UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF NEW YORK

ASSOCIATION FOR MOLECULAR PATHOLOGY; AMERICAN COLLEGE OF MEDICAL GENETICS; AMERICAN SOCIETY FOR CLINICAL PATHOLOGY; COLLEGE OF AMERICAN PATHOLOGISTS; HAIG KAZAZIAN, MD; ARUPA GANGULY, PhD; WENDY CHUNG, MD, PhD; HARRY OSTRER, MD; DAVID LEDBETTER, PhD; STEPHEN WARREN, PhD; ELLEN MATLOFF, M.S.; ELSA REICH, M.S.; BREAST CANCER ACTION; BOSTON WOMEN'S HEALTH BOOK COLLECTIVE; LISBETH CERIANI; RUNI LIMARY; GENAE GIRARD; PATRICE FORTUNE; VICKY THOMASON; KATHLEEN RAKER, Plaintiffs, vs. UNITED STATES PATENT AND TRADEMARK OFFICE; MYRIAD GENETICS; LORRIS BETZ, ROGER BOYER, JACK BRITTAIN, ARNOLD B. COMBE, RAYMOND GESTELAND, JAMES U. JENSEN, JOHN KENDALL MORRIS, THOMAS PARKS, DAVID W. PERSHING, and MICHAEL K. YOUNG, in their official capacity as Directors of the University of Utah Research Foundation, Defendants.	09-CV-4515 (RWS) ECF Case

BRIEF FOR AMICI CURIAE

The International Center for Technology Assessment, the Indigenous Peoples Council on Biocolonialism, Greenpeace and the Council for Responsible Genetics

IN SUPPORT OF PLAINTIFFS

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STATEMENT OF INTERESTS OF *AMICI CURIAE*

Amici seek to provide this Court with insight into the broader adverse effects of human gene patents, including *inter alia* scientific, cultural, and environmental impacts. These adverse impacts could and should be avoided, because human gene patents such as the Myriad patents are not proper patentable subject matter. The Myriad patents have a direct, severe, and adverse impact on the Amici non-profit organizations, at risk indigenous populations, scientific progress in disease research and potentially the enitre human community.

Amicus **the International Center for Technology Assessment ("ICTA")** was formed in 1994 to assist the public and policy makers in better understanding how technology affects society. ICTA is a non-profit organization devoted to analyzing the economic, environmental, ethical, political, and social impacts that can result from the application of technology or technological systems. ICTA's *PatentWatch* Project works to expose and challenge the inappropriate use of the U.S. patent system. Over the past three decades, policies established by the U.S. Patent and Trademark Office ("PTO") have significantly expanded the range of patentable technologies, allowing corporations and institutions to patent virtually "anything under the sun," illegally allowing for a corporate monopoly on life itself by allowing patents on human DNA, plants and animals, and their DNA and cells. ICTA's *PatentWatch* operates on the principle that life and its elements are the common heritage of all and should remain available to all to learn from, wonder at and utilize. ICTA's *PatentWatch* identifies pernicious patents granted by the PTO, encourages grassroots activities against such patents, and initiates and supports legal challenges against existing and future patents. *PatentWatch* has over the

last several years successfully challenged patents on various plants and animals gaining rescission of patents on broccoli, beagles and rabbits.

Amicus **the Indigenous Peoples Council on Biocolonialism ("IPCB")** is a non-profit Indigenous people's organization established in 1999 located on the Pyramid Lake Paiute Reservation in Nixon, NV. The IPCB seeks to protect the Indigenous knowledge, cultural heritage, and genetic materials of Indigenous peoples. The IPCB monitors and evaluates the complex linkages between biotechnology, intellectual property rights, and the forces of globalization in relation to Indigenous peoples' rights and concerns. The IPCB's primary focus is to develop resources, information and tools to help Indigenous peoples address these issues from their own cultural perspectives and on their own terms in the exercise of their human right of self-determination. The IPCB works to build the capacity of Indigenous peoples to be effective advocates in defense of their rights in international fora, and to develop capacity and awareness locally.

Amicus **Greenpeace, Inc**. is a California nonprofit corporation that is associated with Greenpeace offices worldwide. Greenpeace is the leading independent campaigning organization that uses peaceful direct action and creative communication to expose global environmental problems and to promote solutions that are essential to a green and peaceful future. Greenpeace opposes all patents on genes, plants, humans and parts of the human body and regards the biodiversity of this planet the common heritage of humankind. Greenpeace's 2004 report, "The True Cost of Gene Patents," details the severe economic and social consequences of patenting genes and living organisms.[1]

Amicus the **Council for Responsible Genetics ("CRG")** is a national non-profit organization with offices in Cambridge, Massachusetts and New York, New York. CRG

[1]Available at http://weblog.greenpeace.org/ge/archives/1Study_True_Costs_Gene_Patents.pdf

was founded in 1983 to represent the public interest and foster public debate about the social, ethical and environmental implications of genetic technologies. CRG is dedicated to examining the best science, interpreting the results, assessing the implications, communicating them to a general audience and creating lasting policy reform. CRG believes that no individual, institution or corporation should be able to hold patents or claim ownership rights over genes or gene sequences, whether naturally occurring or modified. CRG works with a coalition of health and patient advocacy groups to build support for a ban on gene patents. CRG's *Genetic Bill of Rights*, which outlines the fundamental values that have been put at risk by new applications of genetics, specifically opposes such patents. CRG also publishes a magazine, *GeneWatch*, that regularly includes articles by experts in the field on issues related to gene patents.

`SUMMARY OF ARGUMENT

Defendant Myriad is exerting ownership over gene sequences, specifically the *BRCA*1 and *BRCA*2 genes, which relate to an increased risk of breast and/or ovarian cancer. The grant of these patents is contrary to over a hundred years of patent law in which the courts have held that products of nature are unpatentable subject matter because nature is free to all and can be reserved exclusively to none. *BRCA*1-2 genes are found naturally in humans and therefore are not subject matter eligible for patenting.

