



Patenting nature—a comparative perspective

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ABSTRACT

The landscape for patenting products and processes tied to the natural world has changed dramatically in recent times as a result of a series of decisions of the US Supreme Court, particularly *Mayo Collaborative Services v Prometheus Laboratories* 566 U.S. 66 (2012) and *Association for Molecular Pathology v Myriad Genetics, Inc.* 569 U.S. 576 (2013) (*Myriad*). This article critically analyses these decisions and the multitude of lower court decisions that have followed them. This analysis provides support for the growing concern in the United States that it will be increasingly difficult to use the patent system to encourage the development of therapies and research intermediates useful in developing new therapeutic interventions. One option being posited in the industry to deal with this problem is to lobby Congress to reform the threshold patent eligibility standard in US patent law. It is argued in this paper that a more nuanced approach is preferable. Using the experience in Australia as a case study, this paper argues that such an approach is feasible. Australia has been chosen for analysis because the threshold patent eligibility standard is similar in both countries, much more so than with the European Union, and because the highest court in Australia has ruled on essentially the same patent as in *Myriad*, in *D'Arcy v Myriad Genetics, Inc* [2015] HCA 35. In addition to the nuanced approach to eligibility currently exercised by the Australian courts and patent office, Australia also has a number of post-grant options for addressing the dynamics of patent monopolies. These include experimental use, compulsory licensing, and government use. It is concluded that, while it would be impractical to attempt to replicate the Australian environment in the United States, there is no reason why some lessons can't be learned from the Australian experience with patenting nature.

KEYWORDS: Patent eligibility, nucleotide sequences, BRCA, Myriad, Mayo, USA, Australia

From the standpoint of the United States, modern genomic science began with a land grab, with research organizations patenting isolated sequences (and partial sequences) of DNA upon their discovery, sometimes even before their scientific implications were known. Within the life sciences community, fears quickly emerged that these patents would create an anticommons that would inhibit research;¹ fairly soon it became clear that gene patents would, indeed, interfere with patient care and could slow the development of valuable medical technologies.² To some, patent claims over genetic informational content was also regarded as an abridgment of freedom of thought and expression in ways that implicated the Constitution's First and Fourteenth Amendments as well as statutory protections regarding a patient's right to personal medical information.³

That period is, however, now largely over. With the completion of the Human Genome Project, sequencing human genes has become too routine to patent.⁴ Furthermore, the new generation of genetic research and diagnostic practice does not always require the isolation of genes, and thus does not generally infringe claims to isolated sequences.⁵ Most important, in a series of four cases, the Supreme Court affirmed the continued existence of a judicial exception to patentability for laws of nature, natural

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- ¹ Robert Cook-Deegan & Subhashini Chandrasekharan, *Patents and Genome-Wide DNA Sequence Analysis: Is It Safe to Go into the Human Genome?*, 42 J. L. MED. & ETHICS 42 (2014); Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998).
 - ² Report of the Secretary's Advisory Committee on Genetics, Health, and Society, *Gene Patents and Licensing Practices and Their Impact on Patient Access to Genetic Tests 1-4* (2010), https://osp.od.nih.gov/wp-content/uploads/2013/11/SACGHS_patents_report_2010.pdf (accessed Sept. 12, 2018) [hereinafter SACGHS Report]
 - ³ See *Ass'n for Molecular Pathology v. U.S. Patent & Trademark Office*, 669 F. Supp. 2d 365, 380, 398 (S.D.N.Y. 2009), *aff'd in part, rev'd in part*, 653 F.3d 1329 (Fed. Cir. 2011), cert. granted, judgment vacated sub nom. *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 566 U.S. 9023 (2012), and opinion vacated, appeal reinstated, 467 F. App'x 890 (Fed. Cir. 2012), and *aff'd*, 689 F.3d 1303 (Fed. Cir. 2012); Meredith Knight, *ACLU to Myriad Genetics: Patients, Not Companies, Own Personal Genetic Data*, GENETIC LITERACY PROJECT (July 12, 2016), <https://geneticliteracyproject.org/2016/07/12/aclu-myriad-genetics-patients-not-companies-personal-genetic-data/> (accessed Sept. 12, 2018) (citing the Health Insurance Portability and Accountability Act of 1996 (HIPAA), Pub. L. No. 104-191, 110 Stat. 1936 (codified as amended in scattered sections of 18, 26, 29, and 42 U.S.C.)). See also Daniel J. Kevles, *From Eugenics to Patents: Genetics, Law, and Human Rights*, 75 ANN. HUM. GENET. 326 (2011).
 - ⁴ Cf. The Centre of International Economics, *Final Report: Economic Analysis of the Impact of Isolated Human Gene Patents 75-76* (Report, The CIE, May 2013), https://www.ipaaustralia.gov.au/sites/g/files/net856/f/reports_publications/economic_analysis_of_the_impact_of_isolated_human_gene_patents.pdf (accessed Sept. 12, 2018).
 - ⁵ See eg J. C. Kwong et al., *Whole Genome Sequencing in Clinical and Public Health Microbiology*, 47 PATHOLOGY 199 (2015); Christopher M. Holman, *Mayo, Myriad, and the Future of Innovation in Molecular Diagnostics and Personalized Medicine*, 15 N.C. J. L. & TECH. 639 (2014); Kenneth Offit et al., *Gene Patents and Personalized Cancer Care: Impact of the Myriad Case on Clinical Oncology*, 31 J. CLIN. ONCOL. 2743 (2013); John Conley, *Myriad, Finally; Supreme Court Surprises by Not Surprising*, GENOMICS L. REP., June 18, 2013, <https://theprivacyreport.com/2013/06/18/myriad-finally-supreme-court-surprises-by-not-surprising/> (accessed Sept. 12, 2018) [<http://perma.cc/LC8S-Z8PF>]; W. Nicholson Price II, *Unblocked Future: Why Gene Patents Won't Hinder Whole Genome Sequencing and Personalized Medicine*, 33 CARDOZO L. REV. 1601 (2012). See also *infra* note 198 (describing the current market for diagnostics).

phenomena, and abstract ideas.⁶ Specifically, in *Association for Molecular Pathology v Myriad Genetics, Inc. (Myriad)*,⁷ the Court held unpatentable claims that cover isolated BRCA 1 and 2 sequences and their mutations, on the ground that these sequences, which are associated with early onset breast and ovarian cancer, constitute products of nature.

Paradoxically, however, ending the privatization of genetic information may have created more problems than it solved.⁸ *Myriad* has been read as imposing a bar to patenting all natural products. It possibly also bars the patentability of all products that duplicate (or come close to duplicating) materials found in nature.⁹ Complicating the picture, in *Mayo Collaborative Services v Prometheus Laboratories (Mayo)*, the Supreme Court also barred patents on diagnostic tests that rely on correlations among natural phenomena on the ground the relationships constitute principles of nature.¹⁰ As a result, there is a growing suspicion that it will be difficult to use the patent system to encourage the development of a whole range of therapies and research intermediates useful in developing new therapeutic interventions. These include proteins, kinases, colony-stimulating factors (such as growth factors), peptides, antibodies, viruses, and venoms.¹¹ It also means that advances in personalized medicine, which hold significant promise for curing an array of diseases, may no longer be patent-eligible.¹² Significantly, such advances could include companion diagnostics—information about whether a particular patient will benefit from a proposed therapy.¹³ Unlike earlier forays into genomics, which were centered at university and government laboratories, these new approaches are mainly the province of commercial diagnostic and pharmaceutical companies, which traditionally rely heavily on strong intellectual property protection to earn profits on their investments.¹⁴

Firms interested in investing in new technologies are not sitting still in light of these developments. Many are adopting new strategies for appropriating returns. Some are experimenting with claiming strategies that protect products and processes that differ

⁶ *Bilski v. Kappos*, 561 U.S. 593 (2010); *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, 566 U.S. 66 (2012); *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576 (2013); *Alice v. CLS Bank Int'l*, 134 S. Ct. 2347 (2014).

⁷ *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576 (2013).

⁸ Robert M. Schwartz & Timo Minssen, *Life after Myriad: The Uncertain Future of Patenting Biomedical Innovation & Personalized Medicine in an International Context*, 2015 INTELL.PROP.Q. 189 (2015) (critiquing U.S. case law from a scientific perspective).

⁹ See generally Mateo Aboy et al., *After Myriad, What Types of Claim Amendments Change a Patent Ineligible Isolated Gene Claim Into an Eligible Patent Claim That Is 'Markedly Different' From Nature?*, 35 NAT. BIOTECHNOL. 820 (2018).

¹⁰ 566 U.S. 66 (2012).

¹¹ See eg Dan L. Burk, *The Curious Incident of the Supreme Court in Myriad Genetics*, 90 NOTRE DAME L. REV. 505 (2014); Jacob Sherkow, *Patent Protection for Microbial Technologies*, 364 FEMS MICROBIOL. LETT. fnx205 (2017).

¹² An example is therapies that infuse patients with normal versions of a gene that is mutated in their own bodies, see e Gina Kolata, *In a First, Gene Therapy Halts a Fatal Brain Disease*, NEW YORK TIMES, Oct. 5, 2017, <https://www.nytimes.com/2017/10/05/health/gene-therapy-brain-disease.html?hp&action=click&pgtype=Homepage&clickSource=story-heading&module=second-column-region®ion=top-news&WT.nav=top-news> (accessed Sept. 12, 2018).

¹³ See Arti Rai, *Diagnostic Patents at the Supreme Court*, 18 MARQ. INTELL. PROP. L. REV. 1 (2014).

¹⁴ Cynthia H. Zhang & Y Philip Zhang, *Maximizing the Commercial Value of Personalized Therapeutics and Companion Diagnostics*, 31 NAT. BIOTECHNOL. 803 (2013).

(sometimes only slightly) from those found in nature.¹⁵ These patents may raise the same concerns that were raised in connection with natural phenomena and principles of nature. Other firms are said to be keeping information about natural phenomena and correlations among them as trade secrets.¹⁶ This is a particularly worrisome development as trade secrets arguably interfere even more than patents with dignitary interests and can have their own deleterious effects on research and patient care.¹⁷ Momentum is thus building in many segments of the life sciences community to legislatively expand the scope of patentable subject matter and to reverse the *Myriad* and *Mayo* decisions. For example, the Intellectual Property Owner's Association (IPO) and the American Intellectual Property Law Association (AIPLA) have suggested amending the Patent Act to permit protection of all discoveries, except for claims understood by the ordinary person in the art to 'exist in nature independently' of human activity, or that 'exist[] solely in the human mind'. In the view of these organizations, other provisions of patent law, including the requirements of newness, nonobviousness, and disclosure, will take care of most problematic cases.¹⁸ The American Bar Association (ABA) has made a somewhat similar suggestion: it would expand patentable subject matter unless the right would 'pre-empt the use of others of all practical applications'.¹⁹ These changes pertain only to US law. However, because research and diagnostics can be easily outsourced to places where they can be performed without legal impediment,²⁰ right holders will want to ensure global exclusivity. Thus, any change in the patentability of products and laws of nature in the United States is likely to find its way into the next rounds of international negotiations on intellectual property protection.

¹⁵ See Aboy et al., *supra* note 9, at 824 (noting that examiners have allowed claims to nucleic acids that differ only slightly from those found in nature; giving the example of adding a fluorescent label).

¹⁶ Schwartz & Minssen, *supra* note 8 at 210–11; Robert Cook-Deegan et al., *The Next Controversy in Genetic Testing: Clinical Data as Trade Secrets?*, 21 EUR. J. HUM. GENET. 585–88 (2013). See also John Conley, ACLU v. Myriad Genetics, Round 2: The Problem of Governance-by-Guidance, Genomics Law Report (June 9, 2016), <https://theprivacyreport.com/2016/06/09/acu-v-myrriad-genetics-round-2-the-problem-of-governance-by-guidance/> (accessed Sept. 12, 2018); ACLU HIPPA complaint, <https://www.aclu.org/legal-document/acu-hipaa-complaint> (accessed Sept. 12, 2018).

¹⁷ See eg Bhaven Sampat & Heidi L. Williams, *How Do Patents Affect Follow-on Innovation? Evidence from the Human Genome*, NBER Working Paper 21666 (2017), <http://www.nber.org/papers/w21666> (suggesting that trade secrecy leads to less follow-on innovations than patents).

¹⁸ Intellectual Property Owners Association, Proposed Amendments to Patent Eligible Subject Matter Under 35 U.S.C. § 101, Feb. 7, 2017, http://www.ipo.org/wp-content/uploads/2017/02/20170207_IPO-101-TF-Proposed-Amendments-and-Report.pdf (accessed Sept. 12, 2018); American Intellectual Property Law Association, AIPLA Legislative Proposal and Report on Patent Eligible Subject Matter (2017), <http://www.aipla.org/resources2/reports/2017AIPLADirect/Documents/AIPLA%20Report%20on%20101%20Reform-5-19-17-Errata.pdf> (accessed Sept. 12, 2018).

¹⁹ American Bar Association, Letter to Michelle K. Lee, Supplemental Comments Related to Patentable Subject Matter Eligibility, Mar. 28, 2017, https://www.americanbar.org/content/dam/aba/administrative/intellectual_property_law/advocacy/advocacy-20170328-comments.authcheckdam.pdf (accessed Sept. 12, 2018). See also U.S. Patent and Trademark Office (USPTO), Notice of Roundtables and Request for Comments Related to Patent Subject Matter Eligibility, 81 Fed. Reg. 71485 (Oct. 17, 2016), <https://www.gpo.gov/fdsys/pkg/FR-2016-10-17/pdf/2016-24888.pdf> (accessed Sept. 12, 2018); USPTO, Patent Subject Matter Eligibility Roundtable, <https://www.uspto.gov/patent/laws-and-regulations/comments-public/patent-subject-matter-eligibility-roundtable-2> (accessed Sept. 12, 2018) (Dec. 5, 2016).

²⁰ See Bayer AG v. Housey Pharm., Inc., 340 F.3d 1367 (Fed. Cir. 2003) (interpreting 35 U.S.C. § 271(g) to permit the importation of data, even when produced through a process patented in the United States).

The time has therefore arrived to consider sensible ways in which to revise the legal regime: to devise a rule on patentable subject matter that deals with technologies that function as commercial outputs and research inputs and are significant for patient care, and to consider whether changing the scope of patentability also requires rethinking other facets of the patent regime. Proposals such as those made by the IPO, AIPLA, and ABA have been greeted with considerable skepticism on the ground that other provisions of patent law are too difficult and fact-bound to apply as readily as a subject matter exclusion or that the newness, nonobviousness, and disclosure requirements will not be sufficient to deal with the problems that patenting nature presents.²¹ Furthermore, concepts like pre-emption and existence in nature or the human mind may be too vague to be applied consistently.²² Some commentators have therefore looked to the European Patent Convention and the EU Biotech Directive, which offer a more generous approach to gene patents.²³ It is not, however, clear that these rules work well in Europe or that they would readily transfer from a civil law system that includes many specific exceptions to patentability to a common law system that relies on judge-made law.²⁴

We take a different tack. We compare the situation in the United States with that of Australia. In our view, that comparison is particularly helpful because the *Myriad* case was litigated to the highest court of Australia at roughly the same time as the case was *sub judice* in the United States. It was motivated by similar considerations and based on a similar statute, one that is similarly inflected with considerable judicial gloss. Yet the outcomes and impact of the cases appear to be quite different.²⁵ Using the Australian decision and its aftermath, we identify limiting principles to the bars placed on patenting nature and argue that these limits may be sufficient to permit patenting in areas where the benefits of encouraging life sciences innovation through patenting outweigh the costs. But given the reality that changes in the law are likely to be made, we next consider a remarkable feature of the Australian case, where the *Myriad* decision made little difference in terms of access to genetic information. We examine the factors in Australian practice that ameliorated the effects of gene patenting prior to the decision

²¹ Paul R. Gugliuzza, *Quick Decisions in Patent Cases*, 106 GEO. L.J. 619 (2018); Rochelle C. Dreyfuss & James P. Evans, *From Bilski Back to Benson: Preemption, Inventing Around, and the Case of Genetic Diagnostics*, 63 STAN. L. REV. 1349, 1375 (2011). See also Dennis Crouch & Robert P. Merges, *Operating Efficiently Post-Bilski by Ordering Patent Doctrine Decision-Making*, 25 BERKELEY TECH. L. J. 1673 (2010) (suggesting that the other criteria should be considered first, and subject matter eligibility be considered only in residual cases).

²² Jacob S. Sherkow, *The Natural Complexity of Patent Eligibility*, 99 IOWA L. REV. 1137, 1139 (2014); Katherine J. Strandburg, *Much Ado About Preemption*, 50 HOUS. L. REV. 563, 569–86 (2012).

²³ Convention on the Grant of European Patents, art. 52(3), Oct. 5, 1973, 1065 U.N.T.S. 255, 13 I.L.M. 270; Council Directive 98/44/EC, 1998 O.J. (L 213) 13–14 (EC). See eg Jessica C. Lai, *Myriad Genetics and the BRCA Patents in Europe: The Implications of the U.S. Supreme Court Decision*, 5 UC IRVINE L. REV. 1041 (2015); Joshua D. Sarnoff, *Patent Eligible Medical and Biotechnology Inventions After Bilski, Prometheus, and Myriad*, 19 TEX. INTELL. PROP. L. J. 393 (2011).

