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UNLIKELY SPLICING: THE MYRIAD DECISION, THE GENOMIC RESEARCH AND ACCESSIBILITY ACT, ORPHAN DISEASES, AND THE FUTURE OF ANTISENSE DRUGS

John L. Ryan

I. INTRODUCTION

"Last week, a federal judge threw out patents on two genes linked to cancer," declared comedian and satirist Stephen Colbert on his television show, The Colbert Report, in early 2010.1 "This is a huge blow to the biotech industry," because, after all, "why cure cancer if you can’t make a buck off of it?"2 Colbert then expressed concern over the ruling’s effect on his own patented genetic material, which he had supposedly planned to sell, and worried that “anyone could make a cheap knockoff.”3 Levity aside, the issue of gene patenting is a complex matter that defies simplistic analysis and could significantly affect the future development of life-saving therapeutics. The United States Department of Justice (“DOJ”) has stated that the issue of patenting basic discoveries in genetics “is a question of great importance to the national economy, to medical science, and to the public health.”4

The case mentioned by Colbert is Ass’n for Molecular Pathology v. United States Patent and Trademark Office (“Myriad I”), which was subsequently overturned in part by the United States Court of Appeals for

* J.D. Candidate, The Catholic University of America, Columbus School of Law, May 2012. The author is grateful for helpful feedback from Professor Megan La Belle, Jason Ferrone, and Joseph Kovacs. The author would like to thank the editors and staff of the Journal of Contemporary Health Law and Policy for their help and hard work.


2. Id.

3. Id.

the Federal Circuit ("CAFC"). However, the battle in the courts is only one front of a concerted campaign against gene patenting. In the halls of Congress, there is an interconnected movement working to pass legislation to ban any further patenting of human genetic material. What the scope of this ban should be and how it should be implemented are questions that have aroused great contention.

Congressman Xavier Becerra has previously proposed, and currently plans to reintroduce, the Genomic Research and Accessibility Act ("GRAA"), a bill that, if enacted, would place a broad prohibition on the patenting of any human genetic material. Opponents fear that the indeterminate language of the bill would inhibit production of cutting-edge biotechnology innovations, which offer great promise in combating genetic diseases. Among the most promising of these threatened innovations are antisense drugs, which are short strands of modified DNA and RNA specifically designed to combat genetic disorders by inhibiting the synthesis of disease-causing proteins within the human body. The possible negative effects of the GRAA would fall most heavily on those who suffer from orphan diseases, because most pharmaceutical companies do not consider developing drugs to treat these rare diseases to be commercially viable.

This Note begins by outlining how the U.S. Patent and Trademark Office ("USPTO") and the federal courts determine what constitutes patentable subject matter. Next, this Note describes the burgeoning knowledge of the human genome, and the race to patent the BRCA1 and BRCA2 (Breast Cancer Susceptibility) genes. The patenting of these breast cancer genes is at the root of the potentially landmark Myriad I case, which dramatically upended patent law in 2010, until it was overturned by the CAFC in mid-


8. Zina Moukheiber, Antisense and Sensibility, FORBES.COM (Apr. 1, 2002), http://www.forbes.com/forbes/2002/0401/120.html (stating “[a]ntisense drugs are named after the two strands of DNA that form the double-helix structure, which are known as sense and antisense”).

This Note argues that the structure of federal regulation of the pharmaceutical industry unwittingly aggravated the existing problem of rare diseases. While the Orphan Drug Act of 1983 has partially alleviated the situation, its success has been dependent on private sector investment and innovation that have greatly aided those suffering from rare diseases. This Note makes the case that Judge Sweet's *Myriad I* holding and the proposed GRAA are inappropriate tools to solve the perceived problem of gene patenting because of their overbroad effects. In contrast, the CAFC's *Myriad* holding applies legal precedent and legislative intent more accurately and preserves an imperfect system that is nonetheless generating new cures for diseases each year. Rather than restrain the innovation of the United States’ biotechnology industry, this Note outlines several possible solutions, focusing on careful exercise of march-in rights as enumerated under the Bayh-Dole Act of 1980. These rights would grant additional patent licenses to reasonable applicants when patent owners fail to alleviate satisfactorily the general public’s health and safety needs.

II. PATENTS

The basis for U.S. patent law is found in Article I, Section 8, Clause 8 of the United States Constitution, which assigns to Congress the power "[t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." Through this constitutional authority, Congress has established 35 U.S.C. § 101, which defines what can be patented. The statute reads: "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title." The wording of the statute is intentionally broad. How then has our society gone about granting monopoly rights to inventors? While the


modern patent system covers a broad range of inventions and techniques, the modern "boundary between eligible and non-eligible subject matter is defined, in significant part, by the settled principle that the patent laws do not embrace laws of nature, physical phenomena, or abstract ideas." There are two categories of patent claims at issue in Ass'n for Molecular Pathology v. United States Patent and Trademark Office ("Myriad II"): one set of claims covers the BRCA1/2 genes, which are isolated or purified natural compositions of matter, while the other set of claims covers the diagnostic methods that utilize the isolated BRCA genes, which qualifies as useful processes.

The line of cases surrounding patent eligibility for compositions of matter is a venerable one that stretches back a hundred years. In 1911, the celebrated Judge Learned Hand held that a purified natural form of adrenaline, or epinephrine, was patent-eligible subject matter. This holding was followed by a Supreme Court decision that bacteria inoculants created for leguminous plants that can take nitrogen from the air were patent ineligible because, in the words of Justice Douglas, they were works of nature "like the heat of the sun, electricity, or the qualities of metals." In 1958, however, the U.S. Court of Appeals for the Fourth Circuit held that a product of nature could be patented when it is a "new and useful composition of matter." Twenty-two years later, in Diamond v. Chakrabarty, the Supreme Court came to a different conclusion when considering whether man-made, genetically modified organisms designed to

Secretary of State (which encompassed many more powers than it does today), was America's first patent examiner. One of Jefferson's most famous documents was a letter to Isaac McPherson, in which he stated that there should be no patents on ideas. Id.


17. Myriad II, 653 F.3d at 1352 (citing Parke-Davis & Co. v. H.K. Mulford Co., 189 F. 95 (C.C.S.D.N.Y. 1911)). Judge Lourie distinguished this decision from Myriad I by making a distinction between isolated and purified compounds, although he noted that Judge Hand found the purified adrenaline to be patentable subject matter. Id.


break down components of crude oil, could be patented. The Court held that the microorganisms were patentable subject matter because “the claim is not to a hitherto unknown natural phenomenon, but to a non-naturally occurring manufacture or composition of matter—a product of human ingenuity ‘having a distinctive name, character [and] use.’”

In 2008, the CAFC considered patent process claims in *Bilski v. Kappos*, and reiterated the test for diagnostic methods, also known as the “machine or transformation” test. The test holds that “[a] claimed process is surely patent-eligible under § 101 if: (1) it is tied to a particular machine or apparatus, or (2) it transforms a particular article into a different state or thing.” Unbeknownst to Judge Robert W. Sweet, who utilized the *Bilski* test in *Myriad I*, on June 28, 2010, the Supreme Court decided the *Bilski* case on appeal. In *Bilski v. Kappos*, the Court affirmed the CAFC decision on the merits of the case, while relying on prior precedent to do so, and explicitly rejected the use of the “machine or transformation” test as the sole test for determining patentability. Commentators have noted that while the opinion offers little clarity for determining whether a particular innovation falls within Section 101, “[b]y refusing to state any particular rule or categorical exclusion, the Court has almost certainly pushed Section 101 patent eligibility to the background in most patent prosecution and litigation.”


21. *See Myriad II*, 653 F.3d at 1374 (quoting *Chakrabarty*, 447 U.S. 309-310). According to Judge Lourie, the Supreme Court distinguished *Chakrabarty* from *Funk Brothers* by stating that the organism, because of Chakrabarty’s efforts, had “markedly different characteristics from any [bacterium] found in nature.” *Chakrabarty*, 447 U.S. at 310.