Myriad now holds the patents and therefore a monopoly over these genes. As the plaintiffs and several other *amici* comprehensively detail, the patenting of genes impedes crucial research and interferes with medical care, to the detriment of patients, doctors, non-profit organizations and researchers.

As serious as these harms are, there are unfortunately further significant scientific, cultural, and environmental impacts from these patents. Genes are fundamentally encoded storehouses of information and patents deny the public access to this natural genetic data, in contravention of the public good. Allowing these patents violates fundamental precepts of common heritage, the public domain and the public trust doctrine. Worse, privatizing genes creates rights of unknown scope and significance because humanity currently lacks a holistic understanding of genes and their roles. New research indicates that many human diseases are caused by complex dynamics between non-hereditary proteins, DNA, RNA, the cellular environment, and the extra-human environment, and the patenting of one biological element in that dynamic stalls the research into these processes. Halting science's critical march into a more comprehensive understanding of human disease causation is antithetical to the purpose of U.S. patent law. Finally, gene patents privatize genetic ancestry, making Indigenous peoples and patients into "treasure troves" to be exploited for economic gain, in violation of cultural and religious values and basic rights to informed consent.

Amici hereby request the Court grant the plaintiffs' motion for summary judgment and declare these patents invalid and/or unenforceable.

ARGUMENT

I. THE COURT SHOULD INVALIDATE MYRIAD'S BRCA1 AND BRCA2 PATENTS BECAUSE THEY ARE NOT COMPRISED OF PATENTABLE SUBJECT MATTER, IN VIOLATION OF THE PRODUCT OF NATURE DOCTRINE.

Long-standing legal precedent – required by Article I, section 8, clause 8 of the U.S. Constitution (the patent clause of the U.S. Constitution),[2] as well as 35 U.S.C. §101

[2]Article I of the United States Constitution gives Congress the power to "promote the Progress of Science and the useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."

(the patent statute subject matter requirements)[3] – holds that products of nature are not patentable. This prohibition against patenting "physical phenomena" or "manifestations of nature" is known as the product of nature doctrine. In short, one cannot patent a product that occurs in nature in essentially the same form. The U.S. Supreme Court precedents have clearly and consistently held that products of nature are not patentable. *See, e.g.*, *Diamond v. Chakrabarty*, 447 U.S. 303 (1980); *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127 (1948); *Am. Wood-Paper Co. v. Fibre Disintegrating Co.*, 90 U.S. (23 Wall.) 566 (1874). As the Supreme Court stated in its most recent pronouncement on the subject, "'[t]he relevant distinction' for purposes of §101 is . . . 'between products of nature, whether living or not, and human-made inventions.'" *J.E.M. Ag. Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc.*, 534 U.S. 124, 134 (2001) (*quoting Chakrabarty*, 447 U.S. at 311-12).

A. Products of Nature Are Not Patentable Subject Matter.

In a series of cases over the past century the Supreme Court has held that one cannot patent products of nature, or materials isolated from products of nature, if those materials behave in the same way they would in nature. The product of nature doctrine appears as early as 1889,[4] when, in *Ex parte Latimer*, the Commissioner of Patents rejected a claim seeking to "patent purified pine needle fiber as a 'new article of manufacture' for use in textiles." *Ex parte Latimer,* 1889 Dec. Comm'r Pat. 123 (1889). Although the purified pine needles were valuable, they were not patentable because they

[3]"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 therefore, subject to the conditions and requirements of this title." 35 U.S.C. § 101 (Inventions Patentable).

[4]*See also Am. Wood Paper Co.*, 90 U.S. (23 Wall) at 593-94 (holding that cellulose derived from wood pulp by a new process was not patentable because it was indistinguishable from cellulose previously obtained from other sources via existing processes); *Cochrane v. Badische Anilin & Soda Fabrik*, 111 U.S. 293, 311 (1884) (concluding that artificial alizarine (a dye) derived from a new process was unpatentable because the claimed product was indistinguishable from that obtained naturally from a root).

were naturally occurring, extracted from a natural source: it "cannot be said that the applicant in this case has made any discovery, or is entitled to patent the idea, or fact, rather, that fiber can be found in the needle of the *Pinus australis*." *Id.* at 123, 125, 127. Even if the applicant were the first to appreciate the useful qualities of the needles, this did not entitle him to a patent monopoly: "The allowance of such a patent would make it "possible for an element or principle to be secured by patent," with the ultimate consequence that "successively, patents might be obtained upon the trees of the forest and the plants of the earth." *Id.* at 125-26.[5]

The 1928 decision *General Electric Co. v. De Forest Radio Co.*, involving the development of tungsten wire used in light bulbs, directly applied the reasoning of *Latimer*. *Gen. Elec. Co. v. DeForest Radio Co.*, 28 F.2d 641 (3d Cir. 1928), *cert. denied* 278 U.S. 656 (1929). Like the case at bar, *General Electric* applied the product of nature doctrine applied to an "isolated and purified" form of a substance, in that case a naturally-occurring metal. The court invalidated both patent claims because they were products of nature, not an inventions, and therefore lacked the required subject matter. The patentee had isolated and purified tungsten from its brittle oxide form normally found in the earth. *Id.* at 642. In denying the patent the court held that "[w]hat he discovered were natural qualities of pure tungsten. Manifestly he did not create pure tungsten, nor did he create its characteristics. These were created by nature …." *Id. at 643*; *see also id.* ("Naturally we inquire who created pure tungsten. [The patent applicant]? No. It existed in nature

[5]*See also Am. Wood-Paper Co.*, 90 U.S. (23 Wall.) at 593-94 ("There are many things well known and valuable in medicine or in the arts which may be extracted from . . . substances. But the extract is the same, no matter from what it has been taken. A process to obtain it from a subject from which it has never been taken may be the creature of invention, but the thing itself when obtained cannot be called a new manufacture.").

