication of Patent Eligibility, 17 Wake Forest J. Bus. & Intell. Prop. L. 114, 119–20 (2016); Michael A. Sanzo, Lengthening Shadows: Biotechnology and Patent Eligibility, Landslide, May–June 2017, at 48, 50–51 (noting that *Rapid Litigation* seems to go against the Federal Circuit's previous § 101 case law and that "[i]t is also difficult to resolve the approach taken by the court in this case with that taken in previous decisions where claims were found to be patent ineligible").

227. *Rapid Litigation*, 827 F.3d at 1046.

228. See id. at 1045 (explaining that before the '929 Patent, scientists were already cryopreserving hepatocytes using gradient fractionation).

A. *Patent Prosecution Strategies*

1. *Including Narrow Claims.* — Some patent practitioners recommend including narrow diagnostic method claims within a diagnostic patent as a means of surviving § 101 challenges.[229] Patent practitioners recommend several strategies for narrowing the claims in diagnostic method patents in order to comply with § 101 requirements. First, conventional steps claimed in a diagnostic method patent can be claimed as a new combination of steps to possibly provide the necessary inventive concept to survive *Mayo*.[230] For example, a diagnostic test that uses primers to detect DNA might be valid under § 101 if the claim specifies the primers used and specifically lists a new sequence of assay steps needed to perform the test.[231] Limiting the claims to a specific series of steps will necessarily limit the scope of protection afforded by the patent—competitors will be able to use different primers or different experimental techniques in order to avoid infringing the patent. However, if the limitations of the patent are carefully chosen so that they claim the truly essential components of the invention, the risk of the claims being too narrow is minimized.

The specific language used in the patent claims can play a role in the patent's § 101 validity.[232] Attempts to limit a patent's scope to a specific field of use or including a pre- or postsolution activity will

229. See, e.g., Alan Douglas Miller & Brian Amos, Successful Strategies for Diagnostic Method Patents, 23 J. Com. Biotechnology 39, 42 (2017) (stating that it is difficult to obtain broad diagnostic method claims, but that one possible strategy for improving patentability is to use narrower claims); Anthony C. Tridico, Personalized Medicine Patents at Risk: Tips for Battling *Prometheus* and *Myriad* to Obtain Claims to Diagnostics, Finnegan 3–5 (Mar. 2013), https://www.finnegan.com/print/content/7414/Personalized-Medicine-Patents-at-Risk-Tips-for-Battling-Prometheus-and-Myriad-to-Obtain-Claims-to-Diagnostics.pdf?q= [https://perma.cc/JX82-54EW] (suggesting ways in which to limit the scope of a patent, such as including unconventional reagents or methods within the patent claim).

230. See USPTO, Subject Matter Eligibility Examples: Life Sciences 11, 15 (2016), https://www.uspto.gov/sites/default/files/documents/ieg-may-2016-ex.pdf [http://perma.cc/9BL2-XY9H] (providing examples of diagnostic method claims that are patentable due to inclusion of a specific combination of conventional steps); Andrew Clarke, Five Strategies for Obtaining Diagnostic Method Patents in the United States, Innofy (Aug. 24, 2017), https://www.lexology.com/library/detail.aspx?g=bb59473b-9fbd-4ad6-a939-9d57ab593d56 [http://perma.cc/RZ8D-QNH4] (suggesting that "[i]f your diagnostic method is the only reason as to why you would put together that specific combination, then this combination could serve as the basis of a patentable invention"); Leslie A. McDonell & Amanda K. Murphy, Section 101 Guidance, Finnegan 2–3 (Oct. 2016), https://www.finnegan.com/print/content/4665/Section-101-Guidance.pdf?q= [https://perma.cc/D3ST-FBNX] (analyzing the USPTO guidance for § 101 validity of diagnostic method patents, including the possibility of claiming conventional steps as a new combination).