²⁴ See eg Reinier B. Bakels, *The Half Invention: The Inevitable Truth About the Invention Concept* (2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2993744 (accessed Sept. 12, 2018) (recounting the European Patent Office's attempt to arrive at a stable rule on what constitutes patentable subject matter in the context of software and business methods); Burk, *supra* note 11, at n.149.

²⁵ The difference may also have legal significance for both countries, Australia–United States Free Trade Agreement, U.S.–Austl., art. 17.9.14, May 8, 2004, 43 I. L. M. 1248 (endeavoring to reduce differences in law and practice).

in *Myriad* and suggest ways in which US law could better reflect those factors to create greater certainty for all stakeholders.

The paper proceeds as follows. In Part I, we consider the US *Myriad* decision and its case law progeny, along with PTO guidelines and survey evidence on how these guidelines are applied. For inventions generally drawn to statutory technology, what we see is a two-step approach in which the first step requires the court to consider whether the claim has ‘markedly different’ characteristics than what is found in nature (or for processes, that they could not be performed using mental steps or critical thinking). If the claim is not different enough, the second step is to ask whether the claim adds ‘significantly more’—enough to remove it from the judicial exception.²⁶ We conclude this approach is not viable. Not only does it fail to provide adequate guidance,²⁷ the *Mayo* test makes it difficult to add a diagnostic step as the ‘significantly more’ that saves a natural product from the patent bar and *Myriad* makes adding a natural product element insufficient to deal with the bar on patenting principles.²⁸ Because a third case, *Limelight Networks, Inc. v Akamai Techs., Inc.*²⁹ limits the ability of patent holders to successfully assert method claims when the steps in the method are divided among unrelated actors, adding a treatment step may be similarly unavailing whenever the diagnosis and the treatment are performed by different parties.³⁰ Ironically, and depending on how they are applied, the test may also fail to single out all of the inventions that raise concerns for research and patient care.³¹

Part II examines the alternative approach in Australia. Here we argue that the factorial test propounded by the Australian High Court, as elaborated in Patent Office guidance, significantly improves decision-making. To be sure, there are not as many cases as there are in the United States, and Australia’s ‘*Mayo* moment’ occurred in a lower court and has yet to be reviewed by the High Court. Still, we argue that this approach holds considerable appeal. Part III considers what should occur if Congress concludes that the current state of subject matter jurisprudence is not tolerable and expands the reach of patenting to include all technological arts. Here, Australian practice is particularly illuminating. After describing the reasons why patenting did not create a thicket impeding access there, this section discusses the ways in which those practices can be translated into positive law for the United States.

I. AMP v. MYRIAD: THE US CASE

As related by historian Dan Kevles, the *Myriad* case began in 1990, when Mary-Claire King, a professor at the University of California, traced the BRCA1 gene to a location on chromosome 17. This was an important finding as mutations of BRCA change the pro-

²⁶ USPTO, Subject Matter Eligibility Examples, May 2016, <https://www.uspto.gov/sites/default/files/documents/ieg-may-2016-ex.pdf> (accessed Sept. 12, 2018).

²⁷ Cf. Hal Wegner, *The Mayo-Myriad PTO Guideline*, <http://www.patents4life.com/wp-content/uploads/2014/03/MayoMyriadGuidelinesMarchS.pdf> (“There is no concrete test to show whether a claimed invention is ‘significantly different’ . . .”) (accessed September 12, 2018).

²⁸ See eg *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371 (Fed. Cir. 2014); *Cleveland Clinic Found. v. True Health Diagnostics LLC*, 859 F.3d 1352 (Fed. Cir. 2017).

²⁹ 134 S.Ct. 2111 (2014).

³⁰ See eg Alan D. Miller & Brian Amos, *Successful Strategies for Diagnostic Method Claims*, 23 J. COMM’L BIOTECH. 39, 41 (2017).

³¹ See Sherkow, *supra* note 11, at 1-2 (questioning whether the breadth of patents on certain CRISPR technology is narrow enough to permit research).

tein the gene produces in ways that are associated with early-onset breast and ovarian cancer. A race to characterize the gene ensued; it was won in 1994 by Mark Skolnick, a University of Utah geneticist and cofounder of Myriad Genetics, who quickly moved to patent the isolated gene and its mutations; Skolnick also set up diagnostic testing facilities to detect the sequences in patients. He repeated these efforts a year later, when he found the BRCA2 gene, which is likewise associated with early-onset breast and ovarian cancer, on chromosome 13.³² For several years after these discoveries, multiple laboratories performed diagnostic tests involving the BRCA genes. However, in 1997 Myriad began to assert its US patents and clear both the diagnostic and research markets; in 2004, it apparently started to keep information on mutations, correlations with cancer risk, and algorithms for interpreting genetic information as trade secrets.³³

From a public relations perspective, these actions proved Myriad's undoing. As studies commissioned by the Health and Human Services Secretary's Advisory Committee on Genetics, Health, and Society (SACGHS) later found,³⁴ centralizing genetic testing in a single organization's laboratories eliminated the ability of patients to obtain second opinions (a significant problem for a diagnosis that can lead to surgery to remove breasts and ovaries). Exclusivity also reduced the incentive to improve the tests or keep them current with advances in the underlying science; it also made it impossible to ensure the quality of the existing test by comparing results from different laboratories.³⁵ Furthermore, privatization led to break downs with insurers (particularly for Medicaid patients), slowed the development of innovative diagnostic technologies, and impeded the ability of researchers to find other genes associated with breast cancer.

Concerned about freedom of speech and the implications of recognizing exclusive rights over genetic knowledge for patients, researchers, and science, the American Civil Liberties Union challenged these patents in 2009, naming as plaintiffs individuals and organizations with varying relationships to the Myriad patents.³⁶ The complaint sought declarations that 15 patent claims related to BRCA 1 and 2 genes were invalid because they barred learning, thinking, and transmitting genetic information in violation of the First and Fourteenth Amendments and because they are not drawn to statutory subject matter under § 101 of the Patent Act, which does not extend to laws of nature, phenomena (products) of nature, and abstract ideas.³⁷ The challenged claims covered isolated genomic DNA (gDNA, or native DNA) encoding BRCA proteins; complementary DNA, exon sequences encoding these proteins (cDNA, generated in the laboratory to exclude introns, noncoding regions of the DNA); diagnostic tests that compare a

³² DANIEL J. KEVLES, CAN THEY PATENT YOUR GENES, *THE NEW YORK REVIEW OF BOOKS* (Mar. 7, 2013).

³³ See Cook-Deegan et al, *supra* note 16.

³⁴ Robert Cook-Deegan & Christopher Heaney, *Gene Patents and Licensing: Case Studies Prepared for the Secretary's Advisory Committee on Genetics, Health, and Society*, 12 *GENET. MED.* S1–S2 (2010).

³⁵ See James P. Evans, *Putting Patents Before Patients*, 12 *GENET. MED.* S1–S2 (2010); SACGHS Report, *supra* note 2; *AMP*, 702 F.Supp. 207–213.

³⁶ *Ass'n for Molecular Pathology v. U.S. Patent & Trademark Office*, 702 F. Supp. 2d 181, 200–206 (S.D.N.Y. 2010), as amended (Apr. 5, 2010), *aff'd in part, rev'd in part*, 653 F.3d 1329 (Fed. Cir. 2011), cert. granted, judgment vacated sub nom. *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 566 U.S. 902 (2012), opinion vacated, appeal reinstated, 467 F. App'x 890 (Fed. Cir. 2012) and 689 F.3d 1303 (Fed. Cir. 2012), *aff'd in part, rev'd in part*, 569 U.S. 576 (2013). See also Sandra S. Park, *The Challenge to Gene Patents as Feminist Patent Litigation*, 19 *TECH. & INNOVATION* 659 (2018) (noting the choice of plaintiffs highlighted the civil rights aspects of the case).

³⁷ *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980).

patient's sequence to known sequences; and screening tests to determine whether particular therapeutic substances were effective at halting the growth of cells carrying altered BRCA genes.³⁸ The case was ultimately decided by the Supreme Court. But because we question the Court's disposition, the opinions generated along the way bear consideration.

I.A. The Trial Court Decision

The trial court quickly focused on the traditional challenges under the Patent Act, rather than the novel claims sounding in constitutional law.³⁹ Judge Sweet held the composition claims (to gDNA and cDNA) were not patentable because they were not 'markedly different' from compositions found in nature, as he thought was required by prevailing Supreme Court case law.⁴⁰ Particularly crucial to the court was the way in which DNA differed from other chemical compositions. Relying on a statement of Myriad's own expert witness, Joseph Straus, to the effect that 'Genes are of double nature' in that they are both chemicals and carriers of information,⁴¹ the court stressed that:

The information encoded in DNA is not information about its own molecular structure incidental to its biological function, as is the case with adrenaline or other chemicals found in the body. Rather, the information encoded by DNA reflects its primary biological function: directing the synthesis of other molecules in the body—namely, proteins, 'biological molecules of enormous importance' which 'catalyze biochemical reactions' and constitute the 'major structural materials of the animal body'.⁴²

According to the court, isolation, including removal of noncoding regions, did not change that fundamental character. Both cDNA and gDNA were therefore found unpatentable. In addition, the court held that analysis and comparison of DNA sequences, as described in the diagnostic claims, were abstract mental processes that failed to satisfy the then-prevailing view that a machine or physical transformation was the key to patentability.⁴³ Similarly, it found that the screening claim, which involved comparing the growth rate of cells, was no more than a claim to a scientific method and, as such, was not patentable.⁴⁴

³⁸ *AMP*, 702 F. Supp. at 213–214.

³⁹ *Id.* at 237–238 (dismissing the constitutional arguments once the patent claims were found invalid on a theory of constitutional avoidance).

⁴⁰ *Id.* at 224, citing, among other cases, *Am. Fruit Growers v. Brogdex Co.*, 283 U.S. 1, 12–13 (1931) and *Diamond v. Chakrabarty*, 447 U.S. 303, 310 (1980).

⁴¹ The full statement of Straus, a world renown patent law professor and attorney, see IP Hall of Fame, http://www.iphalloffame.com/joseph_straus/ (accessed Sept. 12, 2018), was: 'Genes are of double nature: On the one hand, they are chemical substances or molecules. On the other hand, they are physical carriers of information, i.e., where the actual biological function of this information is coding for proteins. Thus, inherently genes are multifunctional', *AMP*, 702 F. Supp. at 228.

⁴² *Id.*, citing in re O'Farrell, 853 F.2d 894, 895–96 (Fed. Cir. 1988) and referencing *Learned Hand's Parke–Davis & Co. v. H.K. Mulford Co.*, 189 F. 95 (S.D.N.Y.1911) (finding isolated adrenaline patentable).

⁴³ *Id.* at 236, citing in re *Bilski*, 545 F.3d 943 (Fed.Cir. 2008), which was later affirmed by the Supreme Court on other grounds, *Bilski v. Kappos*, 561 U.S. 593 (2010).

⁴⁴ *AMP*, 702 F. Supp. at 237.

II.B. The Federal Circuit Decision

The Federal Circuit agreed that the diagnostic claim was not patentable,⁴⁵ but in all other respects, it reversed the trial court. Rejecting the focus on DNA's 'informational content',⁴⁶ Judge Lourie (formerly, an organic chemist⁴⁷) conceived of DNA as a chemical molecule—a 'distinctive chemical form... an integral part of a larger structural complex, a chromosome'.⁴⁸ Because the isolated gDNA claimed in the patent required cleaving the covalent bonds in the backbone of the native chemical composition, he regarded the claimed DNA as markedly different from the molecule as found in nature. Thus, it was, in his view, patentable.⁴⁹ A fortiori, so too was cDNA.⁵⁰ Similarly, he considered the cancer screen patent-eligible because it included the concrete steps of growing cells and manipulating them to determine their growth rate and thus was not abstract.⁵¹

Judge Moore concurred, albeit reluctantly on claims to long gDNA strands. Whereas she thought the short strands were patentable because they were not only markedly different from nature, but also had utilities not found in nature, the longer strands had only the differences in the bonding to distinguish them from nature.⁵² Writing on a clean slate, Judge Moore would not have found these patentable. However, because she recognized a strong reliance interest in DNA patents, she concurred in the result, leaving it to Congress to determine whether such claims promote or inhibit science.⁵³

Judge Bryson agreed with the others on the disposition regarding cDNA and the method claims. However, he dissented on the patentability of the gDNA claims, arguing that the patents would 'have broad consequences, such as preempting methods for whole-genome sequencing, even though Myriad's contribution to the field is not remotely consonant with such effects'.⁵⁴ Further, he was not impressed by the differences relied upon by Judge Lourie because he considered the cleavage of bonds 'necessarily incidental to the extraction of the genes from the environment in which they are found in nature'.⁵⁵ He was especially concerned about a claim that he interpreted as covering all isolated DNAs coding for the BRCA1 protein. Noting that it referred to a sequence that was 24,000 nucleotides long with numerous gaps, he argued that:

An almost incalculably large number of new molecules could be created by filling in those gaps with almost any nucleotide sequence, and all of those molecules would fall within the scope of [the] claim. Included in that set are many important molecular variations to the BRCA1 gene that Myriad had not yet discovered and could not have chemically

⁴⁵ *Ass'n for Molecular Pathology v. U.S. Patent & Trademark Office*, 653 F.3d 1329, 1356–57 (Fed. Cir. 2011), citing the Supreme Court's decision in *Bilski v. Kappos*, 561 U.S. 593 (2010), which rejected reliance on the machine or transformation test.

⁴⁶ *Id.* at 1349.

⁴⁷ United States Court of Appeals for the Federal Circuit, Alan D. Lourie, Circuit Judge, <http://www.cafc.uscourts.gov/judges/alan-d-lourie-circuit-judge> (accessed Sept. 12, 2018).

⁴⁸ *AMP*, 653 F.3d at 1351.

⁴⁹ *Id.* at 1352.

⁵⁰ *Id.* at 1353.

⁵¹ *Id.* at 1358–59.

⁵² *Id.* at 1366–67.

⁵³ *Id.* at 1371.

⁵⁴ *Id.* at 1373.

⁵⁵ *Id.* at 1375.

described. Yet those molecules would share only one unifying characteristic: each codes for the same protein as the naturally occurring BRCA1 gene.⁵⁶

III.C. The Supreme Court Decision

Given the split decision on the DNA claims, it was not surprising that the Supreme Court agreed to entertain the case. Indeed, in many ways it was primed to hear it. Starting in the early 2000s the Court had become concerned with the impact of patents on scientific and medical advancement. In 2005, it encountered the crabbed way in which the Federal Circuit interpreted a statutory research exemption that permits research ‘related to the development and submission of information under a Federal law which regulates the manufacture, use, or sale of drugs’.⁵⁷ In *Merck v Integra*, the Court, recognizing the value of experimentation in developing new therapies, reversed the Federal Circuit’s holding that only clinical research is covered by the exemption.⁵⁸ At the same time, however, the Court acknowledged that the exemption did not extend to ‘basic scientific research’.⁵⁹ The next Term, in a dissent from the denial of certiorari in *Lab. Corp. v Metabolite* (*Metabolite*), a case about the subject matter eligibility of a diagnostic test, Justice Breyer opined that ‘sometimes too much patent protection can impede rather than “promote the Progress of Science and useful Arts,” the constitutional objective of patent and copyright protection’.⁶⁰ *Bilski v Kappos*, which barred patents on abstract principles, followed in 2010.

More important, soon after the Federal Circuit’s decision in *Myriad*, the Court reviewed a case that raised the *Metabolite* issue concerning diagnostics. As foreshadowed by Justice Breyer’s dissent in *Metabolite*, in *Mayo* the Court invalidated a patent on a method for determining whether a patient was receiving the correct dose of a drug.⁶¹ The Court reasoned that a claim to a relationship between dose and effect is a natural law; when such a claim includes no more than ‘well-understood, routine, conventional activity previously engaged in by researchers in the field’, the claim ties up use of the underlying law, which can ‘inhibit future innovation’ premised on the law’s use, including, in the *Mayo* case, ‘the development of more refined treatment recommendations’.⁶² Thus, the Court concluded, claims stating laws of nature that do not include an ‘inventive concept’ in the application of the law are unpatentable.⁶³

Because *Mayo* was handed down after the Federal Circuit’s decision in the *Myriad* case, the Court’s first step in reviewing *Myriad* was to ask the Federal Circuit to reconsider its decision in light of *Mayo*.⁶⁴ Oddly, however, *Mayo* barely played a role in any of the subsequent *Myriad* decisions. On remand, Judge Lourie dismissed *Mayo* as solely

⁵⁶ *Id.* at 1376.

⁵⁷ 35 U.S.C. § 271(e) (2018).

⁵⁸ *Merck KGaA v. Integra Lifesciences I, Ltd.*, 545 U.S. 193 (2005).

⁵⁹ *Id.* at 206.

