Overview of Presentation

• Patents & human genes patents
• Gene patents & medical practice
• Why should we care?
• Progress toward solutions
Invention must be:

• New, made by man, & not a product of nature (§ 101)
• Novel (§ 102)
• Not obvious (§ 103)

Patents Established by US Constitution

Grants right to exclude others for limited time from making, using, or selling an invention (35 USC)

Invention must be:

• New, made by man, & not a product of nature (§ 101)
• Novel (§ 102)
• Not obvious (§ 103)
Purpose of Patents

“Promote the progress of science and useful arts...”

• Provide incentive to invent
• Promote disclosure of invention
• Provide incentive & protection for commercialization
How did we get from the patent rights granted by the US Constitution to the patenting of human gene sequences?

Acknowledgment: Roger D. Klein, MD, JD, Cleveland Clinic
Plagued by high unemployment, high inflation, rising oil prices and shaken U.S. confidence
Bayh-Dole Act (December 1980)

• Before Bayh-Dole:
  – 28,000 patents funded and held by US Gov’t
  – <5% licensed to companies for development
Bayh-Dole Act (December 1980)

• Before Bayh-Dole:
  – 28,000 patents funded and held by US Gov’t
  – <5% licensed to companies for development

• Bayh-Dole Act:
  – Non-profits & small businesses can retain patents
  – Universities encouraged to license to businesses
Patenting by Universities

Number of Utility Patents

Year

Impact of Bayh-Dole (1980’s)

• Dramatic ↑ in academic patent licensing
• >2,200 companies founded
• >1,000 new products
• ~250,000 new jobs
• ~$30B annually
• Shift in academia from
  – Scientific rewards (publish, promotion)
  – To monetary gain ($ for academia)
Diamond v. Chakrabarty

Ananda Chakrabarty

Genetically-engineered Pseudomonas Digests Oil

Scientist in R&D working for General Electric Co. in 1971

• Original patent denied 1971: “Living things not patentable”
• Decision appealed to USPTO Board of Appeals: Denied
• Supreme Court 1980: 5-4 decision in favor of Chakrabarty
Post-Chakrabarty Patents

• “Harvard Mouse”
• Leukemia-derived cell lines
• Stem cells
• Human gene sequences
Human Gene Sequences

• Precedents for patents on purified naturally occurring products
  – Epinephrine
  – Vitamin $B_{12}$

• “Isolated and purified” gene patents granted by USPTO

• Treated as chemical substances
Extent of Human Gene Patents

- ~20% of all human genes covered by ≥1 patent\(^1\)
- ~Half of known cancer genes patented\(^2\)
- Incyte holds patents on ~10% of human genes\(^1\)

Examples of Patented Disease Genes

- 5,753,441 BRCA1 & BRCA2
- 5,753,438 Hereditary hemochromatosis
- 5,741,645 Spinocerebellar ataxia type 1
- 5,693,470 HNPCC
- 5,691,144 CMT-X
- 5,686,240 Niemann-Pick disease
- 5,681,699 IBD
- 5,679,635 Canavan disease
- 5,670,320 Dystonia, Leber’s optic neuro.
- 5,658,729 Premature atherosclerosis
- 5,654,138 Von Hippel-Lindau (VHL)
- 5,650,282 Williams syndrome
- 5,650,281 Colorectal cancer
- 5,645,995 Breast or ovarian cancer
- 5,639,614 Idiop dilated cardiomyopathy
- 5,565,323 Sporadic Alzheimer disease
- 5,550,021 Compulsive disorder
- 5,541,060 Early-onset diabetes mellitus
- 5,518,880 XSCID
- 5,508,167 Alzheimer disease
- 5,506,101 Ototoxic deafness
- 5,498,521 Retinal degenerative diseases
- 5,494,794 Alzheimer, Parkinson
- 5,492,808 Familial colon cancer (FCC)
- 5,429,923 Hypertrophic cardiomyopathy
- 5,387,506 Familial dysautonomia
- 5,374,525 Hypertension
- 5,306,616 CMT-1A
- 5,296,349 Myoclonic epilepsy
- 5,266,459 Gaucher disease
- 5,210,016 Compulsive disorder (alcohol)
- 5,045,449 Vascular aneurysms
Human Gene Patents