23. *Id*.


26. *Id*. Instead, it is anticipated that patent litigation should focus on whether the invention is a novelty (§ 102), nonobvious (§ 103), and fully and particularly described (§ 112). *Id* (citing *Bilski*, 130 S. Ct. at 3225).
III. THE SEARCH FOR BRCA AND THE MYRIAD DECISION

A. Genes, BRCA1/2, and Myriad Genetics

Although scientists were able to extract Deoxyribose Nucleic Acid (DNA) as early as 1869, it was not until 1944 that scientists determined that DNA served as the carrier for genetic information. In 1953, scientists James Watson and Francis Crick published *A Structure for Deoxyribose Nucleic Acid*, which posited the DNA double-helix structure. Dr. Crick subsequently proposed the central principle of molecular biology: “(1) information is encoded in a segment of DNA, i.e., a gene; (2) transmitted through a molecule called RNA; and then (3) utilized to direct the creation of a protein, the building block of a body.”

Since these discoveries, knowledge of human genetics has expanded rapidly. The Human Genome Project, an international effort that was coordinated by the U.S. Department of Energy and the National Institute of Health (“NIH”) from 1990 to 2003, has identified approximately 20,000-25,000 genes in human DNA and more than 3 billion chemical base pairs that make up human DNA. As genetics research increased, scientists discovered that genes exist in every cell in the human body, and that they not only determine outward physical traits, but also influence health, longevity, and the development of a multitude of harmful diseases. Breast cancer is the most commonly diagnosed cancer in the world and is “the second leading cause of cancer death for women in the United States.” BRCA1 and BRCA2 (Breast Cancer Susceptibility genes) are human genes known as


28. *Id.* at 193.

29. *Id.*

30. The National Center for Biotechnology Information puts the count at 23,688 genes. *Id.* at 208.


33. *Id.* at 200.
tumor suppressors.\textsuperscript{34} Under normal circumstances, BRCA1 and BRCA2 genes ensure the stability of the cell’s DNA and prevent uncontrolled cell growth, but mutations of these genes have been connected to the development of hereditary breast cancer and ovarian cancer.\textsuperscript{35} Inheriting a mutation of BRCA1 or BRCA2 greatly increases the risk of developing breast or ovarian cancer: on average, an American woman has a twelve to thirteen percent chance of developing breast cancer, but the risk for women with BRCA mutations is between fifty to eighty percent.\textsuperscript{36}

The system required to sequence genes is generally understood by molecular biologists, yet “because sequencing requires knowledge of the sequence of a portion of a target sequence, some ingenuity and effort is required for the initial sequencing of a target DNA.” The search for the genes associated with breast cancer was an internationally competitive project that started in the 1980s.\textsuperscript{38} In 1991, Dr. Mark Skolnick partnered with a venture capital group to found Myriad Genetics and received $55 million from the NIH to discover and sequence the BRCA1 gene.\textsuperscript{39} In August 1994, Myriad began filing patent applications for the isolated BRCA1 gene and associated diagnostic methods.\textsuperscript{40} In November 1995, Myriad and a new group of research allies identified the BRCA2 gene and Myriad filed patent applications for their findings on December 21, 1995.\textsuperscript{41}

\begin{thebibliography}{9}
\bibitem{35} Id.
\bibitem{36} Ass’n for Molecular Pathology v. United States Patent and Trademark Office (“Myriad II”), 653 F.3d 1329, 1339 (Fed. Cir. 2011).
\bibitem{37} Myriad I, 702 F. Supp. 2d at 200.
\bibitem{38} Id.
\bibitem{39} Bryn Williams-Jones, History of a Gene Patent: Tracing the Development and Application of Commercial BRCA Testing, 10 Health L. J. 123, 129-131 (2002). The rival research team, led by Dr. Francis Collins, also received a significant grant from the NIH to pursue BRCA research. Myriad I, 702 F. Supp. 2d at 201.
\bibitem{40} Myriad II, 653 F.3d at 1339. The first patent was issued by the USPTO on December 2, 1997. Id.
\bibitem{41} Myriad I, 702 F. Supp. 2d at 202.
\end{thebibliography}
Myriad provides genetic testing for the BRCA1/2 genes for clinicians and patients at a cost of $3,200 per test. Such testing has been very profitable for Myriad: in 2008, it cost Myriad $32 million to provide the tests while the resulting revenues brought in $222 million. Although Myriad’s testing costs less than certain genetic tests conducted at other facilities, four of the plaintiffs in the Myriad I case stated that certain researchers, clinicians, and pathologists have the resources necessary to sequence and analyze genes such as BRCA1/2 at a lower cost than Myriad’s testing. In Canada, which does not recognize Myriad’s patent, the BRCA testing costs patients a third of what Myriad charges. Myriad has offered licenses to researchers in the past, but those licenses have been qualified by significant limitations, and Myriad has not hesitated to enforce its patent claims against infringers, either through letters or actual lawsuits.

Myriad has long sought Medicaid coverage for its genetic testing, but has thus far been unsuccessful in 25 states. Myriad’s financial assistance program provides free testing to low-income and uninsured patients, but a significant gap exists between women whose insurance carriers will pay for

42. Brendan L. Smith, Wrangling Genes: As the Law Changes and New Medical Frontiers Open, the Dispute over Genetic Patents Intensifies, 95 A.B.A. J. 56, 57 (2009).

43. Myriad I, 702 F. Supp. 2d at 203.

44. Id. at 204.

45. The four plaintiffs are Haig Kazazian, M.D., Harry Ostrer, M.D., David Ledbetter, Ph.D., and Ellen Matloff, M.S. Id.


47. Myriad I, 702 F. Supp. 2d at 207.

48. Id. at 204.
the genetic testing or can afford the out-of-pocket costs, and low-income and uninsured women covered by the financial assistance program. Four of the plaintiffs who brought suit against Myriad fell into this gap: Lisbeth Ceriani, Patrice Fortune, Vicky Thomason, and Kathleen Raker all attempted to obtain some form of BRCA1/2 testing from Myriad, only to learn that Myriad would not accept their insurance coverage, and all were unable to pay the full cost out-of-pocket.

Confirmation of a BRCA mutation may be enough to destroy a person’s life as they knew it. It is because the increased cancer risk presented by testing positive for BRCA mutations is so high that many women choose to undergo radical, preventative surgery based solely on the information provided by the Myriad test. Awareness of the danger of BRCA mutations is slowly seeping into the public consciousness: in the new season of the HBO series In Treatment, a character played by Debra Winger undergoes testing for BRCA1 because she is concerned about her hereditary susceptibility to breast cancer. Because of the tremendous consequences of testing positive for a BRCA mutation, Myriad has faced anger from patients over the expense of the BRCA test, as well as its unwillingness to allow other companies to offer confirmatory testing.

B. The Myriad Decisions

On May 12, 2009, a number of individuals and organizations brought suit against the United States Patent and Trademark Office and Myriad Genetics. Among the plaintiffs were medical associations such as the

49. Id.

50. Id. at 189, 204. However, Judge Lourie’s subsequent opinion noted that “inability to afford a patented invention” did not establish standing. Myriad II, 653 F.3d at 1344 n.3.


The Future of Antisense Drugs

Association of Molecular Pathology ("AMP"), the American College of Medical Genetics ("ACMG"), the American Society for Clinical Pathology ("ASCP"), and the College of American Pathologists. The plaintiffs were later joined by considerable amici curiae, including the powerful American Medical Association ("AMA"). The plaintiffs sought to invalidate the patents on the BRCA genes, as well as Myriad Genetics' patented BRCA testing process, arguing that human DNA is a product of nature. The Myriad I case was one of first impression because no court had yet addressed whether isolated DNA molecules are patentable subject matter.