231. See Clarke, supra note 230.

232. See Duane C. Marks, Roche Diagnostics Operations, A Framework for Patent-Eligibility of Diagnostic Patents Post-*Mayo*, USPTO 5–13, https://www.uspto.gov/sites/default/files/patents/announce/may9forum_marks.pdf [http://perma.cc/P3GW-93WD] (last visited Oct. 18, 2018) (demonstrating how to rewrite an invalid patent claim to make it valid).

generally not improve the patent's chances of being valid under § 101.[233] Therefore, claiming an "administering" step such as "administering a drug providing" will not sufficiently limit the patent's scope because it does not specify how the drug is administered or even which drug is being administered.[234] Instead, patent claims can be narrowed by including the specific drug to be administered, the dose of the drug to be provided, the frequency of administration, and the route of administration.[235] Similarly, including a "determining" step such as "determining the level of drug" will also not increase a patent's chances of being valid under § 101 because the language is still too vague. Instead, the patent claim can be narrowed by specifying in detail the steps used to measure the drug, and claiming the specific recognition element and transduction principle being used.[236]

The scope of a patent can additionally be narrowed through inclusion of a highly detailed specification section.[237] Specifically, the USPTO and courts have rejected broad phrases like "detection," "identifying," and "diagnosis."[238] Detailing exactly how an invention "diagnoses" or "identifies" the analyte of interest may prevent a court from interpreting the patent as a mere application of an unpatentable natural phenomenon.[239] However, some courts have invalidated method claims under § 101 even when the patent contained a detailed specification section, so this recommendation may not work unless the patent claims are also narrowed.[240]

Finally, if the diagnostic test claimed in the patent contains a component that is man-made, such as cells that have been transformed to change their behavior or specific antibodies modified to allow for analyte detection, this can by itself transform the invention into patent-eligible subject matter.[241] Therefore, drafting claims to include any man-made test components can be an effective strategy for improving § 101 eligibility.

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233. Id. at 11–13.

234. Id. at 10.

235. Id.

236. Id. at 11.

237. See Richard Abel, An Update on Software Patentability in the US, Barker Brettell (Nov. 9, 2017), https://www.barkerbrettell.co.uk/update-software-patentability-us/ [http://perma.cc/H5QK-9JMP] (discussing how a detailed specification played an integral role in the Federal Circuit's decision that a software patent was valid under § 101); Clarke, supra note 230 ("[I]t will likely be advantageous, to have a laundry list of features that could be used to bring the method as far away as possible from being a *mere natural phenomenon*.").

238. See Clarke, supra note 230.

239. Id.

240. See Genetic Techs., Ltd. v. Merial L.L.C., 818 F.3d 1369, 1374–75, 1380 (Fed. Cir. 2016) (invalidating a patent even though the specification provided possible applications of the method, such as detecting cystic fibrosis and muscular dystrophy).

241. See, e.g., PerkinElmer, Inc. v. Intema Ltd., 496 F. App'x 65, 72 (Fed. Cir. 2012) ("[T]he host cells [listed in a claim] did not occur naturally; they were man-made and

While narrow patent claims are often seen as less powerful than broad patent claims, they can offer several advantages in addition to increased § 101 validity. Narrow claims can be more difficult for a third party to challenge because less prior art will apply during novelty and obviousness challenges.[242] Additionally, narrow claims can be examined more quickly by the USPTO because the examiner will not have to analyze as much prior art in determining the patent's validity.[243]

2. *Utilizing Manufacture, Composition of Matter, or Machine Claims.* — It is generally recommended that inventors claim their invention in as many different ways as possible.[244] Thus, patentees seeking protection for diagnostic tests should consider claiming the test using composition of matter, machine, or manufacture claims in addition to method claims.[245]

Diagnostic device claims may be better able to withstand § 101 scrutiny partly because diagnostic device claims are generally written more narrowly than method patents.[246] Specifically, device claims are by necessity limited to a specific physical embodiment of the diagnostic test claimed in the patent. In contrast, process patents can be written so as to include all possible methods of performing the test.

