WIPO ASIAN REGIONAL TRAINING COURSE FOR TRAINERS AND INSTRUCTORS OF INTELLECTUAL PROPERTY

organized by
the World Intellectual Property Organization (WIPO)

in cooperation with
the State Intellectual Property Office (SIPO) of
the People’s Republic of China

and with the assistance of
the Japan Patent Office (JPO)

Beijing, July 23 to 27, 2001

INTELLECTUAL PROPERTY (IP) TODAY; OVERVIEW OF RECENT DEVELOPMENTS, CURRENT AND EMERGING ISSUES

(II) PATENTABILITY OF BIOTECHNOLOGY-RELATED INVENTIONS

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Biotechnological Inventions: Emerging Issues & Scope of Patentability

WIPO Asian Regional Training Course for Trainers and Instructors of Intellectual Property
Beijing, China, July 23 – July 27, 2001

Mi-Chung Ahn, Ph.D.
Korean Intellectual Property Office (KIPO)

Biotechnology & Bioindustry (I)

What is Biotechnology?
"bio": the use of biological process
"technology": to solve problems or make useful products

- the use of cellular and molecular processes
to solve problems or make products

; the application of several discrete fields of biological and chemical science to make commercial and industrial products
Biotechnology & Bioindustry (II)

Pharmacy
- Drug Development
- Genomics Application

Biology
- Natural compound
- Synthetic & Analysis

Chemistry

Marine biology
- Fisheries Management
- Gene therapy,
  Biosensor,
  Artificial organ
  Techniques

Breed Improvement
- Massive Production,
  Isolation Techniques
- Bioremediation,
  Waste Treatment

Agricultural engin.

Genetic engin.

Environmental engin.

Biotechnology & Bioindustry (III)

Growth of Word market

1997 $31B
2000 $54B
2010 $154B

<table>
<thead>
<tr>
<th>Year</th>
<th>USA</th>
<th>Japan</th>
<th>EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>'98</td>
<td>$12B</td>
<td>$9.5B</td>
<td>$3B</td>
</tr>
<tr>
<td>Market size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth rate</td>
<td>19% ('96~'97)</td>
<td>16% ('97~'98)</td>
<td>17% ('95~'96)</td>
</tr>
<tr>
<td>Number of Companies</td>
<td>1,283 ('98)</td>
<td>~500 ('98)</td>
<td>~300 ('00)</td>
</tr>
</tbody>
</table>
Importance of BioPatent in R&D and Commercialization (I)

BioPatent as R&D Information
- review of the prior arts
- disclosure of unpublished techniques
- precaution of the patent dispute
- prevention of R&D overlapping

Facilitation of Commercialization
- several huddles for commercialization
  * high quality man-power, tremendous R&D expenses, long-time payback periods, etc.

Importance of BioPatent in R&D and Commercialization (II)
- the link between invention and commercialization
  * guarantee of exclusive rights
  * no immediate competition in sales of the products
  * protection from "free riding"

"High-risk, high-return" field
- strong patent protection justify the risk-taking
  * Bioindustry (USA) as a whole lost $4.7 billion in '99
- exclusive licenses are appropriate in cases
  * Royalties : NIH ($40M), Sloan Kettering ($45M), Stanford U ($43M), Colombia U ($40M), etc
Biotechnology and BioPatents

<table>
<thead>
<tr>
<th>Biotechnology</th>
<th>BioPatent</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recombinant DNA Technology</td>
<td>US 4,237,224 ('80)</td>
<td>- Patent application after publication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- EPO, JP : novelty problem</td>
</tr>
<tr>
<td>PCR Technology</td>
<td>US 4,683,202 ('87)</td>
<td>- Royalty : 2/3 of R&amp;D fund of Stanford U. ('96, $31M)</td>
</tr>
<tr>
<td>Monoclonal Antibody</td>
<td>X</td>
<td>- Techniques for DNA amplification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Dramatically improvement of R&amp;D</td>
</tr>
<tr>
<td>DNA Chip</td>
<td>WO 90/15070</td>
<td>- No patent application</td>
</tr>
<tr>
<td>Animal Cloning</td>
<td>WO 97/07668</td>
<td>- The worst example</td>
</tr>
<tr>
<td></td>
<td>WO 97/07669</td>
<td>- World market : $5 billion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Pioneer Invention (Affimax)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Registration in USA, EU, JP, KR, etc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Process of application in 104 countries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- registered in UK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Royalty (expected) : $1billion</td>
</tr>
</tbody>
</table>