On March 29, 2010, Judge Sweet handed down the decision noting that the question of how to harness the information encoded in our DNA "presents difficult questions touching on innovation policy, social policy, medical ethics, economic policy, and the ownership of what some view as our common heritage." The district court found "all of the challenged claims invalid under 35 U.S.C. § 101," holding "that the challenged composition claims are directed to unpatentable products of nature, and that the method claims, which covered Myriad's diagnostic test process, are directed to unpatentable abstract ideas."

Products isolated from nature must possess "markedly different characteristics" in order to constitute patentable subject matter. However, according to Judge Sweet, because DNA is a "multifunctional" physical carrier of information for synthesizing molecules in other areas of the body, it is a "physical embodiment of laws of nature," and is so "distinct in its essential characteristics from any other chemical found in nature" that its existence in an isolated form cannot alter either the "fundamental quality of

54. Myriad I, 702 F. Supp. 2d at 186-89. The plaintiffs also included health and women's groups such as Breast Cancer Action and the Boston Women's Health Book Collective, scientists who have been deprived of the opportunity to research the BRCA genes, and a group of women whose insurance will not cover the BRCA tests, but who lack the money to pay out-of-pocket. Id.

55. Id. at 190.

56. Id. at 184.

57. DOJ Brief, supra note 4, at 6.


59. Id. at 233-237; see also DOJ Brief, supra note 4, at 7.

60. Myriad I, 702 F. Supp. 2d at 226.
DNA as it exists in the body [or] the information it encodes.\textsuperscript{61} Furthermore, Judge Sweet held that Myriad's methods for detecting BRCA mutations in a patient were invalid because the steps for analyzing and comparing gene sequences were deficient in constituting the specific transformative steps necessary for patentability, and were little more than data gathering.\textsuperscript{62} Thus, the court found that the patents on isolated DNA sequences of genes and patent claims related to the analysis of DNA sequences were invalid.\textsuperscript{63}

On October 22, 2010, Myriad Genetics and its allies filed their Notice of Appeal to the CAFC.\textsuperscript{64} Almost a year later, on July 29, 2011, the CAFC handed down its \textit{Myriad II} decision.\textsuperscript{65} Myriad argued that the plaintiffs lacked standing because the parties “do not have adverse legal interests and . . . [p]laintiffs have failed to allege a controversy of sufficient immediacy and reality to warrant the issuance of a declaratory judgment.”\textsuperscript{66} However, Judge Alan D. Lourie, writing for the majority, concluded that Dr. Harry Ostrer had established standing sufficient to maintain the suit against Myriad because he intended to “immediately engage in allegedly infringing BRCA-related activities” through clinical diagnostic testing.\textsuperscript{67} The CAFC also

\begin{itemize}
  \item \textsuperscript{61} \textit{Id.} at 185, 228.
  \item \textsuperscript{62} \textit{Id.} at 145.
  \item \textsuperscript{64} Brief for the Appellants at 1, \textit{Ass'n for Molecular Pathology v. United States Patent and Trademark Office (“Myriad II”), 653 F.3d 1329 (Fed. Cir. 2011) (No. 2010-1406), 2010 WL 4600106.}
  \item \textsuperscript{65} \textit{Myriad II}, 653 F.3d at 1329.
  \item \textsuperscript{66} \textit{Id.} at 1343. It had been suggested by some commentators that the CAFC would dismiss the entire case on standing grounds. John Conley & Dan Vorhaus, \textit{What We Learned From The Myriad Oral Argument}, \textit{GENOMIC L. REP.} (Apr. 5, 2011), http://www.genomicslawreport.com/index.php/2011/04/05/what-we-learned-from-myriad-oral-argument/.
  \item \textsuperscript{67} \textit{Myriad II}, 653 F.3d at 1344. However, this was a narrow affirmation of the district court's decision to exercise jurisdiction. The women who lacked the money to pay for BRCA testing were excluded, as were other doctors and organizations. Judge Lourie held that "simply disagreeing with the existence of a patent or even suffering an attenuated, non-proximate, effect from the existence of a patent does not meet the
affirmed the district court’s decision that Myriad’s method claims for analyzing DNA sequences are unpatentable because “such claims include no transformative steps and cover only patent-ineligible abstract, mental steps.” Judge Lourie cited *Bilski v. Kappos* to emphasize the importance of transformation to the patentability of method claims and found that in the instant case, the claims “are instead directed to the abstract mental process of comparing two nucleotide sequences.”

However, the CAFC overturned the district court’s judgment and held isolated DNA sequences to be patent eligible. Judge Lourie held that the *Chakrabarty* and *Funk Brothers Seed Co. v. Kalo Inoculant Co.* decisions created the analytical structure through which to evaluate the patent eligibility of isolated DNA. Under such a framework, the difference “between a product of nature and a human-made invention . . . turns on a change in the claimed composition’s identity compared with what exists in nature.” The CAFC concluded that BRCA1 and BRCA2 are patentable because they have a distinctive chemical identity from molecules that exist in nature. When Myriad chemically cleaved the BRCA genes “from their chemical combination with other genetic materials,” it created a distinct chemical entity. The district court had excluded DNA molecules from patentability because both isolated and native DNA retained the same information in its nucleotide sequence; Judge Lourie firmly rejected that train of argument, holding instead that genes “are best described in patents by their structures rather than their functions.”

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Supreme Court’s requirement for an adverse legal controversy of sufficient immediacy and reality to warrant the issuance of a declaratory judgment.” *Id.* at 1348.

68. *Id.* at 1334.

69. *Id.* at 1356.

70. *Id.* at 1351.

71. *Id.*

72. *Id.*

73. Ass’n for Molecular Pathology v. United States Patent and Trademark Office ("*Myriad II*"), 653 F.3d 1329, 1377-80 (Fed. Cir. 2011).

74. *Id.* at 1353.
Perhaps the one thing that can be stated with certainty regarding the gene patenting controversy is that the Judge Lourie opinion is not the final word on the patentability of genes, even at the CAFC level. Judge Kimberly A. Moore's concurring opinion stated that isolated sequences identical to naturally occurring sequences would present a "much closer case" with respect to patentability, whereas Judge William C. Bryson's dissent would have upheld the district court in concluding that DNA sequences isolated from nature do not constitute patentable subject matter.

The plaintiffs in Myriad can either request a rehearing *en banc* at the CAFC or petition for *certiorari* at the Supreme Court. The Supreme Court is likely to accept *certiorari* in *Prometheus Laboratories, Inc. v. Mayo Collaborative Services*, which centered around whether the company's patent claims "are drawn to a natural phenomenon . . . or . . . only to a particular application of that phenomenon." There is also the possibility of Congress wading into the controversy. As Judge Lourie's opinion made clear: "if the law is to be changed, and DNA inventions excluded from the broad scope of § 101 contrary to the settled expectations of the inventing community, the decision must come not from the courts, but from Congress."

IV. GENE PATENTING ON CAPITOL HILL

The battle in Federal Court is but one front of a determined campaign to end "gene patenting." Many of the associations and groups that united to challenge Myriad Genetics have also been active in Washington in an attempt to pressure Congress to advance legislation banning gene patenting. Prospects for concerted congressional action on the issue have been bleak ever since the House Judiciary Committee failed to report the Genomic Research and Accessibility Act ("GRAA") out of committee in the 110th Congress, which met from January 2007 to January 2009. However, Judge Sweet's *Myriad* decision reinvigorated both lobbying organizations and

75. *Id.* at 1366.

76. *Id.* at 1368.


78. *Myriad II*, 653 F.3d at 1373.

The Future of Antisense Drugs

supportive congressmen alike. Moreover, the sharp fight over the Wasserman Schultz provision to the Patent Reform Act of 2011 indicates that the debate over gene patenting is likely to remain contentious.