and doubtless has existed there for centuries. The fact that no one before [the patent applicant] found it there does not negative its origin or existence.").[6]

In the 1948 case *Funk Bros. Seed Co.*, the Supreme Court reaffirmed the unpatentability of products of nature in clear and unambiguous terms, again holding that naturally-occurring products of nature are inherently excluded from patentable subject matter. 333 U.S. at 130. *Funk Bros.* focused on whether mixtures of certain root nodule bacteria used for inoculating the seeds of plants were patentable. *Id.* at 130-31. The Court held that the mixture was not patentable because the combination of bacteria species did not produce a new invention, but served more of a packaging function. *Id.* The gravamen of the Court's holding was that "[e]ach species has the same effect it always had. The bacteria perform in their natural way. Their use in combination does not improve in any way their natural functioning. They serve the ends nature originally provided and act quite independently of any effort of the patentee" *Id.* at 131. The Court further explained that "[p]atents cannot issue for the discovery of the phenomena of nature. . . . [They] are part of the storehouse of knowledge of all men." *Id.* at 130 (citing *Le Roy v. Tatham*, 55 U.S. (14 How.) 156, 175 (1853)).

In 1980 the Court applied the doctrine in the area of biological organisms in *Chakrabarty*, holding that where an inventor introduced new genetic material within a bacterium cell, he had produced (i.e. genetically engineered) something that was not a product of nature and was thus patentable subject matter under 35 U.S.C. §101. 447 U.S. at 309. The first issue the Court took up was whether the bacterium was, on the one

[6]Three years later, the Court of Customs and Patent Appeals followed and cited *General Electric* in a pair of companion cases. *In re Marden* (Marden I), 47 F.2d 957, 957 (C.C.P.A. 1931) (rejecting two patent applications for uranium and vanadium wire products as improper attempts to patent products of nature and inherent natural qualities of those metals); . *In re Marden* (Marden II), 47 F.2d 958, 958 (C.C.P.A. 1937) (rejecting patent application for vanadium wire patents.)

hand, a patentable manufacture or composition of matter, or, on the other, something within the unpatentable categories of "laws of nature, physical phenomena, and abstract ideas." *Id.* at 309. Significantly, the Court cited *Funk Bros.* for the proposition that one cannot patent "manifestations of . . . nature, free to all men and reserved exclusively to none." *Id (quoting Funk Bros.*, 333 U.S. at 130 (internal quotations omitted)); *see also id.* ("This is not to suggest that § 101 has no limits or that it embraces every discovery. The laws of nature, physical phenomena, and abstract ideas have been held not patentable." (*citing Parker v. Flook*, 437 U.S. 584, 593 n.15 (1978)); *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972); *Funk Bros.,* 333 U.S. at 130; *O'Reilly v. Morse,*56 U.S. (15 How.) 62, 112-121 (1854)*; Le Roy*, 55 U.S. (14 How.) at 175. The Court's conclusion was straightforward: "His discovery is not nature's handiwork, but his own; accordingly it is patentable subject matter under § 101." *Id.* at 310.[7]

Finally, as recently as 2001, the Court again cited *Chakabarty* for the product of nature doctrine: "As this Court held in *Chakrabarty*, 'the relevant distinction' for purposes of § 101 is not 'between living and inanimate things, but between products of nature, whether living or not, and human-made inventions." *J.E.M. Ag Supply*, 534 U.S. at 134 (*quoting Charkabarty*, 447 U.S. at 311-12). Significantly, the Court reemphasized that the product of nature doctrine is a section 101 problem -- that is, a question of patentable subject matter, as distinct from other patent requirements such as novelty,

[7]It is immaterial to our argument whether *Chakrabarty* was rightly or wrongly decided in our view, as the crucial holding for this case is simply that that the product of nature doctrine emerged from *Chakrabarty* unchanged. That said, the *Chakrabarty* decision's main holding, a 5-4 decision that the addition of transgenic material is sufficient to create patentability, is far from universally accepted. *See, e.g.*, *Harvard Coll. v. Can. (Com. of Patents)*, [2002] 4 S.C.R. 45, 2002 SCC 76 (Can.) (distinguishing *Chakrabarty* and holding that a transgenic mouse was not patentable subject matter).

utility, or non-obviousness. Accordingly, the Supreme Court continues to view the product of nature doctrine as originally conceived: a robust prerequisite to patentability.

In summary, over a hundred years of precedent has consistently held that products of nature are not patentable subject matter and allowing patents on products of nature violates § 101. A product whose physical characteristics are indistinguishable from those of its naturally-occurring counterpart does not constitute patentable subject matter. Where a claimed invention has a natural precursor or variant, the differences must be robust. The fundamental subject matter defect cannot be remedied by a showing of novelty, utility, or non-obviousness.[8]

B. Myriad's BRCA Patents Violate the Product of Nature Doctrine.

Applying the product of nature doctrine to the BRCA gene patents leads to only one logical conclusion: Myriad's patents are contrary to law. The BRCA genes are manifestations of nature, "free to all men." *Chakabarty,* 447 U.S. at 309. Like gravity, sunlight, leaves on trees, and wind, genes exist in the natural world and do not qualify as potential patent subject matter. There is no "invention" here.[9] As in *Funk Bros.*, the patented gene sequence serve the ends nature originally provided and act independently of any effort of Myriad. 333 U.S. at 130-31. The information dictated by the gene is

[8]Nonetheless, in some cases, the latter three elements may have collateral relevance. If a claimed invention is a product of nature, then it is also likely to be known by others and thus to lack novelty. However the converse proposition is not true: the fact that an invention possesses novelty does not prove that it is not a product of nature, since new products of nature are discovered every day. In addition, the presence of novelty or a new form of utility may provide *evidence* that the claimed invention is materially distinguishable from a naturally-occurring counterpart, and is thus not itself a product of nature.