Patentability of Biotech-related Inventions (I)

Basic Patent Law Requirements
- Novelty, Inventive steps, Industrial applicability
- Disclosure Requirements : Enablement, Written Description,

As a Patenable Invention? (35 U.S.C § 101)
- " - any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement, ~"

Biotech. inventions generally fall within the categories of "manufactures" or "composition of matter"
Patentability of Biotech-related Inventions (II)

Exclusions of Patentable Inventions under TRIPS

- Art. 27.2: “to protect ordre public or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment”

- Art. 27.3(a): “diagnostic, therapeutic and surgical methods for the treatment of humans or animals”

- Art. 27.3(b): “plants and animals other than micro-organism, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes”

  * However, plant varieties should be protected either by patents or by an effective sui generis system or by any combination thereof.

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Patentability of Biotech-related Inventions (III)

Examples of Patentable Biotech. Inventions

- nucleotides (DNA, RNA, gene)
- peptides and proteins
- natural compounds in organism
- processes that are not essentially biological processes for the reproduction
- non-plant or non-animal living organism

  * Animals/plants can be patentable when they have been subject to modifications that serve to distinguish them from animals/plants found in nature.
Patentability of Biotech-related Inventions (IV)

Microorganisms
- "Diamond vs. Chakrabarty" ('80)
  "Anything under the sun that made by man is patentable"

Plants
- 'Sexually reproduced plants' by PVPA ('70)

Animals
- 'polyploid oyster' ('80) : patentable subject ?
- transgenic 'Harvard mouse' ('88)

Patentability of Gene-related Inventions (I)

What is a gene?
- the fundamental physical and functional unit of heredity
Patentability of Gene-related Inventions (II)

DNA transcription mRNA translation Protein

Genetic information

Gene expression

DNA is a chemical, when placed in an appropriate environment, will direct the synthesis of particular & specific proteins

Patentability of Gene-related Inventions (III)

Are patents granted on an individual's gene?

- No, patents do not provide any right to a person or the genes in his or her body.
Patents are granted on "isolated" gene products which have real world applicability.

Patents for DNA fragment?

- Yes, if the research discerns the role of the gene, ESTs (expressed sequence tags) or SNP (single nucleotide polymorphism) in potential commercial application.
**Patentability of Gene-related Inventions (IV)**

![Diagram showing the process from raw data of sequence to lack of utility, leading to developing new drugs.]

**Bioinventions & BioPatents**

<table>
<thead>
<tr>
<th>BioInvention</th>
<th>BioPatent</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microorganism</td>
<td>US 4,259,444 ('81)</td>
<td>Diamond v. Chakrabarty ('80) &quot;Anything under the sun that made by man is patentable&quot;</td>
</tr>
<tr>
<td>Human Gene</td>
<td>US 4,703,008 ('87)</td>
<td>human EPO gene (Amgen)</td>
</tr>
<tr>
<td>Transgenic Plant</td>
<td>US 4,776,575 ('88)</td>
<td>human tPA gene (Genentech)</td>
</tr>
<tr>
<td>Transgenic Animal</td>
<td>US 4,684,611 ('87)</td>
<td>Introduction of foreign gene to plant</td>
</tr>
<tr>
<td></td>
<td>EP 448,511</td>
<td>Novartis transgenic plant</td>
</tr>
<tr>
<td></td>
<td>US 4,736,866 ('88)</td>
<td>Harvard Mouse</td>
</tr>
<tr>
<td>SNP</td>
<td>US 5,712,098 ('98)</td>
<td>Single Nucleotide Polymorphism</td>
</tr>
<tr>
<td>EST</td>
<td>US 5,817,479 ('98)</td>
<td>diagnostic marker hereditary hemochromatosis gene mutation</td>
</tr>
<tr>
<td>Human Embryonic Stem Cells</td>
<td>US 5,843,780 ('98)</td>
<td>Expressed Sequence Tag</td>
</tr>
<tr>
<td></td>
<td>US 6,699,622 ('99)</td>
<td>eligible only in USA</td>
</tr>
</tbody>
</table>
Examination Practice of Gene-related Invention (I)

Gene Related Invention
DNA fragment, SNP, Full-length cDNA

Function is inferred by computer
Homology search, etc.