⁶⁰ *Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc.*, 548 U.S. 124, 126–27 (2006) (Breyer, J., dissenting from the denial of certiorari).

⁶¹ *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66 (2012).

⁶² *Id.* at 86–87.

⁶³ *Id.* at 83.

⁶⁴ *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 132 S. Ct. 1794 (2012) (mem.) (order granting certiorari, vacating, and remanding).

concerned with the preemption of laws of nature;⁶⁵ Judge Moore stuck to her previous views even though she claimed to consider *Mayo* applicable;⁶⁶ Judge Bryson did not mention the decision at all—and, surprisingly, the Supreme Court barely referenced it in its plenary review.⁶⁷ Instead, the Supreme Court started off by conceptualizing Myriad’s invention much as Judge Sweet did, downplaying DNA’s character as a molecular structure (as Justice Thomas put it, ‘Myriad’s claims are simply not expressed in terms of chemical composition’⁶⁸) and stressing its informational content (the ‘claim is concerned primarily with the information contained in the genetic sequence, not with the specific chemical composition of a particular molecule’⁶⁹). The Court did not, however, reach the same conclusion as Judge Sweet. Rather than focus on the question whether information directing the synthesis of proteins is patentable subject matter, the Court relied on the distinction between natural and artificial creation. Because it considered the gDNA naturally occurring, it held it unpatentable. Since the cDNA was synthesized, the Court found it to be statutory subject matter.⁷⁰

The natural/artificial distinction is not, however, satisfying as a theoretical matter or helpful as legal guidance. Once the Court recognized the biological functioning of DNA sequences, it is difficult to understand how it could distinguish between cDNA and gDNA as both encode the identical information. Both raise the problem of inhibiting science, which was the focus of Justice Breyer’s concern in *Metabolite*. Moreover, the ownership of what are essentially biological instructions—whether embodied in gDNA or cDNA—ties up principles about the relationships among the nucleotides comprising DNA and the protein chains these nucleotides produce. Since these relationships are at least as fundamental to future innovation as the laws at issue in *Mayo*, it would seem that the cDNA claims should be equally vulnerable to invalidation. (Indeed, the informational nature of DNA—the extent to which it encodes a biological process—is arguably why the Court’s initial intuition in *Myriad* was to remand it in light of *Mayo*.⁷¹)

The decision has other problematic features. Although the Court found cDNA patentable, it recognized that sometimes native sequences do not contain noncoding regions. Because such strands ‘may be indistinguishable from natural DNA’, Justice Thomas opined that they are not patentable.⁷² Conversely, the Court noted that ‘[i]n rare instances, a side effect of a viral infection of a cell can be the random incorporation of fragments of the resulting cDNA, known as a pseudogene, into the genome’. Since the Court thought these so-called pseudogenes ‘serve no purpose’, it held such strands are patentable.⁷³ In other words, cDNA is patentable except when it isn’t, while gDNA is not patentable except when it is. Because detecting these special situations may not

⁶⁵ *Ass’n for Molecular Pathology v. U.S. Patent & Trademark Office*, 689 F.3d 1303, 1331 (Fed. Cir. 2012),

⁶⁶ *Id.* at 1339–40.

⁶⁷ *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576, 586, 589 & 594 n.7 (2013).

⁶⁸ *Id.* at 2118.

⁶⁹ *Id.*

⁷⁰ *Id.* at 2118–19.

⁷¹ Cf. Burk, *supra* note 11, at 506 (pointing out the curious nature of the remand), 516 (conceiving of informational molecules as embodying the process that leads to a product—in other words, the embodiment of a principle).

⁷² *FTC v. Actavis, Inc.*, 133 S. Ct. at 2119 (2013).

⁷³ *Id.* at 2119 n. 8.

be easy (and because science may someday identify a use for pseudogenes), these exceptions create an element of unpredictability for other gene-related patents.

Even more worrisome is the difficulty in determining the patentability of other substances that are based on nature, such as venoms isolated from animals and used in research on alleviating pain, unmutated genes introduced into patients to stimulate the development of normal proteins, antibodies produced by rats and then treated so that they are close enough to human antibodies to withstand rejection, or proteins and kinases that are used in the development of therapies. Since the Court never explained why it ignored the cleaved bonds that were so important to Judge Lourie, it is not clear how far a synthetic molecule must depart from its naturally occurring analog to be considered patentable. The humanized rat antibody is one illustration of the difficulty; another is Dan Burk's example of a peptide nucleic acid, which is entirely artificial yet carries the same sequence information as DNA.⁷⁴ Furthermore, because the Court never relied on the differences that Judge Moore had pointed out in the ways in which short (as opposed to long) strands of DNA can be used, and because gDNA and cDNA include the same instructions on making proteins, functional changes do not appear to be a key feature of the analysis. Nor is it clear that the inventiveness of the synthesis will matter. Because *Mayo* was not, in the end, important to the decision in *Myriad*, arguably *Mayo's* methodology, and its reliance on an inventive concept, is irrelevant to decisions about the patentability of phenomena of nature.⁷⁵ And that is possibly true even though the case after *Mayo*, *Alice v. CLS Bank (Alice)*, emphasized that when a claim is drawn to a judicial exception, patentability is saved only when there is 'an "inventive concept"—i.e., an element or combination of elements that is sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself.'⁷⁶ Certainly, the *Myriad* Court did not bother to look for such a concept: Justice Thomas never asked whether generating cDNA is a 'well-understood, routine, conventional activity, previously engaged in by those in the field', as *Mayo* required.⁷⁷

IV.D. The Aftermath

Subsequent events, including the PTO's 2016 guidelines, its 2018 memoranda, and PTO examples, a survey of issued patents, and the near 100 cases the Federal Circuit has decided since *Alice*, demonstrate how difficult it is to work with the Supreme Court's framework.⁷⁸ Despite the uncertainty about the relationship between *Myriad*

⁷⁴ Burk, *supra* note 11, at 509.

⁷⁵ See generally, Jeffrey A. Lefstin, *The Three Faces of Prometheus: A Post-Alice Jurisprudence of Abstractions*, 16 N.C. J. L. & TECH. 647, 659 (2015).

⁷⁶ *Alice Corp. Pty. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2355 (2014) (internal quotation and citation to *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 82 (2012) omitted).

⁷⁷ *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 82 (2012).

⁷⁸ See USPTO, Formulating a Subject Matter Eligibility Rejection and Evaluating the Applicant's Response to a Subject Matter Eligibility Rejection, May 4, 2016, <https://www.uspto.gov/sites/default/files/documents/ieg-may-2016-memo.pdf> (accessed Sept. 12, 2018); Index of Eligibility Examples, https://www.uspto.gov/sites/default/files/documents/ieg-dec-2016-ex_index.pdf (accessed Sept. 12, 2018) [hereinafter Subject Matter Examples]; Chart of Subject Matter Eligibility cases (May 3, 2018), available as a link in USPTO, Subject Matter Eligibility, <https://www.uspto.gov/patent/laws-and-regulations/examination-policy/subject-matter-eligibility> (accessed Sept. 12, 2018) [hereinafter PTO Chart]. After this article was complete and the patents discussed in this article issued, much of the PTO materials were incorporated in the Manual of Patent Examining

and *Mayo*, the guidelines (and now the Manual of Patent Examining Procedure) apply the *Mayo* approach to all subject matter eligibility issues. They instruct examiners to determine whether claims are directed to a statutory category (Step 1). For a claim that is within a statutory category, the examiner must next decide whether it is directed to a judicial exception (for life sciences, a law of nature or a natural phenomenon) or is ‘markedly different’ from the exception (Step 2A). If it is not different, the examiner must then determine whether there are elements in the claim, alone or in combination, that add ‘significantly more’ than the judicial exception, elements that amount to more than a well-understood, routine convention activity in the relevant art (Step 2B).

From the new life-sciences examples that accompany the 2016 guidelines, it is clear that as far as the PTO is concerned, Step 2A is the more critical. The examples include two products derived directly from nature. The first (Example 28, a vaccine) comprises seven claims, six of which the PTO considers patent-eligible. Of those, five are regarded as patent eligible because they cover material that is ‘markedly different’ under Step 2A; in only one case is eligibility dependent on a finding that ‘significantly more’ was added per Step 2B. Claim 30 (a sweetener) includes six claims. Four are considered patent-eligible, all because they are ‘markedly different’ from nature under step 2A. For diagnostics, the analysis is similar. In Example 31, which is based on the *Myriad* case, three of the five claims are considered patentable because they are ‘markedly different’ from a natural law or a mental act (Step 2A); only one is eligible because nonconventional activity added ‘significantly more’ (Step 2B). While four of the seven claims in Example 29 (diagnosis and treatment of a hypothetical disease) are considered patent-eligible under Step 2B, still there are two claims in this example that pass muster because of Step 2A. Had the PTO considered Step 2B equally determinative, it would presumably have offered more examples of how to use it.

The importance of Step 2A is even more evident in the Federal Circuit case law. Of the nearly 100 cases listed by the PTO as of May 3, 2018, only 10 can be classified as involving laws or products of nature.⁷⁹ Of these, in only three was the patent upheld—tellingly, two on the ground that it was not directed at a patent-ineligible concept (Step 2A, which confusingly, the court calls Step 1).⁸⁰ Patent holders forced to the second step thus mostly lost. Of the cases involving abstract ideas, the patent holder prevailed in 10; seven because of Step 2A (aka Step 1), two on Step 2B; in the last case, there is considerable ambiguity (and a dissent) as to how the court decided the claims were statutory subject matter.⁸¹ It is, in short, much harder for the patentee to win once

Procedure in its January 2018 revision, see § 2106. See also Aboy et al., *supra* note 9; Miller & Amos, *supra* note 30.

⁷⁹ PTO Chart, *supra* note 78; In re Bhagat, No. 2016-2525, 2018 WL 1378062 (Fed. Cir. Mar. 16, 2018) (nonprecedential); Exergen Corp. v. Kaz USA, Inc., No. 2016-2315, 2018 WL 1193529 (Fed. Cir. Mar. 8, 2018) (nonprecedential); Cleveland Clinic Found. v. True Health Diagnostics LLC, 859 F.3d 1352 (Fed. Cir. 2017); Rapid Litig. Mgmt. Ltd. v. CellzDirect, Inc., 827 F.3d 1042 (Fed. Cir. 2016); Genetic Techs. Ltd. v. Merial L.L.C., 818 F.3d 1369, 1373 (Fed. Cir. 2016); Ariosa Diagnostics, Inc. v. Sequenom, Inc., 788 F.3d 1371 (Fed. Cir. 2015); In re BRCA1- & BRCA2-Based Hereditary Cancer Test Patent Litig., 774 F.3d 755 (Fed. Cir. 2014); In re Roslin Institute (Edinburgh), 750 F.3d 1333 (Fed. Cir. 2014); SmartGene, Inc. v. Advanced Biological Labs., SA, 555 F. App’x 950, 954–55 (Fed. Cir. 2014) (nonprecedential).

⁸⁰ Vanda Pharm. Inc. v. West-Ward Pharm. Int’l Ltd., 887 F.3d 1117 (Fed. Cir. 2018); Rapid Litig. Mgmt. Ltd. v. CellzDirect, Inc., 827 F.3d 1042 (Fed. Cir. 2016).

⁸¹ The seven Step (2B)—Step 1—cases are Core Wireless Licensing S.A.R.L. v. LG Elecs., Inc., 880 F.3d 1356 (Fed. Cir. 2018); Finjan, Inc. v. Blue Coat Sys., Inc., 879 F.3d 1299 (Fed. Cir. 2018) Visual Memory LLC v.

the decision-maker decides the claim is drawn to a judicial exception under Step 2A. To be sure, that might change now that the Federal Circuit's *Berkheimer v HP Inc.* decision (*Berkheimer*) has stressed the factual underpinnings of the second inquiry as to whether the claims add elements that is not a well-understood, routine, conventional activity.⁸² Since the test now requires proof by clear and convincing evidence that the activity is conventional, it may become easier for issued patents to survive the second step.⁸³

Still, the near-dispositive nature of the first step in the analysis of life sciences cases is not difficult to understand: it is not evident what the second step, which looks for 'significantly more', actually means. Following *Berkheimer*, the PTO issued a memorandum that attempts to clarify the analysis. It instructs examiners that the facts must show not simply that the activity was known or obvious, but that it was 'widely prevalent or in common use in the relevant industry'.⁸⁴ Further, it states that if the activity constitutes several elements, they must be examined both individually and in combination. Whether the Supreme Court will approve this approach is an open question and the PTO has asked for public comments.⁸⁵ So far, the Office appears willing to accept as 'substantially more' anything not already widely known, including material known, but not for the particular application recited in the claim;⁸⁶ or known and used by only a few scientists; or methods nonconventional at the time of the application, even if after the date of invention or application, they became routine.⁸⁷ It has not, however, come

NVIDIA Corp., 867 F.3d 1253 (Fed. Cir. 2017); *Thales Visionix Inc. v. United States*, 850 F.3d 1343 (Fed. Cir. 2017); *Trading Techs. Int'l, Inc. v. CQG, INC.*, 675 F. App'x 1001 (Fed. Cir. 2017) (nonprecedential; includes a Step 2B back-up); *McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299 (Fed. Cir. 2016); *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016). The two Step 2B—Step 2—cases are: *BAS-COM Glob. Internet Servs., Inc. v. AT & T Mobility LLC*, 827 F.3d 1341 (Fed. Cir. 2016); *DDR Holdings, LLC v. Hotels.com, L.P.*, 773 F.3d 1245 (Fed. Cir. 2014). The ambiguous case is *Amdocs (Israel) Ltd. v. Openet Telecom, Inc.*, 841 F.3d 1288 (Fed. Cir. 2016) (also raising the question whether eligibility must be determined by the claims alone, or whether the specification can also be included).

⁸² *Berkheimer v. HP Inc.*, 881 F.3d 1360, 1368 (Fed. Cir. 2018). See also *Aatrix Software, Inc. v. Green Shades Software, Inc.*, 882 F.3d 1121 (Fed. Cir. 2018).

⁸³ An example of the analysis is provided by a nonprecedential opinion in *Exergen Corp. v. Kaz USA, Inc.*, No. 2016-2315, 2018 WL 1193529, at *4 (Fed. Cir. Mar. 8, 2018).

⁸⁴ USPTO, Memorandum on Changes in Examination Procedure Pertaining to Subject Matter Eligibility, Recent Subject Matter Eligibility Decision (*Berkheimer v. HP, Inc.*) (Apr. 19, 2018), <https://www.uspto.gov/sites/default/files/documents/memo-berkheimer-20180419.PDF> (accessed Sept. 12, 2018).

⁸⁵ Department of Commerce, Request for Comments on Determining Whether a Claim Element is Well-Understood, Routine, Conventional for Purposes of Subject Matter Eligibility, 83 Fed. Reg. 17536 (Apr. 20, 2018).

⁸⁶ See eg Subject Matter Examples, *supra* note 78, Example 29, Claim 3 ('use of porcine antibodies in veterinary therapeutics was known to most scientists in the field. But significantly, there is no evidence that porcine antibodies were routinely or conventionally used to detect human proteins such as JUL-1') and Claim 5 ('Vitamin D was known to doctors, and was routinely and conventionally used as an oral supplement to maintain bone health prior to applicant's invention, and at the time the application was filed. However, mere knowledge of vitamin D or its use in other ways to treat other medical conditions does not make the administration of topical vitamin D to treat juitis a conventional step that those in this field would routinely practice. The evaluation turns on whether the use of topical vitamin D was widely prevalent in the field at the time the invention was made and the application was filed.')

⁸⁷ *Id.*, Example 31, Claim 80 ('Although Cool-Melt PCR was used by a few scientists in the field to amplify nucleic acids at the time the invention was made and the application was filed, use by only a few scientists does not make the technique routine or conventional in the field as a whole. Nor does it matter that at a later time, Cool-Melt PCR became a routine and conventional technique. Instead, the evaluation turns on whether

down on another issue splitting the Federal Circuit: whether the ‘significantly more’ must be explicitly claimed or whether it is enough that it appears in the specification.⁸⁸

It is also difficult to win under the second step because, as two of the life sciences cases demonstrate, the ‘significantly more’ cannot involve something that is itself patent-ineligible. Thus, in *Ariosa Diagnostics, Inc. v Sequenom, Inc.*, the inventors had discovered that paternally inherited cell-free fetal DNA (cffDNA) circulates in a pregnant woman’s blood and they found ways to detect it and use it to determine fetal characteristics. Although the test represents a major breakthrough in prenatal care, cffDNA is a natural phenomenon and so fails to meet the requirement of Step 2A. The diagnosis is a law of nature and therefore cannot save the invention under Step 2B.⁸⁹ Similarly, in *Cleveland Clinic Found. v True Health Diagnostics LLC*,⁹⁰ a diagnostic based on the correlation between an enzyme, myeloperoxidase (MPO), and cardiovascular disease is ineligible under Step 2A because it is a law of nature; MPO is naturally occurring so detecting it, as required by the claims, does not add enough ‘more’ to save the diagnostic’s patentability.