[9]For some of the numerous academic works on this subject, *see generally* Eileen Kane, *Patent Ineligibility: Maintaining a Scientific Public Domain*, 80 ST. JOHN'S L. REV. 519 (2006); Peter Fox, *It's Not Over for the Product of Nature Doctrine Until the Synthetic Super-Heavy Element ("SHE") Sings*, 79 Temp. L. Rev. 1005 (2006); Eileen Kane, *Splitting the Gene: DNA Patents and the Genetic Code*, 71 TENN. L. REV. 707 (2005); John M. Conley & Roberte Makowski, *Back to the Future: The Product of Nature Doctrine As a Barrier to Biotechnology Patents (Part I)*, 85 J. PAT. & TRADEMARK OFF. SOC'Y 301 (2003); Linda J. Demaine & Adam Xavier Fellmeth, *Reinventing the Double Helix: A Novel and Nonobvious Reconceptualization of the Biotechnology Patent*, 55 Stan. L. Rev. 303 (2002).

identical, whether inside or outside the body. As in *Latimer* and *General Electric*, a mere description using "isolated" and "purified" should not create patentable subject matter if there is not a difference in substance. *Gen. Elec.*, 28 F.2d at 642-43; *see Ex parte Latimer*, 1889 Dec. Comm'r Pat. at 123, 125, 127. It contains exactly the same genetic information as its natural counterpart, does the same work as a naturally occurring gene-protein synthesis and it employs the same processes to do it. The useful properties of a gene are not ones that the scientist has invented (or created through isolation or purification), but rather are natural, inherent properties of genes themselves. And, as detailed in Section II *infra*, these patents improperly privatize the "storehouse of knowledge of all men," contrary to the Court's teachings. *Funk Bros.*, 333 U.S. at 132.

II. GENE PATENTS SUCH AS MYRIAD'S BRCA1 AND BRCA2 PATENTS HAVE SIGNIFICANT NEGATIVE SCIENTIFIC, SOCIAL, CULTURAL AND ENVIRONMENTAL CONSEQUENCES.

In June 2006, Justice Breyer discussed why it is important not to have patents on products of nature or laws of nature:

> The justification for the principle does not lie in any claim that "laws of nature" are obvious, or that their discovery is easy, or that they are not useful. To the contrary, research into such matters may be costly and time-consuming; monetary incentives may matter; and the fruits of those incentives and that research may prove of great benefit to the human race. Rather, the reason for the exclusion is 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.

Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc., 548 U.S. 124, 126-27 (2006) (Breyer, J., dissenting) *denying cert. to* 370 F.3d 1354 (Fed. Cir. 2004). There is substantial evidence from plaintiffs and other *amici* in this case that Myriad's patents and gene patents like them are causing great harm by impeding the progress of necessary scientific research, patient care and the development of cures. (*See, e.g.*, Pls.' Compl. at

¶¶ 2, 7-26, 48, 81-101; Pls.' Mem. of Law in Supp. of Summ. J. 5-6; Br. of *Amicus Curiae* March of Dimes, *et al.* 2-5, 14-16, 21-23; Br. of *Amicus Curiae* Am. Med. Assn, *et al.* 9-14.) These negative consequences are foreseeable and natural consequences of granting patents on genes in violation of the product of nature doctrine.

However, there are other consequences, equally if not more important, as well. The privatization of this genetic heritage violates fundamental precepts of common heritage, the public domain and the public trust doctrine. Additionally, when the USPTO grants a patent on a gene and removes it from the public domain it does so with only very incomplete knowledge of what that gene actually does in the body. Hence there is an additional negative result that these broad patents create exclusive rights of presently unknown scope and significance, which further impedes the progress of science. Finally, the granting of gene patents creates a system where people are nothing more than "treasure troves" to be mined for private economic gain, violating the fundamental rights of indigenous peoples and patients.

A. The Privatization of Genetic Heritage Violates Fundamental Precepts of Common Heritage, the Public Domain and the Public Trust Doctrine.

The genetic building blocks of life and its elements are the common heritage of humanity, available to all to learn from and utilize. Patenting of human genetics, such as the BRCA1 and BRCA2 genetic sequences, is antithetical to the tenets of public domain, common heritage, and public trust. As naturally occurring resources that are central to human identity and human survival, human genes are part of the common heritage of humanity and should be held as part of the public trust. As such, human genetics are owned by all people, and under patent law, a single firm should not be granted the right to exclude others from using human genetics.

The public domain is explicitly recognized in patent law by judicial exclusion of the laws of nature, natural phenomena, and abstract ideas from patent protection. The U.S. Supreme Court has held that existing knowledge and materials that exist in the public domain are the default presumption and are not to be patented: "Congress may not authorize the issuance of patents whose effects are to remove existent knowledge from the public domain, or to restrict free access to materials already available." *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 6 (1966); *see also Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 151 (1989) (explaining that "free exploitation of ideas will be the rule, to which the protection of a federal patent is the exception"); *Precision Instrument Mfg. Co. v. Auto. Maint. Mach. Co.*, 324 U.S. 806, 816 (1945) ("A patent is an exception to the general rule against monopolies."). By preventing research and monopolizing genetic data, patents on gene sequences take information out of the public domain and impede the progress of science, contrary to the express intent of the Constitution. *See* U.S. Const. art. I, § 8, cl. 8 (giving Congress the power to issue patents in order to "promote the Progress of Science and the useful Arts").