The organizations advocating for a ban on gene patents vary both in size and political temperament. The American Civil Liberties Union ("ACLU") has spearheaded the campaign in Washington by employing such grassroots tools as a letter-writing campaign and a Facebook group. The ACLU has also been joined by groups with powerful clout in Washington, including the AMA. Former Congresswoman Elizabeth Holtzman is currently lobbying on behalf of Bio-Reference Laboratories because that corporation’s ability to administer certain tests has been stymied by owners of gene patents exercising exclusive licenses concerning those tests. In addition, several conservative religious groups oppose gene patents "because they believe

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God has given us these genes, and they should not be parsed out for patents."86  Michael Crichton, the late novelist, was an outspoken critic of gene patenting: he lectured, published articles,87 and even wrote the novel Next, set in a world where a rapacious biotechnology company has the legal right to forcefully extract cancer-fighting cells from a man and his progeny.88

These groups have found allies within the congressional ranks who share the view that "gene patents aren't benign and never will be."89  On February 9, 2007, Congressman Xavier Becerra, a member of the powerful Ways and Means Committee, introduced H.R. 977, also known as the GRAA.90 One of the original co-sponsors of the bill was former Congressman Dave Weldon, M.D., effectively making the bill a bipartisan undertaking.91 Becerra and Weldon were also joined by five other Congressmen—all Democrats.92


89. Crichton, supra note 87.


92. H.R. 977.
H.R. 977 is a relatively short and seemingly simple bill. Title 35 of the United States Code deals with patents, and Chapter 10 of Title 35 addresses the patentability of inventions.\textsuperscript{93} Six sections currently exist under Chapter 10,\textsuperscript{94} and Congressman Becerra's bill would add section 106, titled "Prohibition on patent of human genetic material."\textsuperscript{95} The proposed section reads: "notwithstanding any other provision of law, no patent may be obtained for a nucleotide sequence, or its functions or correlations, or the naturally occurring products it specifies."\textsuperscript{96} In terms of applicability, the bill states: "the amendment made by subsection (a) shall not apply to a patent issued before the date of the enactment of this Act."\textsuperscript{97} Thus, while the legislation would prohibit future gene patents, it is not retroactive and would not invalidate previously issued patents.\textsuperscript{98} Patents are valid for 20 years from the date that an application is originally filed; thus, if Congressman Becerra's bill is signed into law, the human genome will become patent-free in twenty years.\textsuperscript{99}

In March of 2007, H.R. 977 was referred to the House Judiciary Subcommittee on Courts, the Internet, and Intellectual Property.\textsuperscript{100} On October 30, 2007, Congressman Howard Berman organized a hearing on the issue entitled "Stifling or Stimulating: The Role of Gene Patents in Research

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\textsuperscript{94} Id. The six sections are (§ 100) Definitions, (§ 101) Inventions patentable, (§ 102) Conditions for patentability; novelty and loss of right to patent, (§ 103) Conditions for patentability; non-obvious subject matter, (§ 104) Invention made abroad, and (§ 105) Inventions in outer space. Id.
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\textsuperscript{95} H.R. 977.
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\textsuperscript{96} Id.
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\textsuperscript{97} Id.
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\textsuperscript{99} However, any pending application would not be patentable whether the application was filed 2 days or 19 years before passage of the Becerra bill. Id.
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and Genetic Testing."

The recommendations of the four members of the biotechnology research industry called to testify were similar in just one respect: though all "endorsed some type of gene patent reform, none presented testimony in favor of the sweeping reform embodied" by Congressman Becerra’s bill.

Apart from the hearing, no further action was taken to advance H.R. 977, and because the bill was not favorably reported out of Committee during the 110th Congress, it was cleared from the books and failed to become law.

Prospects for the passage of similar legislation in the near future seem somewhat dim due to the departure of half of the Congressmen who originally co-sponsored H.R. 977.

101. Id.

102. The four who testified were Marc Grodman, CEO of Bio-Reference Laboratories; Jon Soderstrom, managing director of the Office of Cooperative Research at Yale University and President-Elect for the Association of University Technology Managers (AUTM); Lawrence Sung, a professor at the University of Maryland and partner at Dewey & LeBoeuf LLP; and Jeffrey Kushan, who presented testimony on behalf of the Biotechnology Industry Organization. Id. at 303-04. Professor Sung argued for inoculating academic researchers and their institutions from patent infringement and establishing a right to use patented technology for basic research. Id. Jeffrey Kushan argued that, in technical terms, a person’s DNA already lies outside the realm of patentability. Id. Jon Soderstrom argued that there was currently no tragedy of the anti-commons in the biotechnology industry. Id. Marc Grodman’s solution to gene patenting involves the exercise of the march-in provision of the Bayh-Dole Act, which will be addressed later in this Note. Id.

103. To become law, a congressional bill must be reported out of its assigned Committee and be voted on favorably by the entire House of Representatives, also known as the Committee of the Whole. The bill must then be passed by the Senate before it comes to the President’s desk for his signature or veto. See generally How Our Laws Are Made, H.R. Doc. No. 110-49 (2007), http://www.gpo.gov/fdsys/pkg/CDOC-110hdoc49/pdf/CDOC-110hdoc49.pdf.

However, Judge Sweet’s *Myriad I* decision breathed new life into the efforts of legislators and interested groups in Washington attempting to ban gene patenting. Congressman Becerra hailed *Myriad I* as representing a “significant progress,” but noted that the holding “does not prevent the U.S. Patent and Trademark Office [USPTO] from issuing future patents.”

Congressman Becerra then announced his intention to reintroduce the GRAA. The ACLU also created a section on their website where interested parties can send an editable form letter requesting that their members of Congress sign on as a co-sponsor of a reintroduced GRAA.

The ACLU, AMP, and Breast Cancer Action (“BCA”), as well as other like-minded groups, recently flexed their lobbying muscles in order to scuttle a proposed provision by Congresswoman Debbie Wasserman Schultz that would have allowed second opinion testing in genetic tests. Congresswoman Wasserman Schultz is a breast cancer survivor, who, after taking Myriad’s genetic test and discovering that she carried the BRCA2 mutation, underwent seven major preventative surgeries, including a double mastectomy and an oophorectomy.

Congresswoman Wasserman Schultz was disturbed by the fact that there was no way to get an independent confirmatory BRCA test, especially given the significant consequences to women’s lives as a result of testing positive for the BRCA mutation. Congresswoman Wasserman Schultz’s amendment to Congressman Lamar Smith’s “Manager’s Amendment,” entitled “Permitting Second Opinions in Certain Genetic Diagnostic Testing,” would have created a new section, listed as Section 287(d) in the Patent Act, that would have enabled providers to offer second opinion genetic tests without the fear of being subjected to damages for patent infringement.

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106. *Id.*

107. *Tell Congress, supra* note 82.


109. While Congresswoman Wasserman Schultz’s personal experience with BRCA testing undoubtedly influenced her decision to offer the amendment, she also noted that patients lacked the option of confirmatory genetic tests for colon cancer, Parkinson’s disease and Alzheimer’s disease, among others. *Id.*

The reaction from the ACLU and its allies to this proposed change was swift and negative. Letters were sent immediately to Congressmen denouncing the Wasserman Schultz provision. While the ACLU supported the amendment’s goal of allowing patients more testing options, the ACLU maintained that the amendment “fail[s] to block all patent holder objections to testing, fails to address the many other limitations on scientific research arising out of the issuance of [gene patents], and risks allowing gene patent holders to argue that Congress implicitly endorses the validity of such patents.” Faced with this determined opposition, Congresswoman Wasserman Schultz backed down and introduced a new amendment, which would eliminate the safe harbor provision and instead require the USPTO to conduct a study on genetic diagnostic tests. The fight for legislation banning or modifying genetic patents will likely continue well into the future, because regardless of the ultimate outcome of the court battles, “Congress will continue to loom in the background, with the ability at any moment to completely rewrite the rules of the game.”

