ENCLOSURES OF THE MIND

INTELLECTUAL MONOPOLIES

A Resource Kit on Community Knowledge, Biodiversity and Intellectual Property

About RAFI and the Community Biodiversity Development and Conservation Program

This kit has been researched, written, and disseminated in print and electronically by the Rural Advancement Foundation International (RAFI), with a grant from the International Development Research Centre (IDRC) based in Ottawa, Canada. It is part of RAFI's and IDRC's commitment to the International Policy Program of the Community Biodiversity Development and Conservation (CBDC) program.

The CBDC is an inter-regional initiative developed by agricultural non-governmental organizations (NGOs) in Africa, Asia and Latin America, in cooperation with Northern partners, with the purpose of strengthening the ongoing work of farming communities in conserving and enhancing the agricultural biodiversity important to their security.

RAFI is a Canadian-based international NGO dedicated to the conservation and sustainable use of agricultural biodiversity, and concerned about the impact of intellectual property rights on agriculture, food security and rural communities.

Edited by Anne Gillies

Design, layout and production by DesignCo

All photos provided by IDRC

ENCLOSURES OF THE MIND:
Intellectual Monopolies

**A Resource Kit on Community Knowledge,
Biodiversity and Intellectual Property**

**Prepared for the
Community Biodiversity Development and Conservation Program
by
The Rural Advancement Foundation International (RAFI)**

Table of Contents

Why This Kit? iv
User's Guide iv
List of Abbreviations and Acronyms v

Enclosures of the Mind: An Introduction to Intellectual Monopolies 1
- The New Act of Enclosure 2
- Enclosing Diversity 4
- Enclosing Minds 5
- Enclosing Life 6
- Enclosing Strategies 7
- Enclosing Global Conventions 9

Intellectual Property Monopolies: Systems of Greed 11
- A Very Civil Monopoly… 12
- …Leads to a Very Uncivil Debate 13
- The Great Capitulation 14
- The Campaign to Patent Life 15
- The World's Intellectual Property Infrastructure 18
- The Biodiversity Convention 19
- The World Trade Organization 21

Intellectual Integrity: Systems of Generosity 25
- The Logic of Generosity 26
- Common Threads 27
- Four Case Studies: Systems of Generosity and Greed in Conflict 29

The Lords of Life 33
- Biotechnology and the Life Industries 34
- Agriculture 35
- Medicinal Plants 37
- Microbial Biodiversity 37
- Human Patenting 40

What Next: Generosity or Greed? 45
- Strategies and Options for Change 46
- National Level Strategies 47
- Regional Level Strategies 48
- International Level Strategies 48

Endnotes 54

Appendices
A: A Short History of the Patent System (table) 56
B: Who Has Access to Western Intellectual Property Systems? (table) 60
C: Bioprospecting and Biopiracy Activities (table) 62
D: The Lords of Life: Leading Enterprises in Five Major Life Industry Segments (table) 68
E: The Pharmaceutical Industry and Human Genome Companies 71
F: Glossary 72
G: Resources 78

Tables, Charts and Maps

Table One	The Debate over Intellectual Property Monopolies	16
Table Two	What the Biodiversity Convention Says	20
Table Three	South Members of the World Trade Organization	22
Table Four	GATT TRIPS – Relevant Clauses	23
Table Five	Agricultural Innovation and Intellectual Property	28
Table Six	The Role of Community Knowledge in Global Development	29
Table Seven	International Patent Culture Depositories: Budapest Treaty	38
Map	Centres of origin of domesticated plants and animals	39

USER'S GUIDE

Inside the kit, users will find the following information:

- a short history of the revolution in intellectual monopolies
- practical definitions of the legal terminology used
- an overview of different interpretations of intellectual property issues within the international debate
- trends of concern to agricultural producers and rural societies
- a description of international organizations and meetings where the intellectual property debate is occuring. Boxes at the beginning of each chapter give a short summary of its key contents and arguments, and describe how the chapter can be used.

Tables, charts and maps throughout the text give some information in summary form. Other tables in Appendices A, B, C, D, and E provide more detailed information on specific topics linked to the main text.

Many key terms are presented in **bold** type the first time they appear in the text. Sidebars in the text give short definitions of key terms used for the first time. Detailed definitions are provided in the Glossary in Appendix D.

Why This Kit?

This kit is designed as an information and advocacy tool in response to two new, legally-binding international agreements.

- The Convention on Biological Diversity, adopted at the Rio Earth Summit in 1992, came into force in December 1993. The Biodiversity Convention affirms the sovereignty of nations over their biological resources, but also accepts the concept of "intellectual property" over living materials.
- In June 1994, at Marakesh, the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) was signed, and on January 1st, 1995 the World Trade Organization (WTO) came into being to administer and monitor both the Uruguay document and the ongoing process of global trade harmonization. For the first time, a global trade accord contained explicit obligations for signatory states to adopt legislation for intellectual property, including monopolies over life forms.