It is also possible that courts (and the PTO) are reluctant to rely heavily on Step 2B because that test may not serve anyone’s purposes. For the patent holder, ‘significantly more’ is basically a limitation that can make the patent easy to invent around. In particular, some of the PTO’s examples of patentable subject matter include, as the non-conventional addition, activity that could be performed by a party different from the one using the patent-ineligible concept. For instance, Claim 5 in Example 29 adds to a diagnostic step involving a law of nature, a treatment step (‘administering an effective amount of topical vitamin D to the diagnosed patient’) that saves the diagnostic from being considered unpatentable. However, if the treatment is not administered by the entity that conducted the diagnosis, then all the steps recited in the patent will not have been performed by the same party. Unless there is a close enough relationship among them to meet the test set out in *Limelight Networks, Inc. v Akamai Techs., Inc.*,⁹¹ as interpreted by the Federal Circuit⁹²—a circumstance that those using the invention will likely endeavor to avoid—there will be no one who can be regarded as an infringer.⁹³ Nor is it clear that Step 2B will benefit the public by freeing fundamental processes for use in follow-on innovation. Although the PTO examples are aimed at identifying

the use of Cool-Melt PCR to amplify nucleic acids was actually routinely or conventionally used by scientists in this field at the time the invention was made and the application was filed.’)

⁸⁸ See eg *Amdocs (Israel) Ltd. v. Openet Telecom, Inc.*, 841 F.3d 1288, 1312 (Fed. Cir. 2016) (Reyna, J., dissenting).

⁸⁹ 788 F.3d 1371, 1377 (Fed. Cir. 2015).

⁹⁰ 859 F.3d 1352 (Fed. Cir. 2017).

⁹¹ 134 S.Ct. 2111 (2014).

⁹² *Akamai Techs., Inc. v. Limelight Networks, Inc.*, 797 F.3d 1020, 1023 (Fed. Cir. 2015) (requiring a principle-agent relationship or when an ‘alleged infringer conditions participation in an activity or receipt of a benefit upon performance of a step or steps of a patented method and establishes the manner or timing of that performance’).

⁹³ See Hunter Keeton & Kevin Mosier, *The More Things Change, the More They Stay the Same After Akamai v. Limelight V, BNA’s Patent, Trademark, and Copyright J.* (Daily Ed.)(Sept. 8, 2017), https://cdn2.hubspot.net/hubfs/454850/BBNAInsight_PrintFinal_Wolf_Keeton_AkamaiEffect.pdf (accessed Sept. 12, 2018). To be sure, the claim in *Vanda Pharmaceuticals Inc. v. West-Ward Pharmaceuticals, Ltd.*, 887 F.3d 1117, 1121 (Fed. Cir. 2018), which involved the use of a genetic diagnostic as part of a method of treatment, used the phrases ‘obtaining or having obtained’ and ‘performing or having performed’ the diagnostic test. This may avoid the *Limelight* problem, depending on how the phrases are interpreted.

features that ‘meaningfully limit the claim[s]’,⁹⁴ meaningfulness is a slippery standard. In particular, allowing patentability to turn on a step that later becomes conventional will surely hamper future actors.

Putting the emphasis on Step 2A may, however, actually make patent eligibility even harder to predict. In the case of abstractions (the bulk of the Federal Circuit case law), a key problem is choosing the level of generality at which to describe the claim.⁹⁵ The more abstract, the less there is left to consider when determining whether there is something ‘markedly different’ about the claim. For the law of nature cases, there is an analogous problem in that the analysis requires the identification of the law of nature. Whether the claim is markedly different depends on how the decision-maker conceptualizes the law. For example, the law in *Mayo* was about how a patient metabolizes a pharmaceutical. Since the drug was *artificially* introduced into the body, it is a law of nature only if that term is broadly conceived.

In the abstraction cases, imprecision in the starting point of the analysis leads to the result that claims said to be improvements (or enhancements) are far more likely to be considered patent-eligible, for the focus on the improvement persuades the court that the advance is different from the underlying concept.⁹⁶ That dynamic may be true of the life sciences cases as well. Consider, for example, *Rapid Litig. Mgmt. Ltd. v CellzDirect, Inc.*⁹⁷ The invention was a method of preserving hepatocytes (a type of liver cell). The trial court found the advance unpatentable because it was directed to the law of nature that hepatocytes are capable of surviving multiple freeze-thaw cycles. The Federal Circuit reversed on a finding that the claims ‘are directed to a new and useful method of preserving hepatocytes’—one that involved an improvement over the basic freeze-and-thaw technique in that it required freezing and thawing the cells at least two times. Yet it is unclear why the district court was wrong. Why is a better survival through double freezing not itself a law of nature? Aside from the predictability problem, this approach elevates the role of drafting, in direct contravention to one of the Supreme Court’s concerns in *Mayo*.⁹⁸ Similarly, in *Vanda Pharmaceuticals Inc. v West-Ward Pharmaceuticals, Ltd*, the court emphasized that the advance was a ‘new way of using an existing drug’, and found it patentable even though the ‘new way’ was, as in *Mayo*, based on how the patient responded to the treatment.⁹⁹

⁹⁴ See Example 28, Claim 3. See also Example 29, Claims 2 and 6.

⁹⁵ See eg *Visual Memory LLC v. NVIDIA Corp.*, 867 F.3d 1253, 1262-63 (Fed. Cir. 2017) (Hughes, J., dissenting).

⁹⁶ See eg *McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299, 1310 (Fed. Cir. 2016) (‘the claims are ... patent eligible because they effect an improvement in [a] technology or technical field’) (internal quotes omitted); *Amdocs*, 841 F.3d at 1300; *Enfish LLC v. Microsoft Corp.*, 822 F.3d 1327, 1339-40 (Fed. Cir. 2016). See also *Core Wireless Licensing S.A.R.L. v. LG Elecs., Inc.*, 880 F.3d 1356, 1362 (Fed. Cir. 2018) (‘We previously have held claims focused on various improvements of systems directed to patent eligible subject matter under § 101’). *Finjan, Inc. v. Blue Coat Sys., Inc.*, 879 F.3d 1299, 1304 (Fed. Cir. 2018). See also USPTO, Memorandum on Recent Subject Matter Eligibility Decisions (Apr. 2, 2018), <https://www.uspto.gov/sites/default/files/documents/memo-recent-sme-ctdec-20180402.PDF> (accessed Sept. 12, 2018), which in a two page memo, mentions variations on ‘improvement’ seven times.

⁹⁷ 827 F.3d 1042 (Fed. Cir. 2016).

⁹⁸ *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S., at 72 (‘[Precedents] warn us against interpreting patent statutes in ways that make patent eligibility depend simply on the draftsman’s art’ (internal quote omitted)).

⁹⁹ 887 F.3d 1117, 1135 (Fed. Cir. 2018).

For claims to products, the issue is somewhat different. There, Step 2A requires a comparison between the claimed subject matter and material found in nature. That, in turn, requires the identification of a basis for the comparison.¹⁰⁰ As Brad Sherman has pointed out, in *Myriad*, the comparison could have been between the *instructions* in the cDNA and the *instructions* in the gDNA, but that was not the comparison the Court made. Although the Court ignored the covalent bonds that influenced Judge Lourie, it still followed his approach of comparing *molecular compositions*. Thus, it found that eliminating the noncoding regions of the DNA made cDNA different enough to patent.¹⁰¹ Furthermore, as we saw, the Court ignored pseudogenes, even though they are found in nature.¹⁰²

An even more significant problem is that the concept of ‘markedly’ in ‘markedly different’ is not defined by the case law, so it is not clear how different the claim must be from the thing to which it is compared. *In re Roslin*,¹⁰³ which involved the patentability of a cloned sheep, furnishes an example. In holding the sheep was not patentable subject matter because it was identical to a sheep found in nature, the court was unimpressed by differences in mitochondrial DNA or the effect of the environment on the cloned sheep’s genotype and physical characteristics.¹⁰⁴ Furthermore, some claims cover multiple embodiments. In those cases, presumably every embodiment must be different from what occurs in nature, yet it is unlikely that every embodiment can be identified and compared to nature. There are also claims that are drawn to a combination of known elements: is it enough that the combination does not occur naturally, or must the combination also create functional differences in the final product?¹⁰⁵ Finally, there is a degree of fluidity as to what about the claim makes it ‘markedly different’ and what constitutes ‘significantly more’. Thus, the cases do not always clearly differentiate between eligibility by reason of Step 2A or 2B.¹⁰⁶ Sometimes the Federal Circuit backs up a finding on the first step with a finding on the second.¹⁰⁷

The bottom line is that it is now extremely difficult to know how to successfully protect advances in the life sciences. Kathy Liddell and her co-authors surveyed patent applications published between June 2010 and June 2013 which included at least one claim to a simple isolated gene sequence. They found that inventors have tried eight different prosecution strategies to differentiate their advances from phenomena of nature.¹⁰⁸ These were met with varying degrees of success, depending in part on what the

¹⁰⁰ See Burk, *supra* note 11, at 516.

¹⁰¹ Brad Sherman, *The Meaning of Myriad*, 5 U.C. IRVINE L. REV. 1193, 1212–13 (2015).

¹⁰² See text at note 73, *supra*.

¹⁰³ *In re Roslin Institute (Edinburgh)*, 750 F.3d 1333 (Fed.Cir. 2014).

¹⁰⁴ *Id.* at 1338–39; Sherman, *supra* note 101, at 1219–20.

¹⁰⁵ See eg Subject Matter Examples, *supra* note 78, Example 28, Claim 3 (‘While the mixture of these two naturally occurring components is novel and does not occur in nature, there is no indication that mixing these components changes the structure, function, or other properties of the peptide or water.’).

¹⁰⁶ See eg *Amdocs (Israel) Ltd. v. Openet Telecom, Inc.*, 841 F.3d 1288, 129 (Fed. Cir. 2016); *Vanda Pharm. Inc. v. W.-Ward Pharm. Int’l Ltd.*, 887 F.3d 1117, 1140 (Fed. Cir. 2018) (Prost, J., dissenting from a finding that a method of treatment claim was patentable subject matter, arguing that that the court conflated the two steps)

¹⁰⁷ See eg *Trading Techs. Int’l, Inc. v. CQG, INC.*, 675 F. App’x 1001 (Fed. Cir. 2017) (nonprecedential); *Rapid Litig. Mgmt. Ltd. v. CellzDirect, Inc.*, 827 F.3d 1042 (Fed. Cir. 2016).

¹⁰⁸ Aboy et al., *supra* note 9, at 822 ((i) amending to cDNA, (ii) amending to nucleic acids with nonnaturally occurring sequence variations, (iii) amending to nucleic acids recombinantly linked with heterologous se-

examiner in question thought was or wasn't found in nature.¹⁰⁹ In some cases, the authors questioned whether the differences claimed in the issued patents were 'markedly different'. For example, they found that examiners have allowed claims to nucleic acids that differ only slightly from those found in nature, giving the example of adding a fluorescent label.¹¹⁰ They also noted interexaminer variability on the issue and were skeptical as to whether the issued patents provided significant coverage.¹¹¹ Similarly, Alan Miller and Brian Amos reviewed 100 diagnostic method patents and found several different claiming strategies (depending, in part on when the applications were filed). They found that the claims most likely to issue were those that included several steps, used a specific agent in the diagnosis, included a treatment step, or avoided the term 'diagnosis'.¹¹² Like Liddell, they were concerned about the consistency of examination across the examiner corps and the enforceability of the patents that issued.

In a sense, it is difficult to fathom how outcomes could be other than haphazard. Concepts like 'markedly different' and 'significantly more' can distinguish what is patentable from what is not only if accompanied by a metric for what counts as 'marked' or 'significant'. That requires a theory for why a difference from nature is required at all. While it is clear that the Supreme Court became interested in the question of patentable subject matter out of a concern about inhibiting future innovation, that apprehension appears to have dropped out of the equation. In *Myriad*, Justice Thomas did not distinguish among claims that specified all the nucleotides in the sequence and those that included many unknown regions, even though Judge Bryson pointed out how much broader the latter claims were. Nor did he adopt Judge Moore's suggestion of thinking about long strands with no difference in functionality from nature differently from short strands, which had very articulable (and possibly narrow) functionalities. Most important, the Court never considered whether the artificiality of cDNA would make rights over it any less chilling of future research than rights over gDNA.

The failure to consider preemption can be attributed directly to *Mayo*, where the Court conceded that the law of nature at issue in the case—the relationship between a metabolite of a drug and the appropriate dose of that drug—was extremely narrow and had limited application.¹¹³ By nonetheless finding the claims unpatentable, the decision implied that preemption was not the sole concern. That said, the *Mayo* Court still noted that future work ('the development of more refined treatment recommendations'¹¹⁴) could be inhibited by the patent and in *Alice*, the Court emphasized the preemption point.¹¹⁵ Thus, the analysis of whether a claim is different enough or adds sufficiently more should turn, at least in part, on whether the difference or addition is such that the

quences, (iv) amending to labeled nucleic acids, (v) amending to a nucleic acid in a vector, (vi) amending to a nucleic acid recombined with a nonspecific regulatory sequence, (vii) amending with a type 2 change and a negative claim clause, and (viii) amending to a nucleic acid so short that it does not naturally occur)

¹⁰⁹ *Id.* at 823–24.

¹¹⁰ *Id.* at 824.

¹¹¹ *Id.* at 825.

¹¹² Miller & Amos, *supra* note 30, at 41.

¹¹³ 566 U.S. at 86. See eg *Cleveland Clinic Found. v. True Health Diagnostics LLC*, 859 F.3d 1352, 1363 (Fed. Cir. 2017) (noting that when a patent discloses unpatentable subject matters, preemption arguments are moot).

¹¹⁴ *Id.* at 87.

¹¹⁵ *Alice Corp. Pty. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2354–55 (2014).

claim preempts activity related to what the inventor discovered. Indeed, some judges on the Federal Circuit appear to be approaching the problem this way. While some are using what Judge Plager calls the common law method of comparing new cases with the disposition in older ones,¹¹⁶ other jurists have tied the analysis to the goal of ‘maintain[ing] the incentive of “some future inventor, in the onward march of science” to discover new ways of achieving the same result more cheaply and efficiently than has the patentee.’¹¹⁷ Similarly, while the court applies the *Mayo* two-step as its primary analytical tool, it tends to sneak a peek at the preemptive effect of the claims it upholds. For example, in *CellzDirect* the Court stated that

[W]hile pre-emption is not the test for determining patent-eligibility, it is certainly the concern that undergirds ... § 101 jurisprudence. Here, while not resting our opinion on them, we note the district court’s findings that the ‘929 patent ‘does not lock up the natural law in its entirety’ and that ‘LTC has already managed to engineer around the patent’. These findings accord with our conclusion that the patent is not “directed to” a patent-ineligible building block of human ingenuity.¹¹⁸

To the extent that the § 101 analysis would be improved by adding to the test as currently articulated a concern for preemption, the question is how to determine what is too preemptive to patent. Judges Bryson and Moore offered a few clues, as has one of us in previous work.¹¹⁹ For more, we turn to Australia.

II. THE AUSTRALIAN POSITION: D’ARCY, CARGILL AND MORE

II.A. D’Arcy v Myriad

At around the same time that proceedings were commenced against Myriad in the United States, an action was brought against the firm by Cancer Voices Australia, a non-profit association, and Yvonne D’Arcy, a breast cancer sufferer. Cancer Voices became unincorporated during the proceedings but Ms D’Arcy continued her action through to the High Court of Australia (the equivalent of the US Supreme Court).¹²⁰ The action followed a period of intense public scrutiny of the enforcement strategies of Myriad’s licensee, Genetic Technologies Ltd. (GTG). GTG had threatened to enforce the relevant patent against public testing laboratories during 2003 and again during 2008. The Australian proceedings challenged the validity of claims in Australian patent number 686,004 (Patent 686,004), the key Australian BRCA 1 patent entitled ‘In vivo mutations and polymorphisms in the 17q-linked breast and ovarian cancer susceptibility

¹¹⁶ See eg *Amdocs (Israel) Ltd. v. Openet Telecom, Inc.*, 841 F.3d 1288, 1294 (Fed. Cir. 2016).

¹¹⁷ *Id.* at 1309 (Reyna, J. dissenting, citing *O’Reilly v. Morse*, 56 U.S. 62, 113 (1854)).

¹¹⁸ 827 F.3d at 1052 (internal quotations omitted). See also *DDR Holdings, LLC v. Hotels.com, L.P.*, 773 F.3d 1245, 1259 (Fed. Cir. 2014) (“It is also clear that the claims at issue do not attempt to preempt every application of the idea’); *BASCOM Glob. Internet Servs., Inc. v. AT & T Mobility LLC*, 827 F.3d 1341, 1350 (Fed. Cir. 2016) (“Nor do the claims preempt all ways of filtering content’). Cf. *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371, 1379 (Fed. Cir. 2015) (noting that ‘questions on preemption are inherent in and resolved by the § 101 analysis’).

¹¹⁹ Dreyfuss & Evans, *supra* note 21 (suggesting four factors: the ability to invent around, the need for interoperability, the breadth of the prospects, and the identity of the inventor).