• A range of patent claims:
  • Gene & cDNA sequences
  • Mutations in gene
  • All methods of looking at the gene
  • Correlation of gene mutation with disease

• Not clear what has been “made by man”

• Permit monopolization of medical information
Overview of Presentation

• Patents & human genes patents
• Gene patents & medical practice
• Why should we care?
• Progress toward solutions
I am a Molecular Pathologist

- Medical (MD) & molecular biology (PhD) training
- Residency training in Pathology
- Specialize in use, performance & interpretation of clinical tests based on genetic material (DNA/RNA)
- Translate genetic/genomic science into tests
- Molecular pathology tests important for patient care
- My medical practice, not research
- First gene patent enforcements in 1997 at UPenn
PROBLEMS: Exclusive licensee as sole test provider & Unreasonable test price

As part of our efforts to be at the forefront of developments in diagnostic testing, I would like to advise you that Athena Diagnostics has acquired exclusive rights to certain tests in the diagnosis of late onset Alzheimer’s disease. These tests are covered under U.S. Patent number 5,508,167 a copy of which is enclosed.

The patent covers methods of diagnosing for increased risk of late onset Alzheimer’s disease by testing for the presence of the ApoE4 allele.

We understand that University of Pennsylvania may be offering a diagnostic test covered by this patent. Any such testing would infringe on the above patent under which Athena has exclusively licensed.

This diagnostic testing service is available through Athena’s facilities, and it is only by using Athena’s facilities that other laboratories can offer this patented diagnostic test without infringing the patent.

If University of Pennsylvania is interested in continuing to offer this patented testing service to its customers, Athena would be pleased to perform the services on University of Pennsylvania behalf. Our currently published price is $195 per specimen.

Very truly yours,

Michael A. Boss, Ph.D.
Vice President, Research and Development

MAB/eme

UPenn $100.50
June 24, 1998

Dr. Debra Leonard
University of Pennsylvania Medical Center
3400 Spruce Street
7103 Founders
Philadelphia, PA 19104-4283

PROBLEM: Unreasonable licensing fee

Hereditary Hemochromatosis Assay

I would like to bring to your attention three U.S. patents, 5,705,343; 5,712,098; and 5,753,438 all relating to an assay for hereditary hemochromatosis. The '098 patent may be of most interest to you and I have taken the liberty of enclosing a copy of it for your convenience. These patents are owned by Progenitor, Inc. and licensed exclusively to SmithKline Beecham Clinical Laboratories, Inc. for use in running a home-brew assay.

If you are offering a genetic test for hereditary hemochromatosis, please provide me with an assurance that the test procedure you are running is not covered by one or more of the three mentioned patents. If your test might be covered by these patents, SBCL is willing to make arrangements to insure that your clients have continued access to this gene-based HHC test discovered by Progenitor within the context of Progenitor’s issued patents. I invite you to initiate such arrangements by contacting Rose Tricoski at SmithKline Beecham Clinical Laboratories, 1201 South Collegeville Road, Collegeville, PA 19426. Please feel free to call her at 610.454.6367, by fax at 610.983.2302 or by e-mail at rose.tricoski@sb.com. She and others at SBCL can assist you with making the necessary arrangements to avoid any inconvenience or interruption of services to your clients.

I ask that you follow up with Ms. Tricoski by July 24th. Thank you.

Sincerely,

David O'Bryan
David O'Bryan, Ph.D.
Vice President and Director, Science and Technology

$25,000 upfront fee or IP rights + Fee per test performed
October 16, 1998

RE: U.S. Patent Number 5,741,645

Dear Dr. Leonard:

I would like to advise you that Athena Diagnostics is the licensee to a recently issued U.S. patent 5,741,645, which is directed Spinocerebellar Ataxia type 1 (SCA1). A copy of the patent is enclosed for your convenience.