V. ORPHAN DISEASES AND ANTISENSE DRUGS

An orphan disease is so rare that it is not considered commercially viable for a pharmaceutical company to develop a drug to treat it. Americans afflicted with orphan diseases have suffered adverse consequences brought on by a gradual increase of regulation by the Food and Drug Administration

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111. See generally Letter from ACLU, supra note 81; Letter from AMP, supra note 81.


113. Vorhaus, Update: Proposed Second Opinion, supra note 112. See also Wasserman Schultz Speech, supra note 108.


115. Aronson, supra note 9, at 244.
The Future of Antisense Drugs

("FDA") over the course of the twentieth century.116 The Orphan Drug Act of 1983 significantly alleviated many of these problems and provided an impetus for a burgeoning pharmaceutical industry that includes the emerging antisense technology field.117 However, the success of the Act was achieved primarily by granting patent protection and limited market exclusivity to new drugs and compounds, including those of modified genetic material.118 The movement to ban gene patenting potentially threatens both the livelihoods of those who suffer from rare diseases and the future of the pharmaceutical industry.

A. Orphan Diseases

The FDA began functioning as a modern regulatory agency in 1906, but originally, it wielded little of the power it does today.119 This lack of power changed following the horrific sulfanilamide tragedy of the mid-1930s, which resulted in the deaths of over a hundred children.120 Because manufacturers were not required to demonstrate the safety of their products, the FDA was powerless to hold the offending company accountable for the


117. Id.


119. In United States v. Johnson, 221 U.S. 488 (1911), the Supreme Court held that the agency could not even regulate or punish false therapeutic claims by drug manufacturers. FDA History-Part 1, U.S. FOOD & DRUG ADMIN., http://www.fda.gov/AboutFDA/WhatWeDo/History/Origin/ucm054819.htm (last visited Sept. 23, 2011).

120. In the late 1930s, many Americans took sulfanilamide, a pill that was very effective in combating bacterial infections, but was unpalatable and difficult to consume. Linda Bren, Frances Oldham Kelsey: FDA Medical Reviewer Leaves Her Mark on History, FDA CONSUMER MAG., Mar.-Apr. 2001, available at http://permanent.access.gpo.gov/lps1609/www.fda.gov/fdac/features/2001/201_kelsey.html. The S. E. Massengill Company tasked its chemist with creating a solvent that would make sulfanilamide easier to consume, especially for children. Id. Unfortunately, the solvent turned out to be similar in content to antifreeze, and 107 people, mostly children, were killed, along with the unfortunate chemist, who took his own life. Id.
deaths, and it could only fine the company for "misbranding" its product.\textsuperscript{121} The disaster and the FDA's lack of ability to regulate effectively or punish the responsible company sparked public outrage, which led to the Food, Drug, and Cosmetic Act, ("Act") passed by Congress in 1938.\textsuperscript{122} The Act was later augmented by the 1962 Kefauver-Harris Amendments, passed after the United States narrowly escaped another drug tragedy.\textsuperscript{123} Under the 1938 law, manufacturers needed only to show that their drugs were safe, but the Kefauver-Harris Amendments required manufacturers also to demonstrate that the new drugs were effective.\textsuperscript{124}

Unfortunately, even eminently reasonable laws passed by the government to protect its citizens can sometimes have unintended side effects. In the case of the Kefauver-Harris Amendments, proving efficacy significantly escalated the cost of drug development.\textsuperscript{125} As a result, pharmaceutical companies began "making decisions about which compounds they would develop based not on scientific importance, but on the size of the potential

\textsuperscript{121} Id.

\textsuperscript{122} Under the Act, pharmaceutical companies were now required to label their drugs, and to demonstrate to the FDA that the drug was safe before it could be marketed. \textit{FDA History-Part II, U.S. FOOD \& DRUG ADMIN.,} http://www.fda.gov/AboutFDA/WhatWeDo/History/Origin/ucm054826.htm (last visited Sept. 23, 2011).

\textsuperscript{123} In the late 1950s, thalidomide seemed to be a wonder drug that caused no hangover, was not habit-forming and yet was able to bring "a quick, natural sleep for millions of people who had trouble drifting off, and . . . gave pregnant women relief from morning sickness." Bren, \textit{supra} note 120. The drug was marketed throughout Europe, South America and Canada, but its introduction into the United States was delayed by an FDA medical officer named Frances Oldham Kelsey. \textit{Id.} Kelsey's concerns led her to continually request more information from the pharmaceutical company seeking to introduce thalidomide. \textit{Id.} As a result of the 1938 law, the FDA had 60 days to review a drug application, and if the medical officer was not satisfied that the application was complete, it was considered withdrawn. \textit{Id.} The company would then have to resubmit the request with additional data, and the 60-day clock would begin running again. \textit{Id.} Kelsey's persistence delayed approval of the drug until November 1961, when a German pediatrician determined that the birth of children with terrible deformities was directly linked to thalidomide use by their pregnant mothers. \textit{Id.} By then, more than 10,000 children in 46 countries had been born with thalidomide-related deformities. \textit{Id.}

\textsuperscript{124} Id.

\textsuperscript{125} \textit{HISTORY OF THE ORPHAN DRUG ACT, supra} note 116.
market and the likelihood of larger returns on investments.126 By the
1970s, as the detrimental effects of the 1962 amendments became clear,
public attention turned to the plight of those suffering from the rare orphan
diseases, which were estimated to afflict around 20 to 25 million
Americans.127 Several non-profit patient organizations successfully financed
research on treatments for certain rare diseases but were unable to find any
pharmaceutical companies willing to make the drugs commercially
available.128 The pharmaceutical industry denied that orphan drugs were
unaddressed by their companies and campaigned strongly against
government intervention, but a concerted publicity campaign elicited a
groundswell of support that led to passage of the Orphan Drug Act of
1983.129

The Orphan Drug Act provides four main incentives for companies to
research cures for orphan diseases: federal research grants for clinical
testing, a tax credit that covers half of the costs of clinical trials, exemption
from FDA drug application fees, and most importantly, 7-year market
exclusivity for orphan drug sponsors.130 Over the nearly three decades since

126. Id.

127. Estimates of those affected by rare diseases have shifted over time. The Orphan
Drug Act defines orphan diseases as those for which there are fewer than 200,000
patients in the United States, and in 1990 the New York Times estimated that about 10
million to 20 million Americans suffered from 5,000 rare diseases. Andrew Pollack,
Human Services stated that around 20 million Americans suffered from around 6,000 rare
diseases. IMPLEMENTATION AND IMPACT, supra note 118, at 5. See also M. Angeles
Villarreal, Orphan Drug Act: Background and Proposed Legislation in the
at 7,000, and the number of Americans afflicted at 25 million. Walter Armstrong,
Pharma's Orphans, Pharm. Exec. (May 1, 2010), http://pharmexec.findpharma.com/
pharmexec/article/articleDetail.jsp?id=670568.


129. The publicity campaign included newspapers, magazine articles, and even the
television show Quincy with Jack Klugman. Id.

130. IMPLEMENTATION AND IMPACT, supra note 118. Without exclusive marketing
rights, other companies are barred from marketing their version of the drug unless they
can prove clinical superiority, which is difficult to do. Id. “Marketing exclusivity may
its inception, the Orphan Drug Act has had its fair share of problems, including insufficient funding and companies that use common disease targets to develop orphan drugs that might have larger, more profitable general applications. Despite these flaws, the Orphan Drug Act generally has been considered a great success; since 1983, FDA has approved 353 orphan drugs and granted orphan designations to 2,116 other compounds. Among the drugs approved are those designed to combat multiple sclerosis, cystic fibrosis, hemophilia, Gaucher's disease, HIV-related ailments, and rare forms of cancer such as pancreatic cancer. The future for those suffering from orphan diseases seems brighter than ever before, thanks to continued investment and research, as well as the promise of emerging antisense drugs.