In addition to claiming diagnostic tests as machines or manufacturers, specific components of the test can be claimed separately from the rest of the invention. For example, a novel fluorescent probe used to detect a DNA mutation can be claimed directly using a composition of matter claim.[247] Further, components of tests that are man-made will suffer less § 101 scrutiny than other components of a diagnostic test, making them ideal candidates for patent protection.[248]

3. *Limiting Specification Concessions.* — Several of the most recent § 101 cases relied on statements made in the challenged patents' specifications to bolster the conclusion that the patents employed routine, conventional, or well-known techniques.[249] Therefore, following *Sequenom*,

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thus, were themselves patent-eligible subject matter . . . [T]heir inclusion in the process made the claims patent-eligible . . . ."); see also Marks, supra note 232, at 14.

242. See Wilson, supra note 105.

243. Id.

244. See, e.g., Root, supra note 102, at 42 ("As a matter of good drafting practice . . . drafting claims in various statutory classes should be a practitioner's general rule."); Quinn, supra note 114.

245. See, e.g., U.S. Patent No. 5,145,789 col. 8 l. 53–col. 10 l. 52 (claiming a pregnancy test using method and device claims); U.S. Patent No. 6,255,066 col. 13 l. 30–col. 18 l. 6 (claiming the method for screening for bacterial infection and the dye produced by the method).

246. See supra notes 117–122 and accompanying text.

247. See Clarke, supra note 230.

248. See supra notes 169–170 and accompanying text.

249. See, e.g., Cleveland Clinic Found. v. True Health Diagnostics LLC., 859 F.3d 1352, 1361 (Fed. Cir. 2017) ("The specifications of the testing patents confirm that known testing methods could be used to detect MPO, and that there were commercially available testing kits for MPO detection."); *Sequenom I*, 788 F.3d 1371, 1377 (Fed. Cir. 2015) ("The

it is likely that claim limitations reciting techniques referred to in the specification as "standard," "conventional," or "well-known" will not render a claim patentable under § 101.

Further, the specification section's concessions as to what is standard or well known may become increasingly important in light of the Federal Circuit's recent decision in *Berkheimer,* which emphasized that "whether a claim element or combination of elements is well-understood, routine and conventional to a skilled artisan in the relevant field is a question of fact."[250] Thus, under *Berkheimer,* summary judgment is only appropriate when there is no genuine dispute over whether a claim recites well-understood, routine, and conventional techniques.[251] Significantly, the *Berkheimer* court stated that the fact that a given technique is "disclosed in a piece of prior art . . . does not mean it was well-understood, routine, and conventional."[252] Thus, claims may now survive § 101 summary judgment even if they employ techniques cited in the academic literature. However, the USPTO has stressed that there is no genuine issue of material fact if the specification contains "an express statement" that "demonstrates the well-understood, routine, conventional nature" of the technique.[253] Thus, § 101 summary judgment remains available for patents containing such statements even though *Berkheimer* may make § 101 summary judgment less common in general. Therefore, patent prosecutors trying to help their clients' patents survive § 101 summary judgment may want to limit the number of techniques they refer to as "standard" or "conventional" in the specification.[254]

B. *Revisiting the Mayo Test*

Ultimately, patent prosecution strategies may not be enough to render many diagnostic method claims valid under the current *Mayo* framework.[255] Of particular concern is whether, after *Sequenom*, a narrow

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specification of the '540 patent confirms that the preparation and amplification of DNA sequences in plasma or serum were well-understood, routine, conventional activities performed by doctors in 1997."). For example, courts have cited parts of patent specifications that explain that the claimed invention can be performed "by standard techniques." Id.

250. Berkheimer v. HP Inc., 881 F.3d 1360, 1368 (Fed. Cir. 2018).

251. See id. at 1369.

252. Id.

253. Memorandum from Robert W. Bahr, Deputy Comm'r for Patent Examination Policy, USPTO, to Patent Examining Corps 3 (Apr. 19, 2018), https://www.uspto.gov/sites/default/files/documents/memo-berkheimer-20180419.PDF [https://perma.cc/U3T4-VZL9].