The patent covers methods of identifying whether an individual is or is not at risk for developing SCA1 disease by analyzing whether the SCA1 gene has an increased or normal number of CAG repeats.

We understand that University of Pennsylvannia may be offering a diagnostic test covered by this patent. Any such testing would infringe on the above patent under which Athena has exclusively licensed.

This diagnostic testing service is available through Athena's facilities, and it is only by using Athena's facilities that other laboratories can offer this patented diagnostic test without infringing the patent.

PROBLEMS:
Exclusive licensee as sole test provider
& One gene controls testing for many
ACOG recommends Canavan screening for all Jewish women; Part of a “Jewish genetic panel”

PROBLEMS: Unreasonable licensing conditions & One gene controls testing for many

at least $12.50 per test.

These binding agreements contain volume limitations. Once MCHRI commences Phase II of its licensing program (likely to occur very soon), it may well be prevented by contract from licensing any latecomers. In addition, our largest licensee may require the right to enforce the Canavan Patent against non-licensed offerers of Canavan testing.
Myriad Genetics & BRCA1

- **BRCA1** mutations increase breast cancer risk
  - Myriad Genetics is patent holder
  - Limited license for common mutations only
  - Exclusive US provider of complete BRCA1 testing
  - Also captures BRCA2 testing

- Dr. Arupa Ganguly (Dept of Genetics, UPenn) stopped clinical BRCA1 testing in 1999

**PROBLEMS:** Exclusive licensee as sole test provider, One gene controls testing for many & Unreasonable test price
NO PROBLEM:
Non-exclusive licensing at reasonable licensing fee

Because the '677 patent issued on July 7, 1998, we acknowledge that university diagnostic laboratories currently offering cystic fibrosis diagnostic testing may not be aware of this patent and most certainly are not aware of other related ownership rights held by MICHIGAN and RDLP. It is therefore our intent to inform all cystic fibrosis testing sites that we are offering non-exclusive, worldwide, in-house diagnostic testing licenses for the use of our technologies.

Given University of Pennsylvania Medical Center’s active participation in this diagnostic area, we would welcome further discussions with you or some other University representative about obtaining a diagnostic license for use of the delta F 508 deletion in cystic fibrosis testing. In the event that your laboratory is providing diagnostic results to patients at cost, or reagents for the tests are obtained from one of our current product licensees (please contact me for further information), no license will be necessary.

Please feel free to contact me at your earliest convenience.

Sincerely,

David G. Ritchie, Ph.D.
Technology Licensing Specialist
DRAFT
LICENSE AGREEMENT

Between

INVIVOSCRIBE TECHNOLOGIES (IVS)

and

UNIVERSITY OF PENNSYLVANIA HEALTH SYSTEM (PENN)
1.02 “Licensed Patent Rights” as used herein shall mean to United States Patents Numbered 5,296,351 and 5,418,134.

1.03 “LICENSEE” as used herein shall mean LICENSEE and any and all Affiliates of LICENSEE.

1.04 “Licensed Field” as used herein shall mean the identification of monoclonality and the diagnosis and monitoring of leukemias, lymphomas and other lymphoproliferative diseases using the Licensed Patent Rights.

- IVS sells test kits for clinical testing used for
  - Diagnosis of lymphomas & leukemias
  - Monitor residual disease after treatment
- Method used for clinical testing since 1990
- IVS forced to take an exclusive license from patent holder
- Clinical labs required to obtain license
4.0 LICENSE FOR PRIOR ACTS

Included in the License Issue Fee paid according to Section 5.01 is a retroactive License under Section 3.0 for all of LICENSEE’s use of the Licensed Patent Rights prior to the effective date of this Agreement.

5.0 LICENSE ISSUE, CONTINUING ROYALTY FEES

Payment obligations will accrue during this Agreement as follows:

5.01 Payment for License Issue. In consideration of the issuance of the License granted in Sections 3.0 and 4.0 by IVS under the terms of this Agreement, and as a license issue fee, LICENSEE shall pay IVS the sum of _____ Thousand ($__,000.00) US Dollars, due and payable upon the execution of this Agreement.