¹²⁰ The Australian decisions are: *Cancer Voices v. Myriad Genetics, Inc* [2013] FCA 65; *D’Arcy v. Myriad Genetics, Inc* [2014] FCAFC 115; *D’Arcy v. Myriad Genetics, Inc* [2015] HCA 35.

gene'. This patent application was filed on August 11, 1995 and the granted patent expired on August 11, 2015, almost two months before the decision in *D'Arcy v Myriad Genetics, Inc* (*D'Arcy*) was handed down by the High Court.

The challenge to Patent 686,004 was directed to three disputed claims (of the 30 total in the patent), which included claims to isolated gDNA, and cDNA coding for identified mutations or polymorphisms.¹²¹ Unlike the *Myriad* decision, the Australian courts were not required to consider claims relating to methods of diagnosis, whether methods of comparing DNA sequences against those with known mutations, or screening tests.¹²² Prior to *D'Arcy*, the patentability of isolated DNA sequences in Australia had not been called into question. The practice of the Australian Patent Office was that isolating DNA sequences from their natural environment was enough to make them patentable subject matter.

The Australian courts in *D'Arcy* were required to consider whether the claims constituted patentable subject matter or, specifically, a manner of manufacture, as required by s 18(1) of the *Patents Act 1990*. This provides a threshold requirement: an invention must be a 'manner of manufacture' within the meaning of s 6 of the *Statute of Monopolies 1623*. The Australian *Patents Act 1990* is one of very few patent statutes to retain this requirement from the first patent statute in the common law. Its inclusion signifies broad judicial discretion to determine whether an invention is within the bounds of patentable subject matter. Prior to *D'Arcy*, the High Court stated in *National Research Development Corporation v Commissioner of Patents (NRDC)*,¹²³ the seminal case dealing with the manner of manufacture requirement, that it does not qualify for precise formulation. Rather, the relevant question is: 'Is this a proper subject of letters patent according to the principles which have been developed for the application of s 6 of the Statute of Monopolies?'¹²⁴ In *NRDC*, The High Court held that on the facts of the case this requirement was satisfied because the subject matter in issue was (1) an artificially created state of affairs that (2) had economic utility.¹²⁵ This two-limbed test became entrenched as the accepted test for patentability under Australian law, attaining, as some commentators have argued, the status of a rigidly applied 'rule'.¹²⁶

At first instance, Justice Nicholas¹²⁷ in the Federal Court of Australia upheld the validity of the disputed claims. His Honor found that the claims in question were to isolated nucleic acids (gDNA), and that this isolated gDNA and its counterpart cDNA were structurally different to naturally occurring sequences.¹²⁸ There was no requirement for any change in chemical composition of the isolated sequences, rather, the fact

¹²¹ The challenged claims also included claims to ribonucleic acid (RNA), a molecule similar to DNA in that the sequence of nucleotides sends instructions to the organism. RNA is, however, single-stranded.

¹²² The reason why methods of diagnosis were not challenged in the Australian litigation is unclear.

¹²³ *National Research Development Corporation v. Commissioner of Patents* (1959) 102 CLR 252. Note that s 18(2) of the *Patents Act 1990* excludes form patentability 'Human Beings, and the biological processes for their generation'. The patentability of the invention in *D'Arcy* was not contested on the basis of this exclusion.

¹²⁴ *Id.* at 269.

¹²⁵ *Id.* at 278–79.

¹²⁶ Ann L. Monotti, *The Scope of "Manner of Manufacture" Under the Patents Act 1990 (Cth) After Grant v Commissioner of Patents*, 34 FEDERAL L. REV. 461, 465 (2006)

¹²⁷ Noting that in Australia all members of the judiciary are referred to as 'Justices' and 'their Honours'.

¹²⁸ *Cancer Voices v. Myriad Genetics Inc* [2013] FCA 65, [108].

of their isolation was sufficient to create an artificially created state of affairs.¹²⁹ The second limb, that of economic utility, was not in issue.

On appeal, the Full Federal Court upheld Justice Nicholson's decision. Justices Dowsett, Kenny, Bennett, and Middleton held that the isolated product was not only structurally different, but also *functionally* different to the naturally occurring product.¹³⁰ In other words, the Full Federal Court took a slightly different approach from that of Justice Nicholson in finding that the isolated sequence *did* in fact differ to the naturally occurring sequence.¹³¹ In this respect, the Full Federal Court was influenced by the judgments of Judges Moore and Lourie in the US series of cases.¹³²

Yvonne D'Arcy was granted special leave to appeal to the High Court. Although unanimously holding that the claims in question did not fall within the concept of patentable subject matter, the High Court gave three separate judgments. Most relevant for present purposes is the judgment of the plurality, Chief Justice French and Justices Kiefel, Bell, and Keane. The plurality returned attention to the *NRDC* formulation, reiterating that it is not a rigid test.¹³³ They confirmed that, in many instances, the two-limb test will suffice to determine whether an invention satisfies the manner of manufacture requirement, but where claims fall outside the established boundaries of subject matter, it becomes necessary to turn to a range of other factors as well.¹³⁴

In the case of isolated DNA sequences, the plurality concluded that the two-limb test was not satisfied in that there was no 'artificially created state of affairs' as required by the first limb.¹³⁵ The basis of the plurality's finding was that the sequence claims were to information.¹³⁶ Although there were chemical, structural, and functional differences in the isolated (as compared with the natural) sequences, it was the information stored in them that was the essential element of the invention as claimed. The claims relied in no way on the changes in chemical composition resulting from isolation;¹³⁷ thus, there was nothing 'artificially created'.¹³⁸ In the words of the plurality, the information was 'discerned' not 'made'.¹³⁹

Because the claimed invention fell into what it regarded as a new class of subject matter, the plurality expounded a nonexhaustive list of factors to be taken into consideration:

1. whether patentability would be consistent with the purposes of the Act and, in particular:
 - 1.1 whether the invention as claimed, if patentable under s 18(1)(a) could give rise to a large new field of monopoly protection with potentially negative effects on innovation;

¹²⁹ *Id.*

¹³⁰ *D'Arcy v. Myriad Genetics Inc* [2014] 224 FCR 479, [212].

¹³¹ *Id.* at [213].

¹³² *Id.* at [217].

¹³³ *D'Arcy v. Myriad Genetics Inc* [2015] HCA 35, [28].

¹³⁴ *Id.*

¹³⁵ *Id.* at [90].

¹³⁶ *Id.* at [89]-[90].

¹³⁷ *Id.*

¹³⁸ *Id.* at [91].

¹³⁹ *Id.* at [6].

- 1.2 whether the invention as claimed if patentable under s 18(1)(a) could, because of the content of the claims, have a chilling effect on activities beyond those formally the subject of the exclusive rights granted to the patentee;
- 1.3 whether to accord patentability to the invention as claimed would involve the court in assessing important and conflicting public and private interests and purposes;
2. whether to accord patentability to the invention as claimed would enhance or detract from the coherence of the law relating to inherent patentability;
3. relevance to Australia's place in the international community of nations:
 - 3.1 Australia's obligations under international law;
 - 3.2 the patent laws of other countries; and
4. whether to accord patentability to the class of invention as claimed would involve law-making of a kind which should be done by legislature.¹⁴⁰

Of these factors, the plurality considered 3, 4, and 6 to be of primary importance.¹⁴¹ As noted, their Honors had already found that the claims were to information and were therefore not made, but they also considered the other enunciated factors. They placed particular importance on the fact that allowing the patent could have a chilling effect on innovation, given the odd consequence that '... the patent could be infringed without the infringer being aware of that fact' and the significant, unquantified size of the class of isolated sequences.¹⁴² The plurality reached the same conclusion in respect of cDNA which bears the same characteristics as gDNA in that it '... is synthesized but replicates a naturally occurring sequence of events'.¹⁴³

II.B. Patent Office Practice Post-*D'Arcy*

From the outset, the repercussions of the *D'Arcy* decision were simultaneously welcomed,¹⁴⁴ derided, and hotly debated.¹⁴⁵ Shortly after the decision was handed down, IP Australia (which houses the Australian Patent Office) issued a draft Examination Practice.¹⁴⁶ After a period of public consultation and deliberation, changes to the

¹⁴⁰ *Id.* at [28].

¹⁴¹ *Id.*

¹⁴² *Id.* at [93].

¹⁴³ *Id.* at [89].

¹⁴⁴ See eg Sumer Dayal & Sadat Cheema, *So – What's Next? Divining the Future of Gene Patenting*, 110 INTELL. PROP. FORUM 32 (2017); Lucas McCallum & Thomas Faunce, *Myriad Voices Against Gene Patents in the High Court*, 23 J. L. & MED. 322 (2015).

¹⁴⁵ See eg Charles Lawson, *Patenting Nucleic Acid Sequences: More Ambiguity from the High Court?*, 25 J. L. & MED. 741 (2018); Matthew Rimmer, *An Exorbitant Monopoly: The High Court of Australia, Myriad Genetics, And Gene Patents*, in RESEARCH HANDBOOK ON INTELLECTUAL PROPERTY AND THE LIFE SCIENCES 56 (Duncan Matthews & Herbert Zech eds, Edward Elgar 2016); Peter McFarlane & Betty Kontoleon, *Some Legal Issues Regarding the Patenting of Human Genetic Material*, 24 J. L. & MED. 181 (2016); William Bartlett, *D'Arcy v Myriad Genetics Inc* [2015] HCA 35: The Plurality's New Factorial Approach to Patentability Rearticulates the Question Asked in NRDC, 24(1) Journal of Information, Law and Science 1 (2016); Jessica Lai, *Gene-Related Patents in Australia and New Zealand: Taking a Step Back*, 25 AUSTR. INTELL. PROP. J. 181 (2015).

¹⁴⁶ IP Australia, Consultation examination practice *D'Arcy v Myriad Genetics Inc* (undated) <https://www.ipaustralia.gov.au/about-us/public-consultations/consultation-examination-practice-darcy-v-myriad-genetics-inc> (accessed Sept. 12, 2018).

Manual of Practice and Procedure were implemented.¹⁴⁷ The resulting Practice Note states that isolated nucleic acid sequences (gDNA) are not patent-eligible subject matter.¹⁴⁸ It also precludes from patent-eligibility cDNA and synthetic nucleotide sequences, probes, and primers and isolated interfering/inhibitory nucleotide sequences that merely replicate genetic information of naturally occurring organisms.¹⁴⁹ This aspect of the Practice Note relies on the plurality's judgment that any full or partial sequence that replicates a naturally occurring sequence constitutes information and is not patentable.¹⁵⁰ The potential breadth of this finding by the High Court has been disputed: for example, some commentators have asserted the High Court's finding should be interpreted narrowly, rendering cDNA sequences ineligible only where a corresponding claim to gDNA would be ineligible.¹⁵¹ However, the Practice Note appears to interpret it more broadly and preclude any DNA sequence from patentability where it replicates a naturally occurring sequence.

A number of Patent Office decisions have provided the potential to consider the import of the Practice Note (and *D'Arcy* itself) in the context of sequence information.¹⁵² Although none of them has been particularly illuminating, taken together they suggest that, in practice, IP Australia is interpreting the impact of the *D'Arcy* case cautiously. In *Cargill Incorporated v Dow Agro Sciences LLC*,¹⁵³ the patent eligibility of a fungal sequence was confirmed on the basis that the inventors had codon-optimized the sequence, differentiating it from the naturally occurring sequence.¹⁵⁴ According to the decision-maker in this matter (a Delegate of the Commissioner of Patents), this subject matter was not near the boundaries of patentability and thus did not invoke consideration of the additional *D'Arcy* factors.¹⁵⁵ A similar result was reached in *CSIRO v BASF*.¹⁵⁶ In *Arrowhead Research Corporation*,¹⁵⁷ the generation of target RNA sequences was found by the Delegate to be an important element of the claimed invention, but not the substance of the invention. Instead, the substance of the invention was a pharmaceutical composition comprising interfering RNA because the *particular* nucleotide sequences claimed were not critical to the invention, rather the *capacity provided by the invention to identify* specific target sequences was.¹⁵⁸

¹⁴⁷ Australian Patent Office, Manual of Practice and Procedure, 2.9.2.6 Nucleic Acids and Genetic Information, http://manuals.ipaaustralia.gov.au/patents/national/patentable/2.9.2.6.Nucleic_acids_and_genetic_information.htm (accessed Sept. 12, 2018).

¹⁴⁸ Australian Patent Office, Examination Practice Following the High Court Decision in *D'Arcy v Myriad Genetics Inc.*, <https://www.ipaaustralia.gov.au/about-us/news-and-community/news/examination-practice-following-high-court-decision-darcy-v-myriad> (accessed Sept. 12, 2018) [hereinafter Practice Note].

¹⁴⁹ *Id.* at 3.

¹⁵⁰ *D'Arcy v Myriad Genetics Inc* (2014) 224 FCR 479, [89].

¹⁵¹ Mark Summerfield, *Proposed Australian Examination Practice Gives Narrow Interpretation to High Court's Myriad's Ruling*, Patentology.com.au, Oct. 18, 2015, <http://blog.patentology.com.au/2015/10/proposed-australian-examination.html> (accessed Sept. 12, 2018).

¹⁵² It should be noted that the Australian Patent Office hears first instance pre-grant oppositions and re-examination requests. Appeals for re-hearings can be made to the Federal Court of Australia.

¹⁵³ *Cargill Incorporated v. Dow Agro Sciences LLC* (2016) APO 43 (5 July 2016).

¹⁵⁴ *Id.* at [41].

¹⁵⁵ *Id.* at [47].

¹⁵⁶ *CSIRO v. BASF* [2016] APO 83 (23 November 2016) [55]–[66].

¹⁵⁷ *Arrowhead Research Corporation* [2016] APO 70 (Oct. 13, 2016).

¹⁵⁸ *Id.* at [19]–[29].

Finally, in *Sun Pharmaceuticals v Tasmanian Alkaloids*,¹⁵⁹ the relevant patent claimed the mutagenesis of poppy seeds and screening of progeny plants to produce poppies with a higher output of codeine (over other alkaloids). The Patent Office Delegate found no evidence that a mutation producing levels of codeine in line with those claimed in the patent had or would be naturally occurring. Hence, there was no ground to oppose the patent on the basis that the subject matter was naturally occurring (as it was found to be in *D'Arcy*).¹⁶⁰ On the face of it, these decisions suggest the *D'Arcy* decision has had limited impact on Patent Office practice in relation to determining the patentability of DNA sequences.

The application of the *D'Arcy* test to new classes of claim is discussed more broadly in the Practice Note, which states that the factorial test must only be applied to new classes of claim '... involving a significant new application or extension of the principles of patentability...'.¹⁶¹ Claims relating to technical subject matter that has previously been considered by the courts and not rejected are to be assessed according to the '... normal requirements ...' as laid down in *NRDC*.¹⁶² Subject matter that falls into established categories of patent eligibility is stated in the Practice Note to include recombinant or isolated proteins, pharmaceuticals and other chemical substances, methods of treatment, methods of applying herbicides, and applications of computer technology.¹⁶³ These are all categories of subject matter that have been considered by the Australian courts to be patent-eligible. What this indicates is that it is likely that the factorial approach will only be applied in the rarest of circumstances, for significant new innovations. While the lower courts could derive some real benefit from the guidance provided by the High Court in terms of the range of factors to consider in such circumstances, it is disappointing that their opportunities to do so will be so limited. It is even more disappointing that when opportunities have arisen on the boundaries of patent eligibility, there has been some reluctance to engage with them.

The applicability of *D'Arcy* was considered in several subsequent cases involving product claims, although the *D'Arcy* factors were not invoked because in each of these cases the court found that the claims did not fall within a new class of claim.¹⁶⁴ This apparent unwillingness on the part of the judiciary to engage with the *D'Arcy* factors has led some commentators to question the High Court's approach in *D'Arcy*, and assert that it had introduced uncertainty into Australian patent law.¹⁶⁵ For example, Charles Lawson contends that the plurality's finding that there was nothing 'made' by Myriad suggests that the plurality decided the case on the existing *NRDC* principles, and that their subsequent exposition of the factorial approach may not be binding.¹⁶⁶ While deceptively alluring, this argument overlooks the fact that the plurality did not rule out

¹⁵⁹ *Sun Pharmaceuticals Industries (Australia) Pty Ltd v. Tasmanian Alkaloids Pty Ltd* [2018] APO 7 (Jan. 31, 2018).

¹⁶⁰ *Id.* at [69]–[71].

¹⁶¹ Practice Note, *supra* note 148, at 3.

¹⁶² *Id.* at 1.

¹⁶³ *Id.* at 2.

¹⁶⁴ *Commissioner of Patents v. RPL Central Pty Ltd* [2015] FCAFC 177 [119] (implemented business method claim); *Gilead Sciences Pty Ltd v. Idenix Pharmaceuticals LLC* [2016] FCA 169 (chemical and pharmaceutical compounds).

¹⁶⁵ See eg Lawson, *supra* note 145; Lai, *supra* note 145, at 193.