Function is analyzed and determined by experiment

Credible Utility
- An asserted utility is credible unless the logic underlying the assertion is seriously flawed, or the facts upon which the assertion is based are inconsistently with the logic underlying the assertion.
* polynucleotides used as probe or marker : credible
* protein as an antitumor agent without working examples : not credible

Specific Utility (vs. general utility)
- The subject matter claimed should be specific.
* polynucleotides used as probe or marker in the absence of particular gene or chromosome target : not specific
Examination Practice of Gene-related Invention (III)

Substantial Utility
- If the invention requires or constitute carrying out further research to identify or reasonably confirm a real world use, it does not have a substantial utility.
  * basic research just for the properties of the claimed product itself, or a method for treating an unspecified disease: not substantial

If credible, specific & substantial,
"Well-Established Utility"

* Throw-Away Utility: neither specific nor substantial
  Transgenic mice as snake food.
  Recombinant protein as animal food supplements, etc

Examination Practice of Gene-related Invention (IV)

Identify the claimed invention

- Does the invention have a well-established utility that is specific, substantial and credible?
  - Yes
  - No

- Has the applicant made any assertion of utility?
  - Yes
  - No

  - Does the assertion identify a specific utility?
    - Yes
    - No
    - Rejection

  - Does the assertion identify a substantial utility?
    - Yes
    - No

  - Is the assertion of specific and substantial utility credible?
    - Yes
    - No

- Do not reject
**Examination Practice of Gene-related Invention (V)**

Example of Utility Examination

*Claim*: The isolated protein consisting of the amino acid sequence set forth in SEQ ID. No. 1

*Specification*: Asserted utility curing Alzheimer's disease (but no working examples)

**ANALYSIS**

- It is not an well-established utility since there is no evidence for the activity of the claimed protein.
- Then, does it have an asserted utility? Yes
  - Is the asserted utility specific and substantial? Yes
  - Is the asserted utility credible? No

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**Brief Outlook of Bioindustry in Korea (I)**

**Current situation ('99)**
- Market size: $560M (1.2% of World Market)
- Annual Growth Rate: 30% ('94 ~ '99)
- Number of Companies: ~ 250

**Government Efforts**
- "Genetic Engineering Promotion Law" ('83)
- "Biotech 2000 Program" ('93)
  * National Biotechnology Development Program
Brief Outlook of Bioindustry in Korea (II)

- Government's budget for biotechnology
  - $178M in year 2000
  - an 33% increase over the previous year.

Goal for year 2010
- 6.5% of World Market
- Number of Companies: 1,200
- Intellectual Properties: 10,000

Trend in Applications & Registrations of BioPatent

1. Applications
   (Unit: Number of Applications)

<table>
<thead>
<tr>
<th></th>
<th>'97</th>
<th>'98</th>
<th>'99</th>
<th>2000(1st half)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koreans</td>
<td>596</td>
<td>823</td>
<td>959</td>
<td>281</td>
</tr>
<tr>
<td>Foreigners</td>
<td>948</td>
<td>756</td>
<td>817</td>
<td>434</td>
</tr>
<tr>
<td>Total</td>
<td>1,544</td>
<td>1,579</td>
<td>1,776</td>
<td>715</td>
</tr>
</tbody>
</table>

2. Registrations
   (Unit: Number of Registrations)

<table>
<thead>
<tr>
<th></th>
<th>'97</th>
<th>'98</th>
<th>'99</th>
<th>2000(1st half)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koreans</td>
<td>286</td>
<td>690</td>
<td>667</td>
<td>257</td>
</tr>
<tr>
<td>Foreigners</td>
<td>315</td>
<td>492</td>
<td>584</td>
<td>183</td>
</tr>
<tr>
<td>Total</td>
<td>601</td>
<td>1,182</td>
<td>1,251</td>
<td>440</td>
</tr>
</tbody>
</table>
Major IPCs of BioPatent Applications

Major IPC of BioPatent Registrations
(1990-2000.11 : total 5,385)
BioPatent Examination System in Korea

Genetic Engineering Examination Division

- It is amended to reinforce specific standards for the product of HGP. The amended one is enforced from January, 2001.