5.02 Continuing Royalty. In addition to the License Issue Fee paid under Section 5.01, the following continuing Royalty (the “Continuing Royalty”) shall be due and owing biannually subject to reduction as outlined in Section 7.03.

1. Zero ($0 USD) dollars for each Intramural Test performed using IVS kits using the reaction volumes recommended in the Product Insert or literature accompanying the product(s);
2. Forty ($40 USD) dollars for each Intramural Test performed without use of IVS kits;
3. Forty ($40 USD) dollars for each Reference Test performed using IVS kits using the reaction volumes recommended in the Product Insert or literature accompanying the product(s);
4. Sixty ($60 USD) dollars for each Reference Test performed without use of IVS kits;
Economics of IVS License

• In 2002, 226 IGH and 209 TCR PCR tests
• Cost to perform each test is ~$300
• $40-$60 per test (15-22% of cost)
• $8360 to $9540 per year plus license fee
• Medicare reimbursed $55.39 per test

**PROBLEM: Unreasonable licensing fee**
UPenn Experience

• Stopped: CMT1A, BRCA1, ApoE, Canavan
• Negotiated agreements:
  – Cystic fibrosis
  – Leukemia/lymphoma testing
• Notification letters:
  – Hereditary hemochromatosis
  – Spinocerebellar ataxia, type 1
• Potential of patent enforcement:
  – Spinal muscular atrophy
  – Myotonic dystrophy
  – Others (EGFR, Deafness, etc.)
Patentees & Exclusive Licensees Can:

• Enforce unreasonable licensing conditions
  – High fees for tests with low payment
  – Limitation of test volumes
  – Payment for many licenses for a single test
  – Limit use of methods in clinical practice

• Control of one gene controls disease testing

• Be a sole provider of a clinical service in US
National Experience: 1998 Pilot Survey

• 1998 Pilot Survey of 74 laboratory directors
• ~50% genetic test not offered due to patents
• ~25% stopped testing due to patents
• Potential problem & need for further study

National Experience 1999: One Test

• Hemochromatosis patent enforced by SKBCL

• Surveyed 128 US labs regarding HCR test

• Conducted 117/128 interviews (93%)

• 30% reported not adopting or dropping test

• Reason for not testing
  – 22 labs stated patent was “the” reason
  – 10 labs stated patent one of several reasons

HCR Test Adoption by US Labs

Need for Gene Patents?

- Publication of disease-gene association sufficient for development of clinical test
  - Genetic expertise allows test development
  - Clinical adoption rapid & driven by clinical need
  - Patent protection not required to motivate clinical use of information

- Patent holder benefits from medical market developed by clinical laboratories once patent granted
National Experience 2001: Genetics

• Survey of 132/211 labs (GeneTests or AMP)
  – 121 laboratories performed clinical genetic testing
  – 65% had been contacted by a patent or license owner
  – 53% did not develop a clinical genetic test due to a patent
  – 25% stopped performing a genetic test due to a patent

• Extent of problem
  – 12 genetic tests covered by 22 patents
  – Each test performed by 1 to 9 laboratories (average 4)

## Impact of Gene Patents on Testing

<table>
<thead>
<tr>
<th>Study</th>
<th>Pilot 1998 74 Labs</th>
<th>HCR 1999 117 Labs</th>
<th>National 2001 121 Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Testing Related to Patents</td>
<td>50%</td>
<td>30%</td>
<td>53%</td>
</tr>
<tr>
<td>Stopped Testing Due to Patents</td>
<td>25%</td>
<td>18%</td>
<td>25%</td>
</tr>
</tbody>
</table>
Gene Patents Constrain Medical Practice

• Eliminate competition for test pricing
• Reduce innovation in testing methods
• Dictate medical practice
• Limit patient access
• Limit clinical scientific observations
• Slow new discovery
• Limit medical education
• Prevent advance to genomic medicine
Overview of Presentation