¹⁶⁶ Lawson, *supra* note 145, at 749–50.

the possibility that information encoded in DNA *might* be patentable. In this case Myriad failed to establish patentability, but in cases where a finding of patentability remains open, a finding that a new class of claim is implicated is likely, and presumably, the factorial approach would then be applied. The fundamental fact is that *D'Arcy* did not change the law as laid down in *NRDC*, but merely affirmed the correctness of the *NRDC* approach to areas of technology within the established boundaries of patentability. The plurality's factorial approach effectively legitimizes the approach Australian courts had implicitly taken with respect to determining questions of patentability in areas of new technology. To this extent, it arguably remains the case that *D'Arcy* is not inconsistent with its predecessor decisions, which sanctioned the plurality's approach in any event. It is also evident that the evolution of the manner of manufacture test is an ongoing process, and that jurists can invariably expect to be confronted with further cases which will explore the bounds of the *D'Arcy* decision.

II.C. Australia's *Mayo* Moment? The Patentability of Diagnostic Testing Methods and *Meat and Livestock Australia v Cargill*

Unlike the Supreme Court in *Mayo*, the Australian High Court has not yet been given the opportunity to engage with the question of whether methods of diagnostic testing are patentable. This is significant given the potential impact of the *D'Arcy* principles on the diagnostic testing industry and the biotechnology industry more broadly. It has been recognized that diagnostic method claims are capable of producing a greater blocking effect on diagnostic testing than nucleotide sequence claims.¹⁶⁷

But Australia does appear to be having its *Mayo* moment. *Meat and Livestock Australia v Cargill* (*Cargill*)¹⁶⁸ involved a series of method claims for identifying bovine traits from nucleic acid samples using SNPs (single nucleotide polymorphisms, variants of specific nucleotides) for 'managing, selecting, breeding and cloning cattle'.¹⁶⁹ Patent application number 2,010,202,253, entitled 'Compositions, Methods and Systems for Inferring Bovine Traits', was filed by Banhaven LLC and Cargill Inc.¹⁷⁰ Meat and Livestock Australia (MLA) brought an action under Australia's pre-grant opposition procedure to challenge the claims on several grounds. These included the argument that the claims failed to satisfy the manner of manufacture test,¹⁷¹ in that they were drawn to include known methods of identifying bovine traits, and involved DNA sequences that were either not identified or were yet to be identified. In addition, because the inventors created a high-density map of the bovine genome using variants of specific SNPs and associations that were naturally occurring, MLA asserted a lack of

¹⁶⁷ Isabelle Huys et al., *Legal Uncertainty in the Area of Genetic Diagnostic Testing*, 27 NAT. BIOTECHNOL. 903 (2009).

¹⁶⁸ *Meat and Livestock Ltd v. Cargill Inc* [2018] FCA 51.

¹⁶⁹ *Id.* at [147].

¹⁷⁰ The patent was filed on June 1, 2010 but has a priority date of Dec. 31, 2002 claimed on the basis of an earlier parent application.

¹⁷¹ Although an appeal from a decision of the Patent Office, the hearing was conducted *de novo* with the result that a number of grounds of opposition not considered in the earlier hearing were considered by Beach J in the Federal Court.

patentable subject matter on the basis that there was nothing man-made or artificially occurring.¹⁷²

The case was heard by Justice Jonathan Beach, who brings with him a tertiary education in physical chemistry as well as experience from the bar in intellectual property litigation. As observed by Justice Beach, there was some indication in the judgment of the plurality in *D'Arcy* that because they were not addressing method claims, by implication such claims might be more readily viewed as being within the existing boundaries of patentable subject matter.¹⁷³ Some methods of medical treatment have been considered patentable in Australia; a new method of using a known drug was held by the High Court (by majority) in *Apotex Pty Ltd v Sanofi-Aventis Australia Pty Ltd* to fulfill the manner of manufacture requirement.¹⁷⁴ That case did not, however, address the question of whether physical, as opposed to chemical, methods of medical treatment are patentable, or broader questions of whether methods of diagnosis satisfy the manner of manufacture requirement. It also offered little assistance on the question at issue in *Cargill*, which involved broad methods of identifying bovine traits.

Justice Beach in *Cargill* distinguished *D'Arcy* on a number of grounds, primarily that the claims in *Cargill* were not purely to naturally occurring genetic information, as were the claims in question in *D'Arcy*.¹⁷⁵ Justice Beach considered the claims in *Cargill* to be 'within the plain vanilla concept of manner of manufacture as outlined in *NRDC* and *Myriad*' rather than a new class of claim.¹⁷⁶ He rejected an argument that the claims in issue involved simply the practical application of a naturally occurring phenomenon to a particular use.¹⁷⁷ Instead, what was claimed involved the taking of a sample and analysing the sample to identify SNPs associated with particular traits of interest, which was sufficient, in his Honor's view, to give rise to an artificially created state of affairs.¹⁷⁸

Although Justice Beach was unequivocal in concluding that the claims in *Cargill* were not at the boundaries of patentable subject matter, he went on (seemingly with an eye to the likelihood of an appeal on the decision) to consider how the *D'Arcy* factors would apply in the event that the opposite were true. In applying the *D'Arcy* factors, he rejected an assertion that upholding patentability in *Cargill* would render the decision inconsistent with *D'Arcy*, reiterating his opinion that the claims in *Cargill* were to methods applying information rather than claims to information per se.¹⁷⁹ Further he found no lack of coherency with foreign law in that US law accepts that a method involving the application of a law of nature is patentable, as it is in Australia.

¹⁷² The appeal was founded on a number of further grounds, none of which are directly relevant in the context of this paper: see *Meat and Livestock Ltd v. Cargill Inc* [2018] FCA 51, at [151]–[152].

¹⁷³ *Id.* at [409]. Indeed, in the High Court decision in *D'Arcy*, Gageler and Nettle JJ, in a judgment separate to that of the plurality, acknowledged that a process of using a known technology to isolate a nucleotide sequence and use it to detect or predict malignancy, might be patentable: *D'Arcy v. Myriad Genetics Inc* [2015] HCA 35 [147], [168].

¹⁷⁴ *Apotex Pty Ltd v. Sanofi-Aventis Australia Pty Ltd* [2013] HCA 50 (Dec. 4, 2013). This finding was based on the fact that pharmaceutical products are patentable, and to exclude treatments using such products would produce an anomaly. For an explanation, see the judgment of the plurality in *D'Arcy v. Myriad Genetics Inc* [2015] HCA 35, [28].

¹⁷⁵ *Meat and Livestock Ltd v. Cargill Inc* [2018] FCA 51, at [425]–[433].

¹⁷⁶ *Id.* at [428].

¹⁷⁷ *Id.* at [455].

¹⁷⁸ *Id.* at [455].

¹⁷⁹ *Id.* at [487].

Cargill did not involve an assessment of the applicability (or otherwise) of *Mayo*. Indeed, the judge found ‘[t]he exposition of the test (particularly the second stage (‘apply it’) in *Mayo* is too sweeping for [him] to work out whether [he was] acting consistently or inconsistently with its spirit’¹⁸⁰ when determining what it takes to transform an unpatentable law of nature into a patent-eligible application.¹⁸¹ And he found himself unable to undertake a comprehensive assessment of coherence with foreign laws by considering only ‘cherry-picked jurisprudence from one jurisdiction’ (the United States).¹⁸² Finally, Justice Beach rejected an assertion that the ‘exorbitant’ breadth of the *Cargill* claims would likely have a substantial chilling effect on innovation.¹⁸³ Finding no evidence to support the assertion, he pointed out that the breadth of claims alone would not defeat a claim to patentable subject matter, and that this issue is more appropriately dealt with under other parameters of patentability. On this point, he found that the claims were not only too broad, but also lacked clarity and were poorly defined, and on this basis he instructed the parties to amend the patent application.¹⁸⁴

It seems a foregone conclusion that the decision will be appealed. It is not difficult to envisage the grounds of appeal focusing on whether the claims in the case can truly be dealt with as methods, despite the characterization of them as such. Even if the claims are appropriately classified as method claims, there is a real question as to whether they involve more than the discovery of associations with naturally occurring traits. On this basis, we should expect to see further jurisprudence dealing with this vexed question in the not too distant future.¹⁸⁵

As a final point, it is worth noting comments made by Justice Beach in relation to the High Court’s factorial approach:

Now various questions might be said to suggest themselves concerning the ‘other factors’ approach. First, is this a policy-driven approach to the assessment of patentability for cases on or beyond the existing boundaries? Second, is this approach properly characterised as purposive or consequentialist or both? Third, is there a clear threshold to justify moving into such a space, and if so, what? In some cases reasonable minds might differ as to whether a case is within or without existing boundaries. Fourth, has the plurality just been more transparent about the considerations to be taken into account in assessing whether new or difficult subject matter is a proper subject matter for the grant of letters patent. Fifth and further, various issues concerning the priority ranking and weighting to be given to these factors remain to be explored. ... And am I obliged to consider all of the factors or only some of them?

¹⁸⁰ *Id.* at [492].

¹⁸¹ *Id.* at [492].

¹⁸² *Id.* at [490].

¹⁸³ *Id.* at [496].

¹⁸⁴ *Id.* at [265–26] and [500].

¹⁸⁵ Note also the matter of *Sequenom Inc v. Ariosa Diagnostics Inc & Ors* (File No VID611/2016) is at pre-hearing stage in Australia, with the first instance hearing before Justice Beach scheduled for August 2018. While it is difficult to predict the outcome of the hearing in this paper, it is possible to speculate that Justice Beach will apply the factorial approach if he considers it applicable – depending on his interpretation of the patent claims.

II.D. Lessons for US Practice

While it may well be true that the decision in *Cargill* will be reviewed by higher Australian courts and modified (if not reversed), Justice Beach's interpretation of *D'Arcy*, coupled with the guidelines set out by IP Australia, offers one intuitive way forward in dealing with the problems identified earlier in the aftermath of the US decisions in *Mayo* and *Myriad*. This approach furnishes an analytical technique that avoids the problems in the two-step *Mayo* test of determining when a difference is marked, deciding what constitutes significantly more, and finding an inventive concept. In contrast to a recent decision of the US Patent Trial and Appeal Board, which invalidated a patent on a method for using SNPs to breed cows,¹⁸⁶ Justice Beach managed, even after *D'Arcy*, to retain the availability of patents to encourage valuable new inventions in the life sciences arena, in this case, one with potential to improve nutrition. He did so in three ways.

First, he regarded invention in traditional ('plain vanilla') subject areas—places where society has not heretofore experienced significant difficulty with patent rights—as the proper subject matter of patenting. To deal with the abstractness problem that concerned the Supreme Court in *Alice* and the breadth issue that worried Judge Bryson in *Myriad*—claims which, as the *D'Arcy* Court put it, one could inadvertently infringe—he deployed other patentability requirements. In US parlance, he required the applicant to supply more information under the rubrics of enablement and distinct claiming.¹⁸⁷ Of course, it remains to be seen whether the patent retains value once the applicant makes the required amendments.

Second, to the extent Justice Beach saw himself as dealing with an area where patenting is new—areas where early insights are likely to be fundamental and where rights could, in Justice Breyer's words, impede rather than promote progress—Justice Beach considered the factorial test. He was able to use this approach to look directly at the problem of chilling future innovation instead of, as in *CellzDirect*, peeking at preemption after struggling with a test that is difficult to apply, not well correlated with the concern, and easily influenced by how a claim is drafted. Thus, while we take Professor Lawson's point that, once the *D'Arcy* court decided genes were not man-made, the factorial test might be considered dictum, we see it as a way to deal with modern technologies that lie close to fundamental scientific principles (so called dual-use technologies) or with the sort of inventions that Dan Burk has identified as troubling because they are communicative in nature.¹⁸⁸ The factorial test draws attention to the concerns attendant to patenting in these areas and requires courts (and patent offices) to engage with the social and proprietary implications of either granting or denying exclusive rights. (As we will argue later, identifying these borderline cases can also be useful to determine the scope of defenses, should the patent be enforced.) In some ways this approach is similar to the suggestion made by Dennis Crouch and Robert Merges that

¹⁸⁶ *American Simmental Assoc. v. Leachman Cattle*, 2016 WL 3268597 (Patent Tr. & App. Bd. June 13, 2016).

¹⁸⁷ 35 U.S.C. § 112 (2018). In some cases, the written description requirement could serve a similar function.

¹⁸⁸ Dan L. Burk, *Patents and the First Amendment*, 96 WASH. U. L. REV. (2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3119362 (accessed Sept. 12, 2018), at 17. Burk regards such inventions as raising First Amendment concerns, but his examples mainly demonstrate the sort of innovation and competition problems that lie at the heart of the subject matter objection.

subject matter eligibility should be considered only after other criteria for patentability are evaluated.¹⁸⁹

Third, Justice Beach appreciated the difference between attempts to privatize pure communicative material (or as the courts call it, information),¹⁹⁰ by claiming the medium in which it is embedded, as opposed to a concrete implementation of that material in a way that can improve social welfare. This is illustrated by the way that he dealt with the two product claims in issue in *Cargill*, a claim to an isolated DNA sequence (claim 13) and a claim to a cloned bovine (claim 11), both resulting from methods also claimed in the patent. The sequence claim was rejected as within the bar created by *D'Arcy*.¹⁹¹ In contrast, Justice Beach found the claim to the cloned animal to be patentable subject matter. He did not stop with the similarities between the clone and its mother, as the Federal Circuit did in *Roslin*, nor did he attempt to decide whether differences in epigenetics or mitochondria were marked or significant enough. Instead he reasoned:

Now of course the cloned cow in one sense is the same as that which it clones. MLA says superficially that it is 'mere genetic information on a grander scale' and accordingly *Myriad* is directly applicable. The submission has a superficial allure, but I reject it. An artificial object of economic significance is produced for its own sake, not merely as a spectacle for its informational content.¹⁹²

To be sure, much as this approach presents a valuable way to preserve patentability in areas where incentives are important and concerns around exclusivity are not paramount, it would be somewhat difficult to reconcile with the Supreme Court's pronouncements. But as noted earlier, the distinction Justice Thomas drew in *Myriad* between man-made and artificial is not as sharp as he maintained. As Judge Lourie argued, isolated gDNA involves broken bonds and is thus somewhat artificial (especially when the claimed fragments possess the sorts of functions Judge Moore described). At the same time, when it is only the exons (coding sequences) that matter, cDNA cannot be considered man-made. In short, supplementary factors will always be necessary to separate patentable and unpatentable subject matter—arguably, that is why the PTO, the Federal Circuit, and the *Alice* Court ignored the *Myriad* Court's failure to cite *Mayo* and instead have relied on its two-step analysis for all subject matter challenges. The factors used in the Australian decisions can be regarded as providing the missing metric for deciding what is different enough from nature to be considered protectable. And, as Crouch and Merges and many commentators have pointed out, reliance on other patentability factors—enablement, written description, distinct claiming, nonobviousness, utility, and novelty—will often be enough to filter out subject matter that should

¹⁸⁹ Crouch & Merges, *supra* note 21.

¹⁹⁰ We note that Professor Lawson disputes the characterization of genetic sequences as information, see Lawson, *supra* note 145, especially at 758–60. However, the description of DNA he provides does not erase its role as communicative, as directing complex processes that are critical to medical science.

¹⁹¹ *Meat and Livestock Ltd v. Cargill Inc* [2018] FCA 51 [409] [482] (noting that even though this claim was different from those invalidated in *D'Arcy* because it was limited to sequences identified through a method that was also claimed in the patent, allowing the claim would conflict with the themes of *Myriad*).

¹⁹² *Id.* at [409] [470].

not be patented.¹⁹³ It would mark quite a shift in Australian jurisprudence, however, if these supplementary factors are considered after the other patentability factors. Patent eligibility has traditionally been considered to be a threshold question.

We may already be seeing the Federal Circuit move in a similar direction, one more hospitable to patenting material drawn to nature. *Vanda Pharmaceuticals Inc. v West-Ward Pharmaceuticals, Ltd.* (*Vanda*), which was decided in April 2018, involved a method for treating schizophrenia based on a patient's genotype.¹⁹⁴ A representative claim included a step to determine (or have determined) the patient's genotype from a biological sample, and then administering an amount of iloperidone that is dependent on whether the patient is genetically inclined to be a poor metabolizer. The method is based on the natural relationship between the P450 2D6 gene and an enzyme that is known to metabolize many drugs, including iloperidone. Nevertheless, the court did not reject the patent as a law of nature, barred by *Mayo*. Instead, like Justice Beach, Judge Lourie confined *Mayo* to its facts. Since the *Mayo* claims 'were not directed to a novel method of treating a disease', he held that *Vanda* 'is not *Mayo*'.¹⁹⁵ That said, as in *Cargill*, the court went on to consider the *Mayo* factors and found the claim was patent-eligible under Step 1 (the PTO's 2A).¹⁹⁶ In addition, it determined that the claim was not pre-emptive because it did not tie up subsequent treatment decisions.¹⁹⁷ Tellingly, Judge Prost's dissent called attention to the ways in which the decision departs from *Mayo* and the court's former understanding of how it applies.¹⁹⁸ But this approach has the advantage of opening opportunities to patent in areas that hold considerable promise, including as in this case, personalized medicine.