B. Antisense Drugs

Antisense drugs are tiny pieces of “DNA or RNA that are chemically modified to engineer good drug properties,” and are then introduced into the body where they bind with messenger RNA. The exact science behind antisense drugs is somewhat complex. Isis Pharmaceuticals, one of the leading pioneers in antisense drugs, describes the production of a protein:

be the most motivating incentive provided by the Act. Without marketing exclusivity, unpatentable products could face competition from lower-priced generic versions of the drug.” VILLARREAL, supra note 127, at 3.

131. The most infamous of these drugs is Botox, which was initially granted orphan drug status for a condition that causes uncontrollable blinking, but has large general cosmetic applications. Armstrong, supra note 127. Another problem has been a risk-minimizing approach from pharmaceutical companies that prefer to develop follow-ons to existing drugs. These follow-ons improve on the effectiveness and safety of existing drugs, but drain funding for new drug research, which is a riskier investment proposition. Id. See also Pollack, supra note 127.


Genes contain the information necessary to produce proteins. A gene is made up of bases (Adenine, Thymine, Cytosine and Guanine commonly referred to as A, T, C and G), which are linked together to form a two-stranded structure that resembles a twisted ladder, known as DNA (deoxyribonucleic acid). The nucleotides on one side of the ladder interact with complementary nucleotides on the other side of the ladder according to specific rules (A pairs with T, C pairs with G), creating the ladder’s rungs. This highly specific nucleotide binding is called hybridization. The sequence or order of these nucleotides establishes the cell’s recipe for making proteins. One of the DNA strands is called the sense strand and the other is called the antisense strand.\textsuperscript{135}

Two linked processes, transcription and translation, are required for protein production.\textsuperscript{136} In transcription, an enzyme known as RNA polymerase temporarily separates the ladder in order to read the DNA code.\textsuperscript{137} The RNA creates the single-stranded messenger RNA (“mRNA”), which “is responsible for communicating the genetic message found in DNA to other areas of the cell so that protein production can take place.”\textsuperscript{138} Translation occurs when “the mRNA travels to the ribosome, which is the cell’s machinery that assembles proteins based on the instructions carried by the mRNA.”\textsuperscript{139} Abnormalities in translation and/or transcription can lead to the overproduction of proteins, which is implicated or associated with many diseases.\textsuperscript{140} It is prior to translation that antisense drugs come into play by causing degradation of the mRNA before it reaches the ribosome.\textsuperscript{141} The antisense drug will bind, or hybridize, to the mRNA and degrade it so that

\begin{itemize}
  \item \textsuperscript{136} Id.
  \item \textsuperscript{138} Basic Science, supra note 135.
  \item \textsuperscript{139} Id.
  \item \textsuperscript{140} Id.
  \item \textsuperscript{141} Id.
\end{itemize}
the ribosome cannot translate the mRNA into a functional protein. This process can inhibit the production of proteins involved in the disease that the antisense drug is created to combat.

To understand the difference between conventional drugs and antisense drugs, an apt comparison can be made between "smart" and "dumb" bombs. Some conventional drug therapies can be likened to World War II-era "dumb" bombs that target healthy and diseased cells alike. For example, chemotherapy drugs act by killing cells that divide rapidly, which is one of the main properties of cancer cells. Unfortunately, they also indiscriminately attack normal healthy cells that also divide rapidly, such as hair follicle cells, which is why loss of hair is commonly associated with chemotherapy. By contrast, antisense drugs theoretically act like "smart" missiles that can identify and destroy only the intended target. For example, if a particular protein caused diseased cells to reproduce to form a cancer tumor, an antisense drug could be designed to interfere with the mRNA of that protein, which would interrupt the formation of the tumor without causing the severe side effects associated with chemotherapy regimens.

Antisense drugs are beginning to make a significant impact in both the pharmaceutical sector at large as well as the more specialized orphan drug sector. Orphan drug status has been granted to medications designed to

142. Id.

143. Id.


help those suffering from rare diseases such as amyotrophic lateral sclerosis ("ALS" or "Lou Gehrig’s disease"), spinal muscular atrophy, homozygous familial hypercholesterolemia, and transthyretin amyloidosis. Antisense drugs offer the afflicted the possibility of combating rare and deadly diseases with limited harmful side effects.

The pharmaceutical companies that have invested in orphan drug and antisense technology research have done so because of the promise of profitable returns through market exclusivity and patent ownership. The Orphan Drug Act provides companies with incentives such as tax credits, research grants, and market exclusivity, but utilizing only a limited amount of taxpayer money to do so. While the Orphan Drug Act has been successful in incentivizing companies to develop new drugs, it is reliant on those companies to make the necessary investments in research and development, and the only real long-term rewards for these investments are patents and market exclusivity for the drugs created. Without those spurs for investment in drug research and clinical testing, which can usually span years, if not decades, most pharmaceutical companies would likely be unwilling to partner with the federal government to combat rare diseases. Thus, the invalidation of patents relating to genetically modified material could have serious adverse effects on pharmaceutical research and those suffering from rare diseases.


VI. ANALYSIS OF MYRIAD I/II AND THE GRAA

The sector of the American biotechnology industry that patents DNA, both naturally-occurring and modified, faces attacks on two fronts: in federal court, where Judge Robert Sweet's Myriad I opinion held that genes do not constitute patentable subject matter, and in the halls of Congress, where Congressman Becerra and his allies seek to pass a law that prohibits the patenting of human genetic material. Both attacks indirectly implicate antisense drugs, are dangerously overbroad in their conception, and thus are ill-suited and inappropriate for dealing with this issue.

A. Myriad I and Antisense

1. Myriad I, Antisense, and the Law

Judge Sweet's Myriad I holding potentially threatened antisense drug patents. The district court judgment pointed out the multifunctional nature of genes: "[genes] are chemical substances . . . compounds, [and yet] they are physical carriers of information."\(^{149}\) All chemical compounds transfer information in some fashion, but genes are unique because they direct "the synthesis of other molecules in the body—namely proteins," which makes them the "physical embodiment of the laws of nature—those that define the construction of the human body."\(^{150}\) Antisense drug patents seem to be implicated by this terminology. After all, antisense drugs are merely pieces of modified DNA and RNA that are specifically intended to affect the synthesis of proteins within the human body. They also constitute the physical embodiment of information and nature's laws. Moreover, the chemically synthesized BRCA1/2 DNA is useful primarily for its ability to bind selectively, or hybridize, to native or isolated BRCA1/2 DNA for diagnostic purposes in much the same way as antisense drugs are designed to bind to mRNA and cause a therapeutic effect.\(^{151}\)

The CAFC's ruling on genetic patenting is more friendly to both antisense drug development and the pharmaceutical industry in general. Under the Lourie standard, the function of the antisense drugs could not be considered. However, antisense drugs have a chemical identity that does not appear in nature—they are instead modified far beyond their ordinary means in order


\(^{150}\) Id.

\(^{151}\) Id. at 197.
to target and inhibit disease. Thus, antisense drugs clearly fit within what the DOJ describes in the *Myriad* brief as molecules that “generally do not occur in nature, but are instead the synthetic results of scientists’ manipulation of the natural laws of genetics.” It is highly unlikely that antisense patents can be challenged successfully in court as long as the Federal Circuit’s position is upheld by the Supreme Court, which would mean that the pharmaceutical industry could continue operating with minimum disruption.