Patents should not be granted for genes, which are *res communis*, the common heritage and inheritance of mankind. Under the common heritage theory, public resources are available for use by all without restriction for the benefit of humanity. *See, e.g.*, Pilar A. Ossorio, *The Human Genome as Common Heritage: Common Sense or Legal Nonsense*?, 35 J.L. MED. & ETHICS 425, 426 (2007).[10] As the Court held in *Funk*

[10] Many have argued that the human genome should be held as common heritage. *See e.g.*, Melissa L. Sturges, *Who Should Hold Property Rights to the Human Genome? An Application of the Common Heritage of Humankind*, 13 Am. U. Int'l L. Rev. 219, 245 (1997); Barbara Looney, *Should Genes Be Patented? The Gene Patenting Controversy: Ethical and Policy Foundations of an International Agreement*, 26 LAW & POL'Y INT'L BUS. 231 (1994); Hubert. Curien, *The Human Genome Project and Patents*, 254 SCIENCE 1710, 1710-12 (1991).

Bros., the information in genes is "part of the storehouse of knowledge of all men." *Funk Bros.*, 333 U.S. at 130. The common heritage doctrine has been applied to a variety of resources, including the sea floor, activities in outer space, the use of seeds, preservation of historical artifacts, and the conservation of environmental resources. *See, e.g.*, Kernal Baslar, *The Concept of the Common Heritage of Mankind in International Law*, The Hague/Boston/London: Martinus Nijhoff, 31-37, 108-109 (1998); *see also* E. Aguis, *Germ-Line Cells – Our Responsibilities for Future Generations*, Valletta, Malta: Foundation for International Studies, 133-143 (Salvino Busuttil ed.,1990) ("If there is an obvious component of the common heritage of mankind, indeed, more obvious than the resources of the sea-bed itself, it is the human genetic system.").[11]

The public trust doctrine has also been invoked to understand why human genetics should be protected as public property. *See e.g.*, Barbara Looney, *Should Genes Be Patented? The Gene Patenting Controversy: Ethical and Policy Foundations of an International Agreement*, 26 LAW & POL'Y INT'L BUS. 267 (1994). The public trust doctrine requires governments to hold trust property for use by the general public, and maintain that property for certain types of public uses. *See generally* Joseph L. Sax, *The Public Trust Doctrine in Natural Resources Law: Effective Judicial Intervention,* 68 MICH. L. REV. 471 (1970). The conceptual underpinnings of the public trust doctrine are that: certain interests are so intrinsically important to every citizen that their free availability tends to mark the society as one of citizens rather than serfs; that certain benefits derive so directly or particularly from nature that they should be available to the

[11]Because of the unique legal status of Indigenous peoples and their rights to their genetic material, which will be discussed in section II. C *infra*, the doctrine of common heritage of mankind is not applicable to them. Accordingly, specific legislation and regulations are needed to reserve the right of Indigenous peoples to determine whether or not they want to provide their genetic material for research purposes.

entirety of a populace; and that certain uses of property have value only to the extent that they are public. *Id*. The public trust doctrine should apply to human genetics. Human genes are of intrinsic importance to all people and their benefits are derived directly from human biology; therefore, they should be available to all people. *See, e.g.*, Pilar A. Ossorio, *The Human Genome As Common Heritage: Common Sense or Legal Nonsense?*, 35 J.L. MED. & ETHICS at 427 (2007).

In addition to violating basic rights common to humanity, permitting the patenting of human genetics causes the underutilization of genetic material. The proliferation of intellectual property rights on original genetic material may stifle life-saving innovations downstream from product research and development due to a phenomenon dubbed "the tragedy of the anticommons." *See, e.g.*, Michael A. Heller and Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998) (*citing* Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621 (1998)). As the right of companies to exclude others from use of genetics expands, all genetic resources become increasingly underutilized, reducing the benefit of these resources to humanity.

Accordingly, the patents on BRCA1 and BRCA2 should be invalidated and such human genetic information should remain in the public domain in order to prevent the monopolization and/or underutilization of our common heritage.

B. Gene Patents Privatize Genetic Information That Scientists Lack a Full Understanding of, Creating Rights of Unknown Scope and Significance.

Gene sequences are not akin to a conventional chemical substance or a drug; they are instead fundamentally information. The patent for a particular gene sequence patents the information contained in the sequence – for example the As, Ts, Cs, and Gs of the

genetic code. *See, e.g.*, Sunny Bains, *Double Helix as Engineer*, 279 Science 2043, 2043 (1998) (detailing that the letters C, G, A and T stand for the four different bases that make up human DNA: cytosine, thymine, adenine, and guanine). The approximately 20,000 genes in our bodies control several hundred-thousand biological proteins. *See, e.g.*, Alan E. Guttmacher & Francis S. Collins, eds., *Genomic Medicine—A Primer*, 347 New Eng. J. Med. 1512, 1514 (2002). The holder of a patent that purports to describe one commercial use should not then have monopoly on all possible functions, particularly given that the scientific scope of what those functions may be is very limited. As noted in the context of AIDS research, "[w]hoever is first to patent a DNA sequence – for any use – can lock up subsequent uses." Eliot Marshall, *AIDS Research: HIV Experts vs. Sequencers in Patent Race*, 275 Science 1263 (1997) (discussing gene sequences patented for AIDS research even though the patent specification did not mention a connection to the HIV infection).

More fundamentally genes are substances that we still know little about. *See, e.g.*, Carl Zimmer, *Now: The Rest of the Genome*, N.Y. Times, Nov. 11, 2008, at D1 (discussing the current gene "identity crisis" and how "new large-scale studies of DNA are causing [scientists] to rethink the very nature of genes"); Brendan Maher, *Personal Genome: The Case of the Missing Hereditability*, 456 Nature 1818-21 (2008), It was believed because of the complexity of the human organism people would have significantly more genes than other life forms. Researchers estimated that humans would probably end up having between one and two hundred thousand genes. The surprising results of the Human Genome Project revealed in 2001 show that humans have only about 20,000 genes, a similar count to worms, flies and yeast. *See, e.g.*, Elizabeth

Pennisi, *Working the (Gene Count) Numbers: Finally, a Firm Answer?*, 316 Science 1113 (2007). Moreover, such organisms as grapes, corn plants and mice have substantially larger number of genes than do humans. Additionally researchers note that we share the vast majority of our genes with other creatures, and in fact have yet to find a single gene that is unique to humans.