III. CONSEQUENCES OF EXPANDING THE REACH OF PATENTABLE SUBJECT MATTER

The US patent community has not reacted to the subject-matter eligibility cases in the same way as Justice Beach did by advocating for a more refined and nuanced analysis of the distinction between eligibility and noneligibility. While USPTO Director Andrei Iancu noted the difficulties in applying current law and concluded that '[s]omething must be done',¹⁹⁹ the bar appears to have little patience with improving the definitions of 'markedly different' and 'significantly more' or with leavening the analysis with technical filters, as in *In Re Fisher*,²⁰⁰ or relying more on the nonobviousness inquiry

¹⁹³ See eg Crouch & Merges, *supra* note 21 and the discussion in John M. Golden, *Redundancy: When Law Repeats Itself*, 94 TEX. L. REV. 629, 701–03 (2016). Further, as Paul Gugliuzza notes, the idea that subject matter eligibility must be decided first introduces new sources of error, see Gugliuzza, *supra* note 21.

¹⁹⁴ 87 F.3d 1117 (Fed. Cir. 2018).

¹⁹⁵ *Id.* at 1134.

¹⁹⁶ *Id.*

¹⁹⁷ *Id.* at 1135.

¹⁹⁸ *Id.* at 1140–43 (Prost, J., dissenting).

¹⁹⁹ Specifically, he noted that: [C]urrent standards [of subject matter eligibility] are difficult for all: stakeholders, courts, examiners, practitioners, and investors alike. System-wide, a significant amount of time is being spent trying to figure out where the lines should be drawn, and what's in and what's out. And multiple people looking at the same patent claims often have trouble agreeing on, and predicting, the outcome. Dennis Crouch, *USPTO Director Andrei Iancu on Patent Policy*, PATENTLYO BLOG, Apr. 11, 2018, <https://patentlyo.com/patent/2018/04/director-andrei-patent.html> (accessed Sept. 12, 2018).

²⁰⁰ 421 F.3d 1365 (2005).

set out in *KSR International Co. v Teleflex, Inc.*²⁰¹ Instead, the consensus seems to be that the ‘something’ must be a dramatic expansion of patentable subject matter. As we saw earlier, various influential organizations such as the IPO, the AIPLA, and the ABA have recommended that Congress amend the Patent Act to vastly expand the scope of patentable subject matter.²⁰²

Should that occur, the question arises as to what will happen to the concerns voiced in the Supreme Court subject matter cases and, almost more important, the patient access problems that animated the *Myriad* case in the first place. Immediately after *Myriad*, patient access to BRCA diagnostics improved rapidly. Two firms (Ambry and Gene-by-Gene) immediately entered the market and lowered costs. Thereafter, other, more efficient, forms of testing (such as testing of multiple genes simultaneously) were made available.²⁰³ Surely, the goal cannot be to roll back the potential for these developments. Rather, we argue that Justice Breyer’s admonition that ‘sometimes too much patent protection can impede rather than ‘promote the Progress of Science,’ should be understood in the context in which it was made, as a reaction to cases limiting the scope of the experimental use defense.²⁰⁴ Thus, it should be interpreted not as advocating fewer patents (the upshot of *Myriad* and *Mayo*), but rather as suggesting that the protection offered by a patent should be tempered by defenses that promote other values. Prior to *Myriad*, SACGHS had recommended the creation of exemptions from patent infringement for use of genetic tests for patient care purposes and for use of patent-protected DNA sequences for research purposes.²⁰⁵ Although the America Invents Act of 2011 did not include these proposals, it did expressly require the Director of the Patent and Trademarks Office to conduct a study into second opinion testing.²⁰⁶ The Report advised caution and made recommendations concerning data sharing and testing.²⁰⁷ However, in light of the Supreme Court subject matter decisions, the study became largely irrelevant. But should the legislature overrule these cases, it must also consider changes along the lines recommended by SACGHS. Once again, the United States can learn a great deal from Australia.

III.A. Australian Practice

As noted above, GTG had taken steps in 2003 and 2008 to assert the BRCA patents against public laboratories and research bodies that were performing BRCA testing.²⁰⁸ However, it was not the decision in *D’Arcy* that altered its behavior. Rather—perhaps surprisingly—it voluntarily ceased its enforcement actions. Partly, it seems that GTG

²⁰¹ 550 U.S. 398 (2007).

²⁰² See text at notes 18–19, *supra*.

²⁰³ See FORCE, *Myriad Genetics vs. Ambry and Gene-by-Gene* (2015), <http://www.facingourrisk.org/our-role-and-impact/advocacy/current-actions/myriad-ambry.php> (accessed Sept. 12, 2018); Robert Cook-Deegan & Annie Niehaus, *After Myriad: Genetic Testing in the Wake of Recent Supreme Court Decisions about Gene Patents*, 2 CURR. GENET. MED. REP. 223 (2014); *In re BRCA1- & BRCA2-Based Hereditary Cancer Test Patent Litig.*, 774 F.3d 755 (Fed. Cir. 2014) (refusing to enjoin other laboratories offering BRCA testing).

²⁰⁴ See text at notes 57–60, *supra*.

²⁰⁵ SACGHS Report, *supra* note 2, at 89, 94–95.

²⁰⁶ Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284 (2011), §27.

²⁰⁷ United States Patent and Trademark Office, Report on Confirmatory Diagnostic Test Activity (2015), https://www.uspto.gov/sites/default/files/documents/USPTO_Report_on_Confirmatory_Genetic_Diagnostic_Test_Activity.pdf (accessed Sept. 12, 2018).

²⁰⁸ See text at notes 120–143 *supra*, Part II A.

was reacting to negative public reactions²⁰⁹ but there was probably more to it than this. A recent empirical study conducted by two of the authors suggests that the unique structure of the Australian genetic diagnostic sector might have played a role in GTG's decision to drop the suit.²¹⁰

As this study reports, traditionally, genetic testing in Australia has been conducted by nationally accredited public pathology laboratories, although several private laboratories have always operated. The public labs mainly serve patients eligible for public funding. These are patients who meet an appropriate risk profile for a particular genetic condition. They are not expected to make any personal payment; instead, funding for their testing is provided by state-based healthcare systems and, to a lesser extent through Australia's federal-government-funded Medicare Benefits Scheme.²¹¹ The conduit between public laboratories and patients is clinical genetic testing services based in each Australian state, which are tasked with genetic counseling and referring patients for testing.²¹²

While public laboratories mainly serve eligible patients and private labs serve private patients, the separation is not perfect. Public laboratories may also perform tests for self-funded, private patients (patients who do not meet the eligibility requirements), many of whom are referred through the clinical genetic testing services.²¹³ At the same time, there are patients referred for genetic testing through the public system who may subsequently be referred on to private laboratories. Prices charged for the tests are generally low. Public laboratories make up a very significant proportion of the market for genetic diagnostic tests in Australia (indeed, at the time GTG contemplated asserting its patents, it was the only private lab in Australia offering BRCA testing); most tests performed are, in fact, publicly funded.²¹⁴ Since government-funded health care is based largely on recovering costs,²¹⁵ excessive test prices are unsustainable.²¹⁶

The result is a structure that largely protects Australian public laboratories from enforcement actions.²¹⁷ For the most part, prices cannot rise more than the government is

²⁰⁹ Upon reviewing its decision to assert its patents in 2003, GTG stated that its rights over the BRCA genes 'are our gift to the Australian people', Genetic Technologies Ltd, Report to shareholders (July 9, 2003), at 1; Genetic Technologies Ltd, New Position re BRCA Testing (Dec. 2, 2008), at 1, no longer publicly available but reported in Dianne Nicol, *Navigating the Molecular Diagnostic Patent Landscape*, 18 EXPERT OPIN. THERAP. PATENTS 461, 466 (2008), <https://eprints.utas.edu.au/7224/> (accessed Sept. 12, 2018).

²¹⁰ Jane Nielsen & Dianne Nicol, *The Myriad Litigation and Genetic Diagnostic Testing in Australia* (2018) (manuscript submitted for publication); Nicol, Nielsen and Dawkins, *The Impact of the High Court's Decision in D'Arcy v Myriad on the Cost of Genetic Testing in Australia* (unpublished manuscript on file).

²¹¹ Australia's federal government allocates funds to each Australian state for the provision of public health services, these being largely operational services (hospitals and associated services). In addition, the federal government has responsibility for funding certain items, including medical services (through the Medicare Benefits Scheme) and prescription pharmaceuticals (through the Pharmaceutical Benefits Scheme).

²¹² Nielsen & Nicol, *supra* note 210, at 5–7.

²¹³ Royal College of Pathologists of Australasia, Report of the RCPA Genetic Testing Survey 2011, 21 (2012), <https://www.rcpa.edu.au/Library/Practising-Pathology/RCPA-Genetic-Testing/Docs/RCPA-Genetic-Testing-Survey-Report.aspx> (accessed Sept. 12, 2018). State governments reimbursed 39.2% of tests, the MBS covered 34.1%, while private patients paid for 19.7% of tests conducted.

²¹⁴ Nicol, Nielsen and Dawkins, *supra* note 210, at 32 (citing a figure of 73.3%).

²¹⁵ *Id.* at 32–37.

²¹⁶ *Id.* at 34–35, 56.

²¹⁷ Nicol & Nielsen, *supra* note 210, at 7–8; Nicol, Nielsen and Dawkins, *supra* note 210, at 56; Dianne Nicol & John Liddicoat, *Do Patents Impede the Provision of Genetic Tests in Australia?*, 37 AUSTRAL. HEALTH REV. 281 (2013).

willing to pay. Moreover, while the public laboratories are competitors of patent holders like GTG, they are also their customers, in that they do the bulk of the genetic testing.²¹⁸ Finally, patent holders know that the government can always send samples abroad for testing. Indeed, in Australia there is an increasing reliance (albeit still small) on foreign laboratories.²¹⁹

There are other dynamics under Australian patent law that influence access to fundamental biomedical patents. Prior to April 16, 2012, when the *Intellectual Property Laws Amendment (Raising the Bar) Act 2012* (Cth) (Raising the Bar Act) came into effect, there was no express exemption from infringement for experimental use in the Australian *Patents Act 1990* and no judicial precedents indicating that such an exemption existed at common law.²²⁰ The Raising the Bar Act introduced a limited research exemption into Australian law via s 119C of the *Patents Act 1990*.²²¹ The research exemption in s 119C protects a person from infringing a patent for an invention where an act is done that would infringe a patent, provided it is done for experimental purposes relating to the subject matter of the invention (often referred to as an exemption for ‘research on’ the subject matter of the invention, as opposed to ‘research with’ this subject matter).²²² The stated intention of this provision was ‘... to give broad and clear protection to research and experimental activities in order to maximise the potential for research in Australia’.²²³ However, its scope and effect are yet to be clearly determined. It is particularly unclear as to how the exemption will apply to gene patents. It is not intended to protect use of patented research tools.²²⁴ Nor would it cover diagnostic testing. Despite its limited reach in relation to ‘public good’ uses, it would, however, permit research about the functions the gene influences and how its expression is controlled.

In an empirical study of patent practice in the Australian medical biotechnology industry undertaken in 2002–2003, two of the authors found that there was a de facto research exemption from infringement, in the sense that owners of gene and other research tool patents tended not to enforce their rights against research users.²²⁵ The one reported exception to this norm related to the polymerase chain reaction patent. These findings were largely affirmed in another empirical study by the authors and

²¹⁸ Nielsen & Nicol, *supra* note 210, at 8; Nicol, Nielsen and Dawkins, *supra* note 210, at 55–58.

²¹⁹ Nicol & Liddicoat, *supra* note 217, at 31–32.

²²⁰ Advisory Council on Intellectual Property (ACIP), Patents and Experimental Use, Final Report 65 (2005), https://www.ipaustralia.gov.au/sites/g/files/net856/f/acip_final_report_patents_and_experimental_use_archived.pdf (accessed Sept. 12, 2018).

²²¹ *Patents Act 1990* s 119C, inserted by Intellectual Property Laws Amendment, *Act 2012* (Cth) sch 2 pt 1 [hereinafter Raising the Bar]: ‘A person may, without infringing a patent for an invention, do an act that would infringe the patent apart from this subsection, if the act is done for experimental purposes relating to the subject matter of the invention.’

²²² *Patents Act 1990*.

²²³ Intellectual Property Laws Amendment (Raising the Bar) Bill 2011, Explanatory Memorandum, The Parliament of the Commonwealth of Australia, Canberra. 9, <https://www.legislation.gov.au/Details/C2011B00114/Explanatory%20Memorandum/Text> (accessed Sept. 12, 2018).

²²⁴ Productivity Commission, Compulsory Licensing of Patents, Report No. 61, 184 (2013), <https://www.pc.gov.au/inquiries/completed/patents/report/patents.pdf> (accessed Sept. 12, 2018).

²²⁵ Dianne Nicol & Jane Nielsen, Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry 217–218 (Hobart: Centre for Law and Genetics Occasional Paper No. 6; 2003), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2583508 (accessed Sept. 12, 2018).

others collaborators some ten years later.²²⁶ In the intervening period it became clear that GTG was enforcing its patent rights, not in relation to the BRCA patents but its own intron sequence analysis patent, with universities, commercial entities, and providers of molecular diagnostic services in various jurisdictions.²²⁷ Noncommercial research organizations were offered research licenses for nominal, one-off fees, whereas commercial licensees were required to pay significant fees for past infringement and future use; indeed, GTG was able to negotiate its exclusive license with Myriad on this basis.²²⁸ This may be another reason why GTG didn't enforce its BRCA patent rights—it didn't need to because it could rely on its own intron sequence analysis patent. Ironically, in the United States, this patent was struck down by the U.S. Federal Circuit post-Myriad for failing to satisfy the subject matter requirement.²²⁹

In addition to the experimental use exemption, Australian patent legislation also includes provisions allowing for certain noninfringing uses of the patented invention without the permission of the patentee, referred to internationally as uses without authorization.²³⁰ Two main forms of use without authorization of the patentee exist in Australia.²³¹ First, a compulsory license is a court or administrative order requiring the patentee to grant a license to a third party to work the invention. Secondly, government use embraces use of the invention by the government for the purposes of the state. The rationale for use without authorization is thought to go to the heart of the justification for the patent system, which is to encourage innovation which has benefits for the economy.²³² If a patent is granted and not exploited this goal is not realized. In such circumstances, it is recognized that others should be allowed to exploit the invention, but only within precisely defined boundaries, prescribed by international and domestic laws.²³³

Prior to an amendment to the Australian *Patents Act 1990* via the *Intellectual Property Laws Amendment Act 2006*, the main ground for compulsory licensing was to provide an opportunity for others to use patented inventions when the 'reasonable requirements of the public' had not been met by the patentee, through s 133 of the *Patents Act 1990*. In effect, this is a type of 'public interest' compulsory license, available where there is a failure on the part of the patentee to meet demand. The 2006 amendment extended the grounds for compulsory licensing to include anti-competitive conduct. In both cases, the licensee must pay reasonable remuneration.²³⁴ Section 133 also allows for

²²⁶ Dianne Nicol et al., *The Innovation Pool in Biotechnology: the Role of Patents in Facilitating Innovation* (Hobart: Centre for Law and Genetics Occasional Paper No. 8; 2014) 86–87, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2503314 (accessed Sept. 12, 2018).

²²⁷ Nicol, *supra* note 209, at 466.

²²⁸ *Id.*

²²⁹ *Genetic Technologies Ltd v. Merial LLC*, 818 F.3d 1369 (Fed. Cir. 2016).

²³⁰ Agreement on Trade-Related Aspects of Intellectual Property Rights, Marrakesh Agreement Establishing the World Trade Organization, Apr. 15, 1994, 33 I.L.M. 81, art. 31 (1994) [hereinafter TRIPS Agreement].

²³¹ Productivity Commission, *supra* note 224, at 113–68.

²³² See eg Richard Nelson & Roberto Mazzoleni, *Economic Theories About the Costs and Benefits of Patents* (Summary of Workshop Held at the National Academy of Sciences by the National Research Council on Intellectual Property Rights and Research Tools in Molecular Biology) 17 (1997), http://www.nap.edu/openbook.php?record_id=5758 (accessed Sept. 12, 2018); Intellectual Property and Competition Review Committee (IPCRC) Final Report, Review of Intellectual Property Legislation under the Competition Principles Agreement 22-3 (2000), https://www.ipaustralia.gov.au/sites/g/files/net856/f/ergas_report_september_2000.pdf (accessed Sept. 12, 2018).

²³³ Productivity Commission, *supra* note 224, at 5.