Depository System for Biological Materials
Electronic Filing System for Sequence Listing
Biotechnology Patent Sequence Search System (BioPASS)

Deposit of Biological Materials for patent applications

3 International Depositary Authorities in Korea

<table>
<thead>
<tr>
<th>Name of IDAs</th>
<th>KCTC</th>
<th>KCCM</th>
<th>KCLRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year acquired IDA Status</td>
<td>1989</td>
<td>1989</td>
<td>1993</td>
</tr>
<tr>
<td>Number of Deposits</td>
<td>1,950</td>
<td>1,489</td>
<td>26</td>
</tr>
<tr>
<td>Number of samples furnished</td>
<td>132</td>
<td>38</td>
<td>30</td>
</tr>
</tbody>
</table>
**Substance Patent & Patenable Subject Matter**

Permission of Substance patent (1987. 7. 1)
- Chemical substances, Pharmaceuticals
- Microorganisms

Expansion of Patenable subject matter (1990. 9. 1)
- Foods or Food stuff

**Unpatentable Inventions (present)**
- *The inventions liable to contravene public order, morality or public health shall not be patented* (Patent Law Article 32)

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**Plant Patent**

**Patent Law Article 31 (Patent for Plant Invention)**
- *Any person who invents a variety of plant which reproduces itself asexually may obtain a plant patent therefore.*
  : Similar to US plant patent law (introduced to Korea in 1946)

**Seed Industry Law (Plant variety protection law)**
- Enforced on December 31, 1997 : UR/TRIPs 27.3(b)
- Species eligible for protection : 57 species (2000)
- Examination Authority : National Seed Management Office
**Animal Patent**

  - Not liable to contravene public order, morality or public health
  - Require the deposit of fertilized eggs

**Examples of Animal Patents**
- Transgenic Mouse Deficient in T Cell (2000)
- Transgenic Mouse Inducing Diabetes (2000)

**Patent Applications of Animal cloning**
- 2 patent applications related with "Dolly" from UK (1998)
- Seoul National University : 10 applications

**Sequence Examination**
Electronic Filing System for Sequence Listing

Submit a sequence listing as a
- computer-readable
- standardized (WIPO ST.25) format !!

... enforced from 1 Jan. 1999

Recent status of Applications containing Sequence Listing

![Bar chart showing the number of applications for sequence listings in 1996 and 2000. The chart indicates a decrease in the number of foreign applications and an increase in domestic applications. The chart includes a note indicating a trend towards increased domestic applications.]
Examples of Application containing Large-sized Sequence Listing

- Application No. 10-2000-07005552
  Applicant: Genset, France
  Size of Sequence Listing: 5.4MB
  (A4 3,000 pages)

- Application No. 10-1999-07010172
  Applicant: Human Genome Sciences, US
  Size of Sequence Listing: 4.2MB

- Applicant: Helix, Japan
  Size of Sequence Listing: 26MB
  (A4 14,500 pages)


Biotechnology Patent Sequence Search System (BioPass)
<table>
<thead>
<tr>
<th>Subject matter</th>
<th>KR</th>
<th>US</th>
<th>EPO</th>
<th>JP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gene</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>DNA fragment</td>
<td>Yes</td>
<td>Yes (with indication of a function and utility)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Protein</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Microorganism</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Plant</td>
<td>Only a variety which reproduces asexually</td>
<td>Yes</td>
<td>Yes except, Varieties</td>
<td>Yes</td>
</tr>
<tr>
<td>Part of human body</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Human ES cell</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Surgical Treatment/ Diagnosis Method</td>
<td>Yes (animal)</td>
<td>Yes</td>
<td>No</td>
<td>Yes (animal)</td>
</tr>
</tbody>
</table>

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