More recently, additional research has amplified these unexpected findings, indicating that human complexity does not come primarily from genes but must be related to other elements of our biology and the outer environment including: 1) the non-coding (non-gene) elements of DNA, so-called "junk" DNA accounting for more than 98% of all DNA, which is now seen to play a far more important role in heredity than previously thought; 2) a cell's RNA often thought merely to be a "messenger" for genes, now understood to play a more important part in heredity and the causation of hereditary disease; 3) the many hundreds of thousands of proteins which also divide during meiosis and mitosis and are found to often have a controlling influence on the action of genes and are viewed as critical biological actors in heredity and the incidences of cancer and other human disease. The ENCODE Project Consortium, *Identification and Analysis of Functional Elements in 1% of the Human Genome by the ENCODE Pilot Project*, 447 Nature 799 (2007); *see also* Rick Weiss, *Intricate Toiling Found in Nooks of DNA Once Believed to Stand Idle*, Wash Post, June 14, 2007 (reporting on the study that "[t]he first concerted effort to understand all the inner workings of the DNA molecule is overturning a host of long-held assumptions about the nature of genes and their role in human health and evolution"); Elizabeth Pennisi, *Genomics: DNA Study Forces Rethink of What It Means to Be a Gene*, 316 Science 1556, 1556-57 (2007) (stating that the research reveals

an extremely different picture of DNA, RNA, protein, and their interactions than the one that scientists have assumed for decades). As for the environment, new findings on "epigenetics" show that the environment is constantly altering DNA and all of the biological elements in cells in dynamic ways, impacting heredity and hereditary diseases in ways that are just beginning to be understood. Laura Beil, *Medicine's New Epicenter? Epigentics*, CureToday, (Winter 2008); Eric J. Richards, *Inherited Epigenetic Variation--Revisiting Soft Inheritance,* 7 Nature Reviews – Genetics 395, (May 2006).

These findings have critical impacts on our understanding of BRCA 1-2. First of all it is important to state that no researcher claims that BRCA 1-2 "cause" breast cancer. There appears to be a statistical "association" between incidences of hereditary breast cancer and these genes.[12] Since both BRCA genes are believed to be related to tumor suppression, this may account for the percentage association with breast cancer; however the mechanism by which such tumor suppression is accomplished remains a mystery, as do the gene "defects" that contribute to breast cancer risk. Not surprisingly given this lack of scientific understanding, virtually all studies reporting this association of BRCA1-2 with incidences of hereditary breast cancer have called for more research to verify the extent of the association and its actual biological basis. *See, e.g.*, Andrea Veronesi, et al., *Familial Breast Cancer: Characteristics and Outcomes of BRCA 1-2 Positive and Negative Cases,* 5 BMC Cancer 70 (2005); H. Eerola et al., *Survival of Breast Cancer Patients in BRCA1, BRCA2, and NON-BRCA1/2 Breast Cancer Families: A Relative Survival Analysis from Finland*, 93 Int'l J. of Cancer 368-372 (2001); Dominique Stoppa-

[12]According to the NIH hereditary breast cancer is believed to represent around 10-15% of all breast cancer, the remaining percentage of cancers are thought to be environmentally caused. Campeau PM, Foulkes WD, Tischkowitz MD. Hereditary breast cancer: New genetic developments, new therapeutic avenues. *Human Genetics* 2008; 124(1):31–42. from the NIH National Cancer Center webpage: http://www.cancer.gov/cancertopics/factsheet/Risk/BRCA

Lyonnet, et al., *Familial Invasive Breast Cancers: Worse Outcome Related to BRCA1 Mutations*, 18(24) J. of Clinical Oncology 4053-4059 (2000); Mario Budroni, et al., *Role of BRCA2 Mutation Status on Overall Survival Among Breast Cancer Patients from Sardinia*, 9 BMC Cancer 62 (2009); Mahmond El-Tamer, el al., *Survival and Recurrence after Breast Cancer in BRCA 1/2 Mutation Carriers,* 11(2) Annals of Surgical Oncology 157-164 (2004); Colin B. Begg, et al., *Variation of Breast Cancer Risk Among BRCA1/2 Carriers*, 299(2) J. of the Am. Med. Ass'n 194-201 (2008); M.C. King, et al., *Breast and Ovarian Cancer Risks Due to Inherited Mutations in BRCA1 and BRCA2*, 302 SCIENCE 643-646 (2003); A. Antoniou et al., *Average Risks of Breast and Ovarian Cancer Associated with BRCA1 or BRCA2 Mutations Detected in Case Series Unselected for Family History: A Combined Analysis of 22 Studies*, 72 Am. J. of the Human Genetics 1117-1130 (2003). Adding to the confusion is a recent 2008 study which demonstrates that high risk women who did not have BRCA 1-2 had a risk of new cancerous lesions considerably greater than those who were positive for the genes. Elizabeth Feldman, et al., *The Incidence of Occult Malignancy and Atypical Histopathology in Prophylactic Masectomy Specimens After Uninformative BRCA Testing*, American Society of Breast Surgeons meeting 2008. As with the association findings these seemingly contradictory findings need further research to be better understood.