• Patents & human genes patents
• Gene patents & medical practice
• Why should we care?
• Progress toward solutions
Classic Medical Genetics

• Diseases caused **entirely** by:
  – Duplication or deletion of entire chromosome, e.g., Down syndrome
  – Alteration of the sequence of a single gene, e.g., cystic fibrosis, Huntington disease, spinal muscular atrophy
Classic Medical Genetics

• Focuses on diseases due to mutations in a single gene that are inheritable
• Very important to affected individuals and their families
• However, these conditions are rare
• Small part of medical practice
• Minimal impact on overall population
### Leading Causes of Death in U.S., 2010

<table>
<thead>
<tr>
<th>Cause</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Disease</td>
<td>597,689</td>
</tr>
<tr>
<td>Cancer</td>
<td>574,743</td>
</tr>
<tr>
<td>Chronic Lung Disease</td>
<td>138,080</td>
</tr>
<tr>
<td>Stroke</td>
<td>129,476</td>
</tr>
<tr>
<td>Accidents</td>
<td>120,859</td>
</tr>
<tr>
<td>Alzheimer Disease</td>
<td>83,494</td>
</tr>
<tr>
<td>Diabetes</td>
<td>69,071</td>
</tr>
<tr>
<td>Kidney Disease</td>
<td>50,476</td>
</tr>
<tr>
<td>Influenza &amp; Pneumonia</td>
<td>50,097</td>
</tr>
<tr>
<td>Suicide</td>
<td>38,364</td>
</tr>
</tbody>
</table>

**All Influenced by Genetics**

**CDC: National Vital Statistics Report 2010**
The Impact of Genetics!

**Jim Fixx**
- 5’10”, 150 lbs, Marathon runner
- Promoted healthy lifestyle
- Died at 52 of MI
- Father died at 43 of MI

**Winston Churchill**
- 5’8”, 270 lbs, Did not exercise
- Smoked
- Unhealthy lifestyle
- Died at 90

The Impact of Genetics!
Genomic Medicine

• Using genome variations for common diseases in medical care for individual patients with test results used for:
  - Diagnosis
  - Treatment
  - Disease monitoring
  - Pharmacogenetics
  - Prognosis
  - Disease prevention
  - Prenatal diagnosis

• Affects virtually every person

• Affects virtually every physician
Gene Patents Limit This Future

- National practice standards set by one provider
- No competition for test cost, quality or method
- Limit advances in scientific knowledge gained through broad clinical practice and observation
- Limit medical education
- Limit medical practice
- Limit broad availability of genetic & genomic tests
- **A sole provider of a medical service is not in the best interest of the public health**

Overview of Presentation

• Patents & human genes patents
• Gene patents & medical practice
• Why should we care?
• Progress toward solutions
Possible Solutions

- **Do nothing** (crossed out)
- Policy
- Congress
- Courts
National Analyses of Gene Patents

- NIH Genomic Inventions Intellectual Property Recommendations in 2005
  - Guidelines to limit patenting & exclusive licensing
  - No enforcement capability

- National Academies Study in 2006
  - Research focused with one unreasonable clinical recommendation to allow second opinion testing

- Secretary’s Advisory Committee on Genetics, Health and Society (SACGHS) in 2010
SACGHS: Gene Patent & Patient Access Task Force

- Chair: James Evans, MD, PhD, UNC Chapel Hill
- Multiple approaches to investigate the clinical impact of gene patents
  - Commissioned in-depth research study
  - Public comment process
  - Consultation on international perspectives
- Comprehensive report to HHS Secretary in 2010
SACGHS Report:  
Gene Patents and Licensing Practices and Their Impact on Patient Access to Genetic Tests

- First national study to document a negative impact of gene patents on patient access & medical practice

- Recommendations include:
  - Patent exemption for diagnostic and research uses
  - Federal monitoring of patient access problems
  - Federal promotion of broad licensing & patient access
  - Enhanced transparency in patents & licensing
Possible Solutions