254. Of course, there is no harm in admitting that truly conventional techniques, such as PCR, are routine. Even if a specification does not concede this point, the USPTO has explained that citations to prior court cases finding that specific techniques are well known and routine may also be used to show there is no genuine issue of material fact. See id. at 4.

255. See, e.g., Patrick H. J. Hughes, AIPLA Says U.S. Patent Act Needs Revamping, Westlaw Intell. Prop. Daily Briefing (May 19, 2017), 2017 WL 2198174 (calling for Congress to modify § 101 to allow for patenting of "future cutting-edge technologies");

diagnostic method claim is patentable if it recites "routine, conventional steps."[256] In other words, the *Sequenom* Court's interpretation of *Mayo* seems to preclude patenting of diagnostic method patents with inventive concepts relating to the use of a novel analyte and not the use of novel assay steps.[257] Though the *Mayo* decision also indicated that patents claiming well-understood, conventional activity were not patentable,[258] some legal scholars have argued that *Sequenom* further narrowed *Mayo* by employing an "overwhelmingly strict" interpretation of what constitutes an inventive step.[259] Therefore, it is currently unclear whether diagnostic method claims that are inventive because they rely on the use of a newly discovered analyte can be patented even if they are narrowly drafted.[260] This is particularly troubling because many significant diagnostic breakthroughs result from finding a previously unknown analyte.[261]

In order to truly encourage diagnostic innovation, the Supreme Court could expand its *Mayo* test to allow for patenting of diagnostic inventions that detect novel analytes using conventional laboratory techniques. Judge Dyk of the Federal Circuit has suggested that these inventions should be patentable so long as they are narrowly claimed and actually reduced to practice.[262] In proposing this § 101 standard, Judge Dyk was responding to a growing fear that the current *Mayo* framework invalidates truly novel diagnostic innovations that are worthy of patent protection.[263]

Valentino, supra note 5 (stating that Congress may need to change the subject matter standard under § 101 to ensure that diagnostic inventions remain patentable).

256. *Sequenom I*, 788 F.3d 1371, 1378 (Fed. Cir. 2015).

257. See *Sequenom II*, 809 F.3d 1282, 1289–90 (Fed. Cir. 2015) (Dyk, J., concurring in the denial of the petition for rehearing en banc) (per curiam).

258. See Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66, 73 (2012); *Sequenom I*, 788 F.3d at 1377.

259. See Koch, supra note 154, at 223.

260. *Sequenom II*, 809 F.3d at 1289 (Dyk, J., concurring in the denial of the petition for rehearing en banc) (stating that *Mayo* does not sufficiently recognize that some inventions stem from discovering a natural law and not from a unique application of a natural law).

261. For example, the discovery of the BRCA mutations allowed for better preventative cancer care by allowing patients to determine whether they were at a higher risk of developing breast cancer. See BRCA Mutations: Cancer Risk and Genetic Testing, NIH, https://www.cancer.gov/about-cancer/causes-prevention/genetics/brca-fact-sheet [https://perma.cc/9XQB-YZ8E] (last updated Jan. 30, 2018). Discovering the correlation between cffDNA and fetal abnormalities allowed pregnant women to undergo fetal testing without the high miscarriage rate of amniocentesis. See generally Christopher Robinson et al., Noninvasive Prenatal Detection of Aneuploidy, 57 Clinical Obstetric Gynecology 210 (2014) (demonstrating that cffDNA can be used to noninvasively detect chromosomal abnormalities in a fetus).

262. *Sequenom II*, 809 F.3d at 1291 (Dyk, J., concurring in the denial of the petition for rehearing en banc) ("However, if the breadth of the claim is sufficiently limited to a specific application of the new law of nature discovered by the patent applicant and reduced to practice, I think that the novelty of the discovery should be enough to supply the necessary inventive concept.").