Our emerging understanding of the role that genes and the other biological elements play in the cell and how the environment influences those elements indicates that the old mechanistic view of genes "causing" complex diseases such as cancer are simply wrong. Research now shows that many cancer cells have no genetic mutations at all. *See, e.g.*, Laura Beil, *Medicine's New Epicenter? Epigentics*, CureToday (Winter

2008). It is now understood that many human diseases are caused by complex dynamics between non-hereditary proteins, DNA, RNA, the cellular environment, and the extra-human environment. By allowing the patenting of one biological element in that process, namely the gene, research into this complex dynamic process is halted. Just as billions of dollars of government research have shown the gene is not "the CEO" of heredity and hereditary diseases, patents on genes such as the BRCA1-2 halt the progress of this new scientific paradigm to see how theses DNA sequences interact with other biological elements which may be far more important than the genes in the disease creation. Halting science's critical march into a more comprehensive understanding of human disease causation is antithetical to the purpose of U.S. patent law, namely to "promote the Progress of Science and useful Arts."

C. Patents on Indigenous Peoples' Genes Facilitate the Exploitation of Indigenous Peoples and Violate International Law.

Genes are fundamentally storehouses of information that has been passed down to each person from his or her ancestors, and that will be passed down to his or her children. For Indigenous groups, their genetic materials hold traditional and spiritual significance.

The permissibility of patenting genes has caused some to view Indigenous peoples as "treasure troves." Researchers have applied for patents based on cell lines derived from Indigenous people without their consent, such as the Guyami of Panama, the Hagahai of Papua New Guinea, and the Melanese of the Solomon Islands. *See, e.g.*, Debra Harry and Le`a Malia Kanehe, *Asserting Tribal Sovereignty over Cultural Property: Towards Protection of Genetic Material and Indigenous Knowledge*, 5 Seattle J. for Soc. Just. 27 (2006). Indigenous communities are attractive to genetic researchers for several reasons, including (1) they are perceived to be more genetically homogenous

than other populations, making it easier for researchers to find links between specific diseases and genetic sequences; and (2) they often have high rates of specific diseases such as Type II diabetes, heart disease, cancers and arthritis. *Id.*

The Havasupai case demonstrates why researchers are interested in Indigenous peoples' genes. Members of the Havasupai Tribe from an isolated region of the Grand Canyon in Arizona were sought as research subjects to study the possibility of a genetic basis for the prevalence of Type II diabetes within the Tribe. Although the Tribe and some members consented to diabetes related research at Arizona State University, their blood samples were used for other purposes, including inbreeding, schizophrenia and ancient migration theories, and transferred to other universities, all without their consent. *See, e.g.,* Lori B. Andrews, *Havasupai Tribe Sues Genetic Researchers*, 4 LAW & BIOETHICS REPORT 10 (2004). In ongoing litigation, the Tribe and individual members maintain that the defendant university and researchers "violated the Havasupai Tribe's and tribal members' cultural, religious, and legal rights and have caused the Havasupai Tribe and its members severe emotional distress." *Havasupai Tribe v. Ariz. Bd. of Regents*, 204 P.3d 1063, 1069 (Ariz. Ct. App. 2008).

The Hagahai and Guayami cases illustrate that genetic research on Indigenous peoples often results in patents. In the case of the Hagahai, the U.S. National Institutes of Health and Department of Health and Human Services (NIH) sought and was granted a patent on a human T-cell line obtained from a Hagahai man, a member of an isolated tribe of Papua New Guinea without his consent. *See id.* at 1067; *see also* U.S. Patent No. 5,397,696 (issued March 14, 1995). NIH eventually forfeited its patent rights, but only after an international uproar. *See, e.g.*, Gary Taubes, *Scientists Attacked for "Patenting"*

Pacific Tribe, 270 SCIENCE 1112 (1995); Sally Lehrman, *U.S. Drops Patent Claim to Hagahai Cell Line*, 384 NATURE 500 (1996).

Another example of the attempted patenting of the genetic sequences revealed from the testing of Indigenous peoples was the "Guayami patent." In that case a patent application was filed on behalf of the U.S. Department of Commerce for "Human T-Lymphotropic Virus Type II from Guayami Indians in Panama," even though neither the tribe nor the woman whose genetic sequence was at issue knew anything about the development of the cell line or the patent application. *See, e.g.*, Marina L. Whelan, *What, If Any, Are the Ethical Obligations of the U.S. Patent Office: A Closer Look at the Biological Sampling of Indigenous Groups*, 2006 Duke L. & Tech. Rev. 14, 13-15 (2006). The President of the Guayami General Congress wrote the U.S. Secretary of Commerce, demanding that the application be withdrawn because it was made without consultation or consent and because the patent was "not an invention but a discovery of an antibody which is part of the blood of a Guayami woman." *Id.* The letter also queried what, if any, benefits the Guayami people would gain from the proposed patent application. As a result of this protest from the Guayami people as well as from numerous public interest groups, the patent was withdrawn. *Id.*

Although the U.S. government elected to drop their patents on the Hagahai and Guayami genes due to public and diplomatic pressure, there was no legal obligation to do so. Thus, Indigenous peoples remain vulnerable to similar patents on their genes, particularly with the passage of the Bayh-Dole Act in 1980, which encourages universities to patent inventions developed with federal funding. Patent and Trademark Law Amendments Act, Pub.L. No. 96-517 (1980). This legislation has facilitated the

entry of universities into the marketplace by giving them the right to patent and commercialize their inventions, including human genes.

The United Nations Declaration on the Rights of Indigenous Peoples, adopted in 2007 by the UN General Assembly, recognizes that "Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, . . . including human and genetic resources." United Nations Declaration on the Rights of Indigenous Peoples, G.A. RES. 61/295 at art. 31, U.N. Doc. A/RES/61/295 (Sept. 13, 2007). This right stems from the central right of self-determination, which includes a right to autonomy or self-government in matters relating to their internal or local affairs. *Id.* at art.4. In the United States, this right is actualized through the recognition of the exercise of sovereignty by federally-recognized tribes. While the proper utilization and disposition of genetic material associated with a tribe is an internal matter there is no requirement in federal law to protect this right.