- Do nothing
- Policy
- Congress
- Courts
Curved Cataract Surgery Incision
Patented & Enforced

AMA lobbied Congress for physician protection
Ganske-Frist Amendment 1996

- Medical procedures on a human body are patentable
- But physicians can perform without infringing patent
- Excludes protection for pathologists who perform clinical tests, except if performed in a physician office

- **Problem:**
  Physicians who provide clinical testing services as their medical practice not protected like other physicians from patent infringement lawsuits under Ganske-Frist
Legislative Option 1: Extend Ganske-Frist

- Exempt physicians who perform molecular tests from patent infringement actions (Rivers Bill; inactive)
  - Extend 1996 Ganske-Frist law to protect all physicians from infringement of gene patents
  - H.R. 3967 introduced by Representative Lynn Rivers
  - Rivers not re-elected, so bill never reintroduced
Legislative Option 2: Mandate Broad & Reasonable Licensing

- University of Michigan licenses Cystic Fibrosis patent to any laboratory with reasonable rates
- Congress could legislate mandatory licensing with reasonable pricing to allow broad access to and use of gene patents
- No such bills drafted to date
Legislative Option 3: Prohibit Gene Patents
H.R. 977: The Genomic Research and Accessibility Act

110th CONGRESS
1st Session
H. R. 977

To amend title 35, United States Code, to prohibit the patenting of human genetic material.

IN THE HOUSE OF REPRESENTATIVES
February 9, 2007

Mr. BECERRA (for himself and Mr. WELDON of Florida) introduced the following bill; which was referred to the Committee on the Judiciary

A BILL
To amend title 35, United States Code, to prohibit the patenting of human genetic material.
SECTION 1. SHORT TITLE.
This Act may be cited as the `Genomic Research and Accessibility Act'.

SEC. 2. PROHIBITION ON PATENT OF HUMAN GENETIC MATERIAL.

(a) In General- Chapter 10 of title 35, United States Code, is amended by adding at the end the following new section:

`Sec. 106. Prohibition on patent of human genetic material

`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.'.

(b) Table of Contents- The table of sections of chapter 10 of title 35, United States Code, is amended by adding at the end the following:

`106. Prohibition on patent of human genetic material.'.

(c) Applicability- The amendment made by subsection (a) shall not apply to a patent issued before the date of the enactment of this Act.

END
Possible Solutions

- Do nothing
- Policy
- Congress
- Courts
Greenberg v. Miami Children’s Hospital Research Institute

- Greenberg’s had kids with Canavan disease
- Helped MCHRI researchers identify causative ASPA gene (deficiency inhibits myelin)
- MCHRI patented ASPA gene
- Greenbergs brought suit b/c MCHRI limited testing
- Settled out of court in 2003

Represented by Lori Andrews, JD
Outraged by Gene Patents
ACLU Case to Stop Gene Patents

- Lori Andrews brought gene patent issue to ACLU
- Meetings held with those affected by gene patents
- ACLU chose to develop case
- *BRCA1* & *2* gene patents most clearly demonstrate problems of gene patents
**BRCA Genes & Myriad Genetics**

- Mutations in *BRCA1* & *2* greatly increase risk of breast, ovarian & other cancers in women & men
- Myriad holds patents on *BRCA1* & *2* gene sequences, mutations & correlation with cancer risk
- Myriad is sole provider of *BRCA1* & *2* testing in the US (unsuccessful enforcement in Europe & Canada)
ACLU Filed Case
May 12, 2009

- 4 medical organizations
- 6 doctors
- 2 genetic counselors
- 5 patients
- Breast Cancer Action
- Our Bodies Ourselves

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

ASSOCIATION FOR MOLECULAR PATHOLOGY, ET AL.,

   Plaintiffs,

-against-

UNITED STATES PATENT AND TRADEMARK OFFICE, ET AL.,

   Defendants.