²³⁴ *Patents Act 1990* s 133(S)(b).

compulsory licensing for dependent patents where a new product involves an important technical advance of considerable economic significance on the invention on which it is dependent. Applications for compulsory licenses must be made to the Federal Court of Australia.²³⁵ To date, three applications have been made, and all have met with very limited success.²³⁶

There are also provisions in ss 163 to 170 of the *Patents Act 1990*, allowing for exploitation of patents by the Crown or by a person authorized by the Crown, as well as compulsory acquisition (s 171) and assignment (s 172). Use by the Crown under s 163 is limited to exploitation ‘for the services of the Commonwealth or State’, where that exploitation is ‘necessary for the provision of those services’. There is no requirement for the Crown to formally apply for an order to exploit a patented invention. Section 165A does, however, provide a safeguard in that the patentee or their nominee can make application for a declaration that such exploitation is not, or is no longer, necessary for the proper provision of relevant services, as well as an order for the Crown to cease exploitation. Consequently, the government remains accountable as to the appropriate compensation and circumstances of use.²³⁷ Like compulsory licensing, there has been limited use of these provisions, although two cases have shown that the provisions cover such things as the use by a state rail authority of an invention for the construction of rail carriages,²³⁸ and the use by a local government authority of a meter relating to measurement of water supply.²³⁹ As with compulsory licensing, compensation must be paid to the patentee by the Crown. Although the public laboratories undertaking BRCA testing did not explicitly rely on Crown use, it was widely understood that they could use this option should they need to, if a cease and desist letter was ever handed to them. Ultimately we will never know whether this ‘threat’ played a part in GTG’s decision to cease enforcement of the BRCA patents.

The provisions were considered by the Australian Law Reform Commission (‘ALRC’) during its inquiry into gene patenting and human health completed in 2004,²⁴⁰ and were again comprehensively examined by the Productivity Commission in 2013.²⁴¹ There was general consensus in both final reports that the Crown use provisions would apply when access to a patented invention is sought to facilitate the provision of public healthcare.²⁴² The ALRC specifically referred to the provision of genetic testing to members of the public, by a public laboratory as one example of such Crown use. There has been further suggestion that the supply of a patented drug to patients in a public hospital would satisfy the Crown use threshold under the Australian legislation, as the provision of a service to the public would constitute an act done in the

²³⁵ *Patents Act 1990* s 133(1).

²³⁶ Productivity Commission, *supra* note 224, at 58.

²³⁷ *Id.* at 170–71.

²³⁸ *General Steel Industries Inc v. Commissioner of Railways* 112 C.L.R. 125 (1964) (NSW).

²³⁹ *Stack v. Brisbane City Council* 32 I.P.R. 69 (1995). See also Productivity Commission, *supra* note 224, at 165–66 and particularly Box 7.1.

²⁴⁰ Australian Law Reform Commission (ALRC), *Genes and Ingenuity: Gene Patenting and Human Health*, Report No 99 (Commonwealth of Australia, 2004), <https://www.alrc.gov.au/publications/report-99> (accessed Sept. 12, 2018).

²⁴¹ Productivity Commission, *supra* note 224.

²⁴² Australian Law Reform Commission, *supra* note 240, at 602; Productivity Commission, *supra* note 224, at 171.

performance of a duty imposed by government.²⁴³ Arguably, the provision of genetic diagnostic testing, surgery,²⁴⁴ drug therapy, or gene therapy to a member of the public could all be construed as ‘services’ undertaken in furtherance of governmental function. Although facilitating access to a patented invention is not a specific duty or function of health departments,²⁴⁵ providing access to a much-needed drug, diagnostic test, or therapy might be. This would be the case whether the service were being provided by a public or private health entity to undertake a function of government.²⁴⁶

Perhaps the most important function of the Australian compulsory licensing/Crown use system is a safeguard effect in dissuading enforcement²⁴⁷ against testing services, particularly publicly funded laboratories. From this perspective, there is a possibility that the lack of patent assertion in the genetic testing area might be partially attributed to the overriding threat of government intervention to enable the continuation of testing in public laboratories.

III.B. Lessons for the United States

The US legal system has had long resisted compulsory licensing and price controls.²⁴⁸ However, the policies furthered by the provisions discussed above—the interest in scientific progress through research and the interest in balancing proprietary interests against the public interest—are well recognized.²⁴⁹ If the Supreme Court’s effort to protect these through a subject matter filter unravel as a result of legislative intervention—or if the Federal Circuit drifts significantly from *Mayo* and *Myriad*—then the approach taken by Australia should be considered.

Australia’s experience demonstrates how government intervention on behalf of patients in the public system can be mobilized to ensure access overall. Thus, one way to avoid ‘too much patent protection’ (in the sense of protection that is too strong) would be for the United States to adopt, to the extent possible, a similar system. For medicines, there is already considerable interest in allowing the federal government to negotiate with right holders in order to lower prices for people on Medicare and Medicaid and, further, to provide more oversight on how private insurers allocate the rebates

²⁴³ Australian Law Reform Commission, *supra* note 240, at 598, citing *Pfizer Corporation v. Ministry of Health* [1965] AC 512, 543–52.

²⁴⁴ It should be noted that the availability of patents for methods of surgery has been the subject of debate for a number of years. The High Court recently held that some forms of methods of medical treatment are patentable. In *Apotex Pty Ltd v. Sanofi Aventis Australia Pty Ltd* [2013] HCA 50, although the Court held that new methods of using known drugs were patentable, no decision was made on whether this holding applied to all methods of medical treatment (including methods of surgery).

²⁴⁵ See the argument in Tracey Dembo, *An Examination of the Crown Use Provisions in the Patents Act 18* *Australian Intellectual Property Journal* 70 (2007) at 82.

²⁴⁶ Productivity Commission, *supra* note 224 at 25 (Recommendation 7-1).

²⁴⁷ *Id.* at 12–13.

²⁴⁸ See *eg Dawson Chem. Co. v. Rohm & Haas Co.*, 448 U.S. 176, 215 & n. 21 (1980) (recounting attempts to institute compulsory licenses); Note, Jonathan Ingram, *Eliminating Innovation How Price Controls Limit Access*, 32 *J. LEGAL MED.* 115, 119–20 (2011) (attempts to institute price controls on pharmaceuticals).

²⁴⁹ See *eg Integra Lifesciences I, Ltd. v. Merck KGaA*, 331 F.3d 860, 873 (Fed. Cir. 2003) (“The purpose of a patent system is not only to provide a financial incentive to create new knowledge and bring it to public benefit through new products; it also serves to add to the body of published scientific/technologic knowledge”) (Newman, J., dissenting in part), judgment vacated, 545 U.S. 193 (2005).

they receive when they manage to obtain price concessions.²⁵⁰ While the federal government has yet to adopt these proposals, some states have used their clout to reduce prices.²⁵¹ A similar strategy could be embraced for diagnostics.

Both state and federal governments also enjoy regulatory authority over laboratories that conduct diagnostic testing; that role could be expanded to consider pricing issues.²⁵² Alternatively, the federal government could create in the United States the competition/customer dynamic present in Australia by establishing its own set of laboratories. US patent law includes an analog to Australia's Crown use in that the US government is exempt from infringement liability (subject to the payment of reasonable and entire compensation).²⁵³ That provision encompasses uses by the United States as well as by a 'contractor, a subcontractor, or any person, firm or corporation for the Government and with the authorization or consent of the Government'. The measure could be construed to cover uses by laboratories designated by the government to provide testing to patients insured by the government.

The United States also plays a significant role in scientific advancement, including in the life sciences, through funding, intramural research, and joint ventures with private parties.²⁵⁴ It has been suggested that the government's authority under the laws that enable this support should be expanded to give it authority to constrain the price at which drugs developed with tax dollars are sold.²⁵⁵ Such expanded authority could also be deployed to limit the cost of diagnostics, to ensure that there is competition in the diagnostics marketplace (sufficient, at least, to create opportunities for second opinion testing and quality assurance), and to require patent holders to tolerate experimental uses of their inventions. Even under existing law, there is at least one possibility for exerting more control: the march-in provision of the Bayh Dole Act could be used to protect the public interest in research, quality control, and second opinion testing regarding the outcome of research supported by the federal government.²⁵⁶ Furthermore, given that the importation into the United States of information (such as a lab report) produced with a patented technology does not qualify as infringing activity,²⁵⁷ price competition could be fostered and access improved by encouraging healthcare

²⁵⁰ The Commonwealth Fund, *Getting to the Root of High Prescription Drug Prices: Drivers and Potential Solutions* 8, 9 & 13 (2017), https://www.commonwealthfund.org/sites/default/files/documents/—media_files_publications_fund_report_2017_jul_waxman_high_drug_prices_drivers_solutions_report.pdf (accessed Sept. 12, 2018) [hereinafter Commonwealth Fund Report].

²⁵¹ See eg Note, Brendan Murphy, *Getting High on Profits: An Analysis of Current State and Federal Proposals to Rein in Soaring Drug Prices*, 12 J. HEALTH & BIOMED. L. 37 (2016) (discussing multiple approaches at the state and federal level). See also Daniel J. Kevles, *Medicare, Medicaid, and Pharmaceuticals: The Price of Innovation*, 15 YALE J. HEALTH POL'Y, L. & ETHICS 241 (2015).

²⁵² See eg Note, Peter M. Kazon, *Regulatory Issues Facing Genetic Testing*, 3 J. HEALTH & LIFE SCI. L. 111 (2010).

²⁵³ 28 U.S.C. § 1498 (2006).

²⁵⁴ See eg E. Ray Dorsey, Jason de Roulet & Joel P. Thomson, *Funding of U.S. Biomedical Research, 2003-2008*, 303 JAMA 137 (2010).

²⁵⁵ The Commonwealth Fund Report, *supra* note 250, at 12–13.

²⁵⁶ 35 U.S.C. § 203 (2018); Rai, *supra* note 13; Arti K. Rai & Rebecca S. Eisenberg, *Bayh-Dole Reform and the Progress of Biomedicine*, 66 LAW & CONTEMP. PROBS. 289 (2003). See also Gary Pulsinelli, *Share and Share Alike: Increasing Access to Government-Funded Inventions Under the Bayh-Dole Act*, 7 MINN. J.L. SCI. & TECH. 393 (2006); NATIONAL RESEARCH COUNCIL, A PATENT SYSTEM FOR THE 21ST CENTURY 108-17 (Stephen A. Merrill, Richard C. Levin & Mark B. Myers eds., 2004)

²⁵⁷ *Bayer AG v. Housey Pharm., Inc.*, 340 F.3d 1367 (Fed. Cir. 2003).

providers to follow Australia's lead and rely, when necessary, on foreign laboratories for analysis.

To respond even more directly to Justice Breyer's concern about 'too much patent protection', the United States could also adopt Australia's decision to enact a research exemption. The Federal Circuit's opinion in *Madey v Duke University*, which limited the ability of academics to engage in research 'in keeping with the legitimate business interest' of their universities, severely restricts the availability of the common law defense.²⁵⁸ After all, research conducted by trained scientists typically furthers at least some interest of their employers. To be sure, a very broad defense could undermine the potential for profits. Thus, devising a defense that protects both public interests in access and proprietary concerns is not easy and a full discussion is beyond the scope of this article. However, many commentators have discussed alternatives, including recommendations along the lines of Australia's 'research on' defense.²⁵⁹ Indeed, there is a proposal to couple such a defense to the legislative expansion of the subject matter category.²⁶⁰ In the alternative, the courts themselves could change tack and uphold the eligibility of some patents falling at the edges of *Myriad* and *Mayo*, while creating a broader common law defense than currently exists post-*Madey*.

Finally, while it is unlikely that the United States will ever move to a compulsory licensing system generally, the use of compulsory licenses to remedy anticompetitive conduct is widely accepted.²⁶¹ Such behavior in the life sciences arena has received considerable scrutiny in the last few years: antitrust law has been used to bar settlements between patent holders and generic drug producers to pay for delayed competition and it has been relied on to prevent product hopping.²⁶² If clearing markets to remove opportunities for second opinion testing, quality assurance programs, and the like do not rise to the level of antitrust violations, an alternative would be to consider them patent misuse and to refuse to enforce the relevant patent until the misuse is purged.²⁶³ Along the same lines, the Supreme Court permits courts to withhold injunctive relief when

²⁵⁸ *Madey v. Duke University*, 307 F.3d 1351, 1362 (Fed. Cir. 2002).

²⁵⁹ See eg Rochelle Cooper Dreyfuss, *Reconsidering Experimental Use*, 50 AKRON L. REV. 699 (2016); Rochelle Dreyfuss, *Protecting the Public Domain of Science: Has the Time for an Experimental Use Defense Arrived?*, 46 ARIZ. L. REV. 457 (2004); Rochelle Cooper Dreyfuss, *Varying the Course in Patenting Genetic Material: A Counter-Proposal to Richard Epstein's Steady Course*, in PERSPECTIVES ON PROPERTIES OF THE HUMAN GENOME PROJECT (F. Scott Kieff ed., 2003). See also Katherine J. Strandburg, *What Does the Public Get? Experimental Use and the Patent Bargain*, 2004 WISH. L. REV. 81 (2004); Maureen A. O'Rourke, *Toward a Doctrine of Fair Use in Patent Law*, 100 COLUM. L. REV. 1177 (2000); Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017 (1989).

²⁶⁰ See eg Banbury Center, *Cold Spring Harbor Laboratory, A Proposed Path Forward for Legislatively Addressing Patent Eligibility Law* (2016), Comments Submitted at the USPTO Patent Subject Matter Eligibility: Roundtable 2, <https://www.uspto.gov/sites/default/files/documents/Updated%20Banbury%20Statement.pdf> (accessed Sept. 12, 2018).

²⁶¹ See eg *United States v. Nat'l Lead Co.*, 332 U.S. 319 (1947); *Hartford-Empire Co. v. United States*, 323 U.S. 386, 417 (1945); F.M. SCHERER, *THE ECONOMIC EFFECTS OF COMPULSORY PATENT LICENSING* 47–48 (1977) (canvassing decrees in patent cases).

²⁶² *FTC v. Actavis, Inc.*, 133 S. Ct. 2223 (2013) (pay for delay); *New York ex rel. Schneiderman v. Actavis PLC*, 787 F.3d 638 (2d Cir. 2015) (product hopping).

²⁶³ See eg *Gilead Scis., Inc. v. Merck & Co.*, 888 F.3d 1231 (Fed. Cir. 2018). See also Robin C. Feldman, *The Insufficiency of Antitrust Analysis for Patent Misuse*, 55 HASTINGS L.J. 399 (2003) (arguing that there are harms that do not amount to an antitrust violation that should be regarded as misuse because they undermine the public interest).

the public interest would be disserved by enjoining the defendant's infringing activity.²⁶⁴ Were the impact of market-clearing and researcher-clearing activity of the patent holder understood to constitute reason to deny injunctions, patent holders would become more amenable to negotiating licenses on reasonable terms.

Admittedly, decreasing the scope of patent protection could reduce incentives to innovate. However, the impact of the approaches suggested above is surely less harmful than the effect of denying patent protection entirely, as per *Myriad* and *Mayo*. It is also better than the current practice of inconsistent denials and awards of patent rights—an approach that combines inefficient incentives with harm to the public. Moreover, empirical evidence tends to suggest that concerns about incentives are exaggerated. Licenses issued in antitrust cases have not, apparently, discouraged innovation in the pharmaceutical sector.²⁶⁵ And *Mayo* does not appear to have affected the development of new diagnostics, even though (as suggested earlier), the claims in issued patents are narrower.²⁶⁶

IV. CONCLUSION

To be sure, the Australian public health care system is not without its problems, but the availability and affordability of genetic diagnostic testing has never been one of those problems. The levels of interest and scrutiny the *Myriad* and *Mayo* decisions attracted in the United States have never really been reflected in Australia when comparator judgments were handed down. The essential reason for this is that far less hinged on these decisions: whereas *Mayo* and to a lesser extent *Myriad* had the potential for dramatic effects on rights over nature and fundamental science, *D'Arcy* was viewed more as an interesting diversion. Even Justice Beach's liberal judgment in *Cargill* failed to arouse significant concern, primarily because those involved in the industry take no great issue with method patents, and do not view them as a significant impediment to their activities.

While it would be impractical to attempt to replicate the Australian environment in the United States, there is no reason why some lessons can't be learned from the Australian experience with patenting nature. This article has argued that a number of aspects of Australian jurisprudence are worth considering: a more nuanced view of the judicial exceptions to patentability—one that better identifies claims that have significant potential to impede rather than promote progress—and a backup system that includes structural features of the relevant industries and safeguards to protect public welfare, such as rights to use patented genes and diagnostics to ensure unencumbered delivery of genetic diagnostic testing. At the very least, the Australian experience should provide some impetus to ask where and why the US system has gone awry, and if there really is sufficient interest in addressing its shortcomings, to prompt the examination of alternative approaches.

²⁶⁴ eBay Inc. v. MercExchange, L.L.C., 547 U.S. 388, 391 (2006).

²⁶⁵ Colleen Chien, *Cheap Drugs at What Price to Innovation: Does the Compulsory Licensing of Pharmaceuticals Hurt Innovation?*, 18 BERKELEY TECH. L. J. 853 (2003).

²⁶⁶ Colleen V. Chien & Arti K. Rai, *Dx Innovation in Decline? An Empirical Analysis post-Mayo*, Presentation at the USPTO Roundtable on Section 101 (Dec. 5, 2016), <https://www.uspto.gov/sites/default/files/documents/RT2%206-2%20Colleen%20Chien.pdf> (accessed Sept. 12, 2018) (paper forthcoming).

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