2. *Myriad* and the Facts on the Ground

Judge Sweet’s *Myriad II* opinion admits that “the isolation of the BRCA1/2 genes required considerable effort on the part of Myriad and its collaborators as well as ingenuity in overcoming technical obstacles associated with the isolation process.” That is an understatement. Under the current patent system in the United States, the great rewards for successful research are coupled with considerable risk and uncertainty. Even under the 1983 Orphan Drug Act, “the first drug to obtain marketing approval receives the exclusive marketing rights.” If a company loses the race for a patent, their investors have staked a significant amount of money on research that results in no gain. For example, the research team under Dr. Francis Collins that competed with Myriad Genetics to discover and patent the BRCA1 gene required considerable resources to compete, including a sizeable NIH grant. Myriad’s success meant that the investors for the Collins team received no return.

Given the severe consequences of failure, patent-holders are justified in making a profit off of their hard-won research. The prevalence of breast cancer makes knowing whether one is genetically predisposed to contract

152. DOJ Brief, supra note 4, at 15.


156. It all worked out for Dr. Collins in the end, however. President Obama nominated Collins to be the Director of NIH, and Collins was unanimously confirmed on August 7, 2009. Press Release, U.S. Dep’t of Health & Human Services, Secretary Sebelius Announces Senate Confirmation of Dr. Francis Collins as Director of the National Institutes of Health (Aug. 7, 2009), available at http://www.hhs.gov/news/press/2009pres/08/20090807d.html.
the disease a critical fact in today's society for both women and men. It is a government's obligation to provide for its citizens, especially those groups that are small and powerless enough to fall through the cracks of society; and the Orphan Drug Act is a prime example of the United States attempting to meet this obligation.

Unfortunately, it is not Myriad's social obligation to provide cheap, universal testing for citizens. Myriad was a case of first impression for a reason: of the 4,382 genes patented in the United States, plaintiffs like the AMP and ACMG deliberately chose to bring suit against the BRCA patents in particular because Myriad is a disagreeable opponent. Myriad's diagnostic tests are arguably inordinately expensive, especially considering that BRCA testing is an important health issue that could have a tremendous impact on the lives of millions of Americans. Among other issues, it should be noted that despite the handsome profit Myriad has accrued from its patents, it has neglected to pay agreed-upon royalties to the researchers from the National Institute for Environmental Health Sciences ("NIEHS") who co-invented the BRCA1 patent. However, punishing Myriad's avarice by invalidating human gene patenting would negatively impact more scrupulous and honest patent-holders, as well as the patients who depend on the innovation of the patent system for possible cures to deadly diseases.

Judge Sweet stated "the identification of the BRCA1 and BRCA2 gene sequences is unquestionably a valuable scientific achievement for which Myriad Genetics deserves recognition, but that is not the same as concluding that it is something for which they are entitled to a patent." The problem


158. Id. at 202.

159. One could posit a situation in which a medical test was so critical to the health of the United States' citizenry, and the costs charged by a patent-holder such as Myriad so overly expensive, that the United States government could exercise aggressive tactics such as using its power of eminent domain to appropriate the intangible property of the patents, with the stipulation that the patent-holder be reasonably recompensed. Although the federal government has used the threat of compulsory licensure, as a tactic in the past, an actual policy would be without precedent in the health care field, and would require a greater societal consensus concerning the appropriate role of the United States government in health care. Kevin Outterson, State Pharmaceutical Eminent Domain Legislation, Nat'l Legislative Ass'n on Prescription Drug Prices (Jan. 28, 2005), http://www.reducedrugprices.org/read.asp?news=207. See also Matt Fleischer-Black, The Cipro Dilemma, Am. Law (Jan. 2002), available at http://www.law.com (archived).

with that line of reasoning is two-fold. First, without the incentive from a limited period of market exclusivity provided by patents, companies will not take the risk of investing capital on innovative research, and very few products would be brought to market. Second, Congress has not opposed gene patenting; when given the chance to clarify its intentions through the passage of the GRAA, it declined to do so. Judge Lourie was correct when he stated that Congress, not the courts, should be responsible for changing the law to exclude “DNA inventions” from patent eligibility.

B. Antisense and Sensibility on the Hill

Congressman Becerra stated that he authored his legislation banning gene patenting in order “to ensure patients’ access to their own medical information, reduce the costs of gene tests and increase scientific research into personalized medicine.” However, the broad nature of Congressman Becerra’s bill as applied to such a complex issue raises extensive concerns because, as with the application of an untested drug, the effects can be unpredictable. The GRAA may appear to be a simple answer to legitimate concerns about the nature of gene patenting, but due to the extremely overbroad scope of the bill, it could damage the American pharmaceutical industry severely.

Groups favoring genetic patenting argue that what are being patented actually are not genes, but instead “isolated and purified” genetic sequences. In his speech introducing H.R. 977, Congressman Becerra denounced this argument as “pure wordplay.” Congressman Becerra went even further in his press release when he declared that his “legislation gives guidance to the [USPTO] on what is not patentable—in this case genetic material, naturally-occurring or modified.” It appears from the language

161. Id. at 211.
163. Moukheiber, supra note 8.
164. Becerra Press Release 1, supra note 80.
166. Id.
of the bill that, if passed, Congressman Becerra’s legislation would cover antisense drugs, which are, after all, only chemically-modified pieces of DNA and RNA. Companies aggressively pursuing antisense technology research would be devastated by such legislation.\(^{168}\)

Citizens who suffer from rare diseases would also be ill-served by such a law. Without the revenue provided by patents on modified genetic material, pharmaceutical companies have little incentive to invest in research and development. The overbroad scope of Congressman Becerra’s bill does not simply affect antisense drugs. Because it would prohibit any patents for “a nucleotide sequence,” critic and patent lawyer Kevin Noonan, who served as amicus curiae on behalf of Myriad Genetics,\(^{169}\) has suggested that patents on “blood clotting Factor VIII, erythropoietin, hemoglobin, albumen, and human growth hormone” would also be banned by H.R. 977.\(^{170}\)

Apart from one congressional hearing three years ago, the GRAA has not been extensively debated in Washington. It is highly probable that should some form of the bill ever be favorably reported from the House Judiciary subcommittee, numerous amendments would be debated and added, which would hopefully lessen the destructive effect of the proposed bill from 2009. The National Organization for Rare Disorders (“NORD”) has developed a moderate proposal for both sides of the gene debate to consider. NORD “supports patents for genes that have been changed or engineered by scientists to create a commercial use, and for commercial products developed from genetic information, but not for genes as they exist in nature.”\(^{171}\) Similarly, the DOJ agrees with Judge Sweet that isolated DNA is not patent-eligible but argues that isolated DNA subject to human manipulation is patent-eligible.\(^{172}\) Although DOJ made this expostulation to

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the Federal Court of Appeals as a matter of interpreting the law, such a clarification could also be incorporated into a legislative revision. Finally, the now-rejected Wasserman Schultz amendment, though it would have created uncertainties and practical problems of implementation, represented another sensible path forward that could have alleviated the worst abuses associated with genetic patenting.173

There is one potential solution to the genetic patenting debate, which is, while unorthodox, explicitly sanctioned by law. The Bayh-Dole Act of 1980 addresses patents achieved partially through the aid of federally funded research, which includes Myriad's BRCA patents.174 Should the government determine that the contractor has failed to take “or is not expected to take within a reasonable time, effective steps to achieve practical application of the subject invention,” or if “action is necessary to alleviate health or safety needs which are not reasonably satisfied by the contractor,” the government is empowered to effectively march-in and grant additional nonexclusive, partially exclusive, or exclusive licenses to responsible applicants.175

In the thirty-one years since Bayh-Dole was enacted, no federal agency has ever exercised its authority to grant additional licenses because such a tremendous exercise of power could have potential chilling effects on entire industries. Marc Grodman, the CEO of Bio-Reference Laboratories, when giving his testimony to Congressman Berman's hearing on Congressman Becerra's bill in 2007, specifically proposed utilizing the march-in powers of the Bayh-Dole Act in the context of the controversy over Myriad's gene patents.176 Exercising the march-in power would be a difficult balancing act: if used too often, it could freeze innovation or be used to punish companies simply for making too much of a profit. However, if exercised

173. Among these uncertainties is whether the safe harbor provision applies to tests with only one provider, and whether the provision would apply when a genetic diagnostic test would be used for “therapeutic treatment selection.” Vorhaus, House Introduces Patent Reform Proposal, supra note 110.