- USPTO
- Myriad Genetics
- 10 directors of the University of Utah Research Foundation
AMP et al v. USPTO et al

Position that patent claims are unconstitutional because are products of nature, including claims on:

- \textit{BRCA1} & 2 gene & cDNA sequences,
- \textit{BRCA1} & 2 mutations,
- Comparing forms of genes (e.g. patient to normal),
- Correlation of mutation with increased risk of breast/ovarian cancer.
AMP et al v. USPTO et al: Actions

- **May 12, 2009**: Plaintiffs file in US District Court of Southern District of New York

- **August 26, 2009**: Plaintiffs move for summary judgment (court decision without trial)

- **September 30, 2009**: Defendants (Myriad) motion to dismiss

- **Nov 1, 2009**: Court rules on motion to dismiss
VIII. CONCLUSION

For the reasons stated above, Defendants' motion to dismiss the Complaint is denied.

It is so ordered.

New York, N.Y.
November 1, 2009
AMP et al v. USPTO et al: Actions

- **May 12, 2009**: Plaintiffs file in US District Court of Southern District of New York
- **August 26, 2009**: Plaintiffs move for summary judgment (court decision without trial)
- **September 30, 2009**: Defendants (Myriad) motion to dismiss
- **November 1, 2009**: Court rules on motion
- **March 29, 2010**: Court issues decision
As discussed infra in greater detail, the challenged patent claims are directed to (1) isolated DNA containing all or part of the BRCA1 and BRCA2 gene sequence and (2) methods of diagnosis, surveillance, and treatment of BRCA1 and BRCA2 gene mutations correlating with ovarian cancer. Plaintiffs, and the parties in interest, and amici, have presented the question:

Are isolated genes patentable inventions, and if so, of what kind?

Two complications involved: molecular biology and its place in society. See: the governing principles of biological essential elements of life and processes and their priority. The prior art in the fields of molecular biology and life sciences in general is vast, but the question before us is limited to the gene patents, disease-gene associations and methods claims not patentable.

VIII. CONCLUSION

For the reasons set forth above, Plaintiffs' motion for summary judgment is granted in part, Myriad's motion for summary judgment is denied, the USPTO's motion for judgment on the pleadings is granted, and the claims-in-suit are declared invalid pursuant to 35 U.S.C. § 101.

Submit judgment on notice.

It is so ordered.

New York, N.Y.
March 29, 2010

[Signature]

ROBERT W. SWEET
U.S.D.J.
AMP et al v. USPTO et al: Appeals

• **June 16, 2010**: Myriad appeals to US Court of Appeals for the Federal Circuit

• **July 29, 2011**: Appeals Court decision issued
United States Court of Appeals for the Federal Circuit

On the threshold issue of jurisdiction, we affirm the district court’s decision to exercise declaratory judgment jurisdiction because we conclude that at least one plaintiff, Dr. Harry Oster, has standing to challenge the validity of Myriad’s patents. On the merits, we reverse the district court’s decision that Myriad’s composition claims to “isolated” DNA molecules cover patent-ineligible products of nature under § 101 since the molecules as claimed do not exist in nature. We also reverse the district court’s decision that Myriad’s method claim to screening potential cancer therapeutics via changes in cell growth rates is directed to a patent-ineligible scientific principle. We, however, affirm the court’s decision that Myriad’s method claims directed to “comparing” or “analyzing” DNA sequences are patent ineligible; such claims include patent-ineligible steps and cover only patent-ineligible, abstract, mental steps.

Decided: July 29, 2011
AMP et al v. USPTO et al: Appeals

• June 16, 2010: Myriad appeals to Federal Circuit

• July 29, 2011: Federal Circuit decision issued

• September 1, 2011: Plaintiffs file Writ of Certiorari with Supreme Court

• March 27, 2012: Supreme Court grants certiorari & remands case back to Federal Circuit in light of new Supreme Court decision: Mayo Collaborative Services v. Prometheus, Inc.
Mayo v. Prometheus

• Prometheus licensee on association patent of:
  • Correlation of thiopurine metabolite levels with drug activity or side effects

• Prometheus sued Mayo for infringement (2004)

• Mayo won: Court decided unpatentable natural law (2008)

• Court of Appeals for Federal Circuit reversed decision (2009)

• Mayo filed Writ of Certiorari with Supreme Court
For these reasons, we conclude that the patent claims at issue here effectively claim the underlying laws of nature themselves. The claims are consequently invalid. And the Federal Circuit’s judgment is reversed.