263. Id. at 1289. Judge Dyk stated:

However, he also acknowledged that broadly written method patents can improperly preempt judicial exception subject matter and therefore should not be patentable under § 101.[264]

Allowing patenting of diagnostic tests that detect novel analytes as long as the claims are narrowly drafted and the invention is actually reduced to practice avoids many of the preemption concerns that underlie current § 101 case law. First, such a standard would be consistent with the Supreme Court's opinion in *Myriad*, in which the Court stated that patents, including method patents, that consisted of "new applications of knowledge about the BRCA1 and BRCA2 genes" could be patentable under § 101.[265] Further, requiring narrowly written claims would prevent a patent holder from claiming all possible methods of performing a specific test. For example, the BRCA tests at issue in *In re BRCA* could have been claimed by referring to specific primers, BRCA mutations, and amplification techniques to limit the scope of the patent to meet Judge Dyk's test. These narrowly drafted claims would only have barred competitors seeking to create their own BRCA test from performing the exact test claimed in the patent, rather than barring them from doing any BRCA detection at all. Additionally, requiring that an inventor patent only that which she has reduced to practice would prevent the inventor from claiming more subject matter than she could possibly develop. Finally, Judge Dyk is not alone in suggesting that patent rights be granted only for narrowly drafted diagnostic method claims[266] that have been actually reduced to practice.[267]

> In my view, *Mayo* did not fully take into account the fact that an inventive concept can come not just from creative, unconventional application of a natural law, but also from the creativity and novelty of the discovery of the law itself. This is especially true in the life sciences, where development of useful new diagnostic and therapeutic methods is driven by investigation of complex biological systems. I worry that method claims that apply newly discovered natural laws and phenomena in somewhat conventional ways are screened out by the *Mayo* test.

Id.

264. Id. at 1291 ("Claims that extend far beyond the utility demonstrated by the patent applicant and reduced to practice should be invalid, as they 'too broadly preempt the use' of the underlying idea by others." (quoting Mayo Collaborative Servs. v. Prometheus Labs., Inc., 566 U.S. 66, 72 (2012))).

265. See Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576, 595–96 (2013) (emphasis omitted); *Sequenom II*, 809 F.3d at 1289–90 (Dyk, J., concurring in the denial of the petition for rehearing en banc) (stating that the *Mayo* decision "may not be entirely consistent with the Supreme Court's decision in *Myriad*").

266. See Diagnostic Method Patents and Harms, supra note 6, at 1370–71 (explaining that granting patent rights to broad diagnostic method claims will limit future innovation); Margaret Kubick, Comment, An Uncertain Future: The Impact of Medical Process and Diagnostic Method Patents on Healthcare in the United States, 9 Nw. J. Tech. and Intell. Prop. 280, 282 (2010) ("Since 1981, the courts have strayed into dangerous territory by allowing increasingly broad patents of medical diagnostic and therapeutic methods.").

267. See Cotropia, supra note 152, at 71.

Following Judge Dyk's proposal would necessarily reduce the scope of the IP rights companies have in their diagnostic inventions. However, as current case law drastically limits the availability of diagnostic method patents at all, allowing narrow method claims might strike an acceptable balance between preventing preemption of judicial exception subject matter and incentivizing development of innovative diagnostic tests that rely on the use of novel analytes.

CONCLUSION

Many medical diagnostic tests are claimed as broad method claims rather than more narrow method, manufacture, or machine claims because broad method claims allow for greater patent protection. However, in light of recent Supreme Court and Federal Circuit case law finding that medical diagnostic method patents frequently claim unpatentable judicial exception subject matter, inventors should consider claiming their diagnostic inventions using narrower claims. While the resulting patents will have a more limited scope of patent protection, they will be less likely to be invalidated under 35 U.S.C. § 101, ultimately granting some measure of patent protection to inventions that would be unpatentable if claimed using broad method claims. Additionally, because many important diagnostic innovations involve the discovery of a new analyte rather than the discovery of novel ways to detect a conventional analyte, the Supreme Court should consider allowing method patent protection of diagnostic inventions that use conventional laboratory steps to detect a newly discovered natural phenomenon so long as the patents are narrowly tailored and actually reduced to practice. Such patents are less likely to improperly preempt a natural phenomenon but will likely serve as sufficient incentive to encourage future diagnostic inventions.