The UN Declaration also recognizes the obligation upon States to obtain the free, prior and informed consent ("FPIC") of Indigenous peoples when legislative or administrative actions may affect them, as well as prior to the extraction of their resources. *Id.* at art. 19 and 32. This principle of international law is closely related to the rights of individual human research subjects and patients to informed consent under federal law except that FPIC is a right uniquely applicable to Indigenous peoples as collective groups rather than as individuals. Given the demonstrated history of utilization of genetic material of Indigenous peoples without their informed consent, the PTO's extension of patent protection to human genes obtained from Indigenous peoples without their free, prior and informed consent is an infringement of their internationally

recognized rights.

All federal agencies have a duty to consult with tribes when "formulating or implementing agency policies that have tribal implications." Exec. Order No. 13,175 (2000). The issuance of a patent on genes taken from tribal members necessarily has significant legal, social, cultural and economic implications for tribes. Yet federal regulations do not require the PTO to inquire into the origin of the genetic material, tribal or otherwise, or require their consent, and therefore the agency does not have any mechanism to ensure that appropriate tribes are consulted before issuance of a patent. Accordingly, properly excluding gene sequences as impermissible subject matter pursuant to the product of nature doctrine would serve to protect the rights of Indigenous peoples under international and federal law that are currently being violated.

D. The Granting of Gene Patents Such as Myriad's BRCA1 and BRCA2 Patents Creates a System that Violates the Rights of Patients' to Informed Consent.

Human gene patents such as Myriad's patents violate basic notions of informed consent as well. Doctors, health care institutions, researchers and hospitals have gone to court to gain ownership of patients' cell lines, tissue, and genes in order to commercialize them, even over the patients' objections. *See, e.g.*, *Moore v. Regents of the Univ. of Cal.*, 793 P.2d 479 (Cal. 1990); *Wash. Univ. v. Catalona*, 490 F.3d 667 (8th Cir. 2007). Justice Cardozo was one of the first to acknowledge the existence of a basic right to informed consent, concluding that "[e]very human being of adult years and sound mind has a right to determine what shall be done with his own body." *Schloendorff v. Soc'y of New York Hosp.*,105 N.E. 92, 93 (N.Y. 1914). Indeed, the concept is "fundamental in American jurisprudence." *Canterbury v. Spence*, 464 F.2d 772, 780 (D.C. Cir. 1972). Informed consent requires disclosure of all the information that is material to a patient's intelligent

and informed decision. *See, e.g.*, *Johnson v. Kokemoor*, 545 N.W.2d 495, 501 (Wis. 1996). Yet, the current patenting of gene sequences allows for indiscriminate patenting without consent or knowledge.

In *Moore*, the seminal case regarding an individual's right to informed consent in medical sampling and research, the patient suffered from hairy-cell leukemia and was admitted to the UCLA Medical Center for treatment. 793 P.2d at 481. Before advising Moore that he needed to have his spleen removed, his physician decided that he would use Moore's spleen for research purposes. *Id.* The physician did not advise Moore of his research intentions when he suggested Moore undergo surgery and later derived a cell line from Moore's T-lymphocytes, valued at $3 billion, over which the University of California applied for a patent. *Id.* Moore sued, alleging, among other things, that he was not able to make an informed decision about whether to undergo his surgery because he was unaware of his physician's ulterior motives. *Id.* at 482. The California Supreme Court agreed, holding that "a physician must disclose personal interests unrelated to the patient's health, whether research or economic, that may affect the physician's professional judgment." *Id.* at 483.

The *Moore* decision, however, has been limited to physicians and other individuals with whom a patient shares a fiduciary relationship. *See Greenberg v. Miami Children's Hosp. Research Inst., Inc.*, 264 F. Supp. 2d 1064, 1070-71 (S.D. Fla. 2003). In *Greenberg*, a researcher patented the genetic sequence for Canavan disease after studying the blood and tissue samples of several donors. *Id.* at 1067. The individuals who provided the samples alleged that the researcher violated principles of informed consent when he did not disclose his economic intentions to patent the genetic sequence

and commercialize it. *Id.* at 1068. The court disagreed, distinguishing *Moore* on the ground that it applied to physicians and patients, but not to researchers and donors. *Id.* at 1070-71. *Greenberg* illustrates how donors who intend to contribute to the public domain can be misled by researchers and left without a remedy.

Genetic research is being undertaken on people without their consent, as researchers prospect for genes. The United Nations Educational, Scientific and Cultural Organization (UNESCO) warned in 2002:

> Industry is naturally interested in human genetic data as well. The legal battle between several European institutions, including France's Institut Curie, and the US firm Myriad Genetics shows this . . . . because the firm refuses to grant manufacturing licences, all DNA samples will have to be sent to the Myriad Genetics headquarters in Salt Lake City for processing, *providing the company with a unique databank about people at high risk.*
>
> The stock of human genetic data is sure to continue increasing. So we have to think about possible misuses . . . At the collecting stage, there is the problem of consent, which is not new to the medical profession. "Free, informed and express" consent is not always self-evident. Suppose researchers in rich countries decide to obtain raw genetic data from people living in countries with less developed economies and legal protection systems, with no legislation about genetic data or even basic information about it, what kind of consent can they give?[13]

CONCLUSION

For the above stated reasons, the Court should deny Defendants' motions to dismiss and grant Plaintiffs' motion for summary judgment.

Respectfully submitted,

Dated: September 10, 2009

/s/Andrew Kimbrell_____
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Zelig Golden
The International Center for Technology Assessment

[13] UNESCO, *Ethical Guidelines Urgently Needed For Collecting, Processing, Using and Storing Human Genetic Data*, Press Release No. 2002-93 (2002), *available at* http://portal.unesco.org/en/ev.php-URL_ID=7791&URL_DO=DO_PRINTPAGE&URL_SECTION=201.html.

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