It is so ordered.
AMP et al v. USPTO et al: Appeals

- **June 16, 2010**: Myriad appeals to Federal Circuit
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United States Court of Appeals for the Federal Circuit

THE ASSOCIATION FOR MOLECULAR PATHOLOGY, THE AMERICAN COLLEGE OF MEDICAL GENETICS, THE AMERICAN SOCIETY FOR CLINICAL PATHOLOGY, THE COLLEGE OF AMERICAN PATHOLOGISTS, HAIG KAZAZIAN, MD, ARUPA GANGULI, 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 CEMANI, RUNI LIMARY, GENAE GIRARD, PATRICE FORTUNE, VICKY THOMASON, AND KATHLEEN RAKER, Plaintiffs-Appellees,

v.

UNITED STATES PATENT AND TRADEMARK OFFICE, Defendant, MYRIAD GENETICS, INC., Defendant-Appellant, DIRECTORS OF THE UNIVERSITY OF UTAH RESEARCH FOUNDATION, Defendants-Appellants.

Decided: August 16, 2012
AMP et al v. USPTO et al: Appeals

• June 16, 2010: Myriad appeals to Federal Circuit
• July 29, 2011: Federal Circuit decision issued
• September 2011: Plaintiffs file Writ of Certiorari
• March 27, 2012: Supreme Court grants certiorari
• August 16, 2012: Federal Circuit decision issued
• April 15, 2013: Supreme Court hears arguments
• June 13, 2013: Supreme Court issues decision
“Genes and the information they encode are not patent eligible under § 101 simply because they have been isolated from the surrounding genetic material.”

Man-made copies of gene transcripts (cDNAs) are patent eligible under § 101 (product of nature).

Unanimous decision (8 joined & 1 concurred)
Medical Community Response

• Plaintiffs and pathology community thrilled!!

• Can invent around inability to use cDNAs for clinical testing

• Medicine can use the human genome for patient care

But Then...
**Injunction Hearing held September 11-12, 2013**

**IN THE UNITED STATES DISTRICT COURT**  
**DISTRICT OF UTAH, CENTRAL DIVISION**

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<td>Plaintiffs,</td>
<td>OPPOSITION TO PLAINTIFFS’ MOTION FOR PRELIMINARY INJUNCTION</td>
<td>Honorable Robert J. Shelby</td>
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<td>vs. AMBRY GENETICS CORPORATION, Defendant.</td>
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**UNIVERSITY OF UTAH RESEARCH FOUNDATION et al.**  

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<th>Plaintiff,</th>
<th>Defendant.</th>
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<td>vs. GENE BY GENE LTD.</td>
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Not Finished Yet!!
Timeline of BRCA Gene Patent Case

5/12/09: ACLU files original case in NY
8/26/09: ACLU summary judgment request
9/30/09: Myriad motion to dismiss
11/1/09: Motion to dismiss denied
3/29/10: NY Court overturns all patent claims
6/16/10: Myriad appeal to Federal Circuit

7/29/11: Federal Circuit upholds gene patents
9/1/11: ACLU files Writ of Cert to SCOTUS

3/29/10: NY Court overturns all patent claims
3/27/12: SCOTUS grants Cert

8/16/12: Federal Circuit upholds gene patents

4/15/13: SCOTUS overturns gene patents

6/13/13: SCOTUS hears arguments

7/13: Myriad sues 2 clinical labs in Utah
9/11/13: Injunction hearing to stop testing
Philosophical Questions

• Are patent incentives needed for discovery or clinical implementation of patented genetic information?

• Should exclusive licensing of fundamental medical knowledge be allowed?

• Is sole ownership of a disease in the best interest of the public health?
Who Owns Your Genes?

Still to be determined...