175. 35 U.S.C. § 203. In addition to (1) a failure to take effective steps to achieve practical application of the subject invention, a federal agency may also grant additional licenses if the action is (2) necessary to alleviate health or safety needs, (3) necessary to meet requirements for public use as specified by federal regulations, and (4) is necessary if the patent holder breaches § 204, which requires that the subject invention be manufactured substantially in the United States. Id.

176. DeGiulio, supra note 100, at 304.
properly against *only* the most egregious companies, the march-in power could encourage continued innovation while stemming the worst excesses of the current patent system. It would be difficult to argue that reasonable exercise of the march-in power is unfair or constitutes meddling federal interference, considering that Myriad and other companies achieved their patents through federal assistance. Use of the march-in powers would protect antisense patents and obviate the need for any broad-based bill such as the GRAA.

One of the most radical solutions to the gene patenting issue was offered by the now-defunct Secretary’s Advisory Committee on Genetics, Health and Society (“SACGHS”) for the Department of Health and Human Services. SACGHS considered march-in rights but concluded that the administrative process for exercising the march-in rights was burdensome, detailed, and time-consuming. Instead, SACGHS recommended that doctors and researchers simply be exempted from liability for infringement of gene patents. Needless to say, this recommendation is extremely controversial and has been denounced by many, including former Senator Birch Bayh. Thus, its chances of being enacted in the near future are negligible.

Despite the recent resurgence of interest caused by the *Myriad* controversy, passage of the GRAA or similar legislation in the near future is extremely unlikely. The bill’s sponsors have been whittled down through deaths, retirements, and lost elections. Congressman Weldon’s retirement in 2008 deprived the GRAA of its only Republican co-sponsor, and the elevation of the Republican Party to the majority in the U.S. House of Representatives for the 112th Congress makes it unlikely that Congressman Becerra, a Democrat, will have more success in passing the bill than he did in the previous two sessions, when the Democrats held the majority. It is traditional political wisdom that the Republican Party is friendlier to

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179. *Id.*
business and industry concerns.\textsuperscript{180} Thus, it is highly unlikely that the GRAA will be passed in the next two years unless conservative religious groups demonstrate a far greater interest and involvement on the issue that goes beyond mere statements of support for banning the patenting of God-given genes.\textsuperscript{181}

Though the GRAA remains defunct for the present, the battle in Washington over gene patenting will likely only intensify in the coming years. The rejection of the Wasserman Schultz amendment by opponents of gene patenting reflected unwarranted confidence in the outcome of the \textit{Myriad} appeal. With their position far less assured following Judge Lourie's decision, the ACLU and its allies may be more open to embracing potential legislative solutions that would give them most, but not all, that they seek. While lobbying for moderate solutions like the NORD proposal, the Wasserman Schultz amendment, or exercise of the Bayh-Dole march-in rights might offer the greatest chance of success, it is also possible that these groups will throw their weight behind radical proposals such as the SACGHS solution or a renewed GRAA, even if that would take years to pass. The future of the conflict over genetic patenting in Washington depends on the \textit{Myriad} opponents' assessment of the probability of success in carrying their legal struggle all the way to the Supreme Court.

Even if \textit{Myriad II} does not immediately incline gene patenting opponents towards what they would see as legislative half-solutions, it must be noted that Congress is not like the Executive branch, where Presidents have a limited window to act upon their agenda for the country. It is not at all uncommon for Congressmen to serve for more than a quarter of a century, which affords them ample time to await the correct moment to pass laws that reflect their long-cherished beliefs.\textsuperscript{182} Congressman Becerra is a powerful Congressman of considerable influence who may remain in Congress for


\textsuperscript{182} The longest-serving member of Congress is currently Congressman John Dingell of Michigan, of whom it was once said that "he knew what he wanted in legislation and, a hunter, he had a hunter's patience, the patience to wait in perfect stillness until the time to strike . . . he could wait, and wait, and wait, through one session of Congress, through an entire Congress, through another entire Congress." \textsc{John M. Barry, The Ambition and the Power} 203 (1989).
quite some time, and the ACLU and affiliated organizations are similarly powerful and dedicated.\textsuperscript{183} Thus, vigilance is required to protect against a reprise of the GRAA or a similar bill, which could be so disastrously overbroad as to deprive those who suffer from rare diseases of the antisense research that might lead to cures.

VII. CONCLUSION

In his \textit{Myriad I} opinion, Judge Sweet referenced a phenomenon known as the "tragedy of the anti-commons," where "numerous competing patent rights held by independent parties prevents any one party from engaging in productive innovation."\textsuperscript{184} The recent tremendous advances made by molecular biologists and pharmaceutical companies contradict this grim prediction.\textsuperscript{185} The burgeoning antisense drug industry provides concrete proof that the current patent system reasonably encourages innovation. The greater danger lies instead in the possibility that, without the ability to profit off of patents on modified genetic material, no company will be willing to take the risk necessary to fund innovative research into new drugs and treatments for illnesses. Those who will suffer the most from that possible future are not only the pharmaceutical companies deprived of their lost profits, but also those who are afflicted with rare diseases. Without the ability to create any kind of revenue from patents, companies will stop investing in research for cures to rare diseases because opportunities offered by the Orphan Drug Act are more in the nature of incentives than a substitute for revenue.

\begin{itemize}
  \item \textsuperscript{183} Congressman Becerra was first elected to Congress in 1992, but at age 52 is still relatively young. \textit{See Biography, Congressman Xavier Becerra}, http://becerra.house.gov/index.php?option=com_content&view=article&id=13&Itemid=1 6 (last visited Nov. 23, 2011). Congressman Becerra is also a senior member of the Ways and Means Committee, the most powerful committee in the House of Representatives, and is also a member of the Democratic Leadership. \textit{Id.}
  \item \textsuperscript{184} Ass'n for Molecular Pathology v. United States Patent and Trademark Office ("Myriad I"), 702 F. Supp. 2d 181, 208 (S.D.N.Y. 2010).
  \item \textsuperscript{185} From 1998 to 2007, the Research and Development programs of publicly traded biotechnology companies has increased by over 60\%, and from 1995 to 2005, the amount of venture capital funding for biotechnology has increased by 300\%. Ted Buckley, The Myth of the Anticommons (May 31, 2007) (unpublished manuscript) (on file with the Biotechnology Industry Organization), http://www.bio.org/ip/domestic/TheMythoftheAnticommons.pdf.
\end{itemize}
Given the intricacy and importance of the issues involved, and the distinct possibility of severe and lasting disruption to the American biotechnology industry, any potential reform or solution to the issue of genetic patenting should be accomplished with the deftness and precision of a scalpel, as possibly the march-in powers of the Bayh-Dole Act could. However, Judge Sweet’s *Myriad* I opinion and Congressman Becerra’s proposed bill slash at the issue like a broadsword. The United States DOJ, NORD, and Congresswoman Wasserman Schultz’s proposed amendment have advanced potentially credible “third-ways” to navigate through the complexities of molecular biology. However, before any reform can be contemplated, our courts and Congress must adhere to the maxim that is the essence of the Hippocratic *corpus*: first do no harm. 186 This has already been accomplished in the courts, where Judge Lourie’s decision preserved the status quo, and it will hopefully be upheld should *Myriad* I’s plaintiffs appeal the case to the Supreme Court. In Washington, there are a multitude of potential ways to address any problems with genetic patenting, but some proposals, such as the Genomic Research and Accessibility Act, would cause so much harm to America’s pharmaceutical industry and those who suffer from rare diseases that they must never be signed into law.

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