Although both these agreements have the force of international law, there remains considerable flexibility in how governments might interpret and implement their intellectual property provisions. Further, the time frame for implementation permitted under the agreements is either undefined, or allows legislators considerable leeway well into the first decade of the next century.

With information about the debates that are occurring internationally, non-governmental organizations (NGOs), farming people, and sympathetic policy makers have an opportunity to influence national and international policy decisions on intellectual property that could have a profound effect on the lives and livelihoods of people in the South.

With this in mind, the kit is intended to be used mainly by two audiences:

1) Farming communities, agricultural NGOs and activists in the South who wish to understand the (sometimes deliberately) confusing debate over intellectual property and increase their background knowledge of the key actors and issues.

2) Southern policy makers both inside and outside governments who wish to join the debate on intellectual property will find the kit helpful in suggesting entry points and means for influencing decisions at the national and international levels.

Governments must still negotiate definitions and potentially conflicting requirements concerning the innovative genius of indigenous communities and the Western concept of intellectual property. The debate over these terms may well occupy the next decade of intergovernmental negotiations and more information is needed to give governments and non-governmental activists the tools to participate fully in these discussions.

List of Abbreviations and Acronyms

CBDC	Community Biodiversity Development and Conservation Program
CGIAR	Consultative Group on International Agricultural Research
COP	Conference of the Parties to the Biodiversity Convention
FAO	United Nations Food and Agriculture Organization
GATT	General Agreement on Tariffs and Trade
HGDP	Human Genome Diversity Project
HUGO	Human Genome Organization
IDRC	International Development Research Centre
IP	Intellectual property
IPR	Intellectual property rights
NGO	Non-governmental organization
PBR	Plant breeders'rights
RAFI	Rural Advancement Foundation International
TRIPS	Trade-Related Aspects of Intellectual Property
UNCED	United Nations Conference on Environment and Development
UNCTAD	United Nations Trade and Development Organization
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPOV	Union for the Protection of New Varieties of Plants
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

Chapter 1

This chapter summarizes the major issues in the present debate on intellectual property, including

- the new industrial/agricultural revolution and its impact on life
- the new "enclosure of the commons" by life industries
- the importance of global biodiversity
- the North's dependence on Southern genetic resources and knowledge systems
- how the knowledge of indigenous communities is being lost and expropriated
- the definition of intellectual property
- the role and scope of current global accords that govern intellectual property rights.

For additional information, see **Appendix A: A Short History of the Patent System,** showing some of the precedent-setting incursions of intellectual property regimes into different areas of life.

ENCLOSURES OF THE MIND
An Introduction to Intellectual Monopolies

OVERVIEW

A new industrial and agricultural revolution is underway that enables the private sector and transnational corporations to create monopolies over many biological processes and life forms through the use of intellectual property. Intellectual property laws now allow patents on living organisms and can be used to privatize indigenous knowledge. Biodiversity, a diminishing resource, has been adequately managed up to now by many indigenous farming societies and cultures. New life industries that use biotechnology and operate under intellectual property systems are poised to take control of valuable organisms and knowledge systems under international accords such as the Convention on Biological Diversity/Biodiversity Convention and the General Agreement on Tariffs and Trades (GATT).

The New Act of Enclosure

For most of history, security and the route to power have been invested in land: land to graze animals, gather food and medicine, collect fuel wood, and build shelters. In virtually every farming society, some portion of the available land is set aside as "the commons" for the entire community. Although there may be rules governing access to and use of the commons, often logically linked to seasonal or other biologically-determined factors, they have remained outside of private ownership.

This was the situation in Europe until the agricultural revolution in the late 18th century, when powerful landlords, championing the cause of scientific progress and claiming the need to feed the continent's growing population, persuaded the governments of the day to allow them to buy the commons. What was not for governments to sell became the private property of the already-rich. Within a matter of decades, landlords fenced off the commons in a political coup that became infamous as the Acts of Enclosure.

Europe's farming communities lost much of their most important land. Their access to forages and medicines was curtailed. Millions were driven from their ancestral lands either to labour in the factory towns of the new scientific revolution or to emigrate overseas to the Americas.

Between 1770 (when Oliver Goldsmith wrote his tragic poem The Deserted Village about the impact of the Acts of Enclosure) and 1850, the British government granted almost 12,000 patents to inventors financed by landlords made rich through the enclosures. In this way, the movement to enclose the land in 18th and 19th century Europe financed the movement to enclose human minds.

In the late 20th century, we are now in the midst of a new "act of enclosure" and on the threshold of another agricultural and industrial revolution. The new revolution combines microbiology (or **biotechnology**) and micro-electronics (or informatics). The key to this micro-revolution lies in its control of information, especially information in the life sciences. The new act of enclosure is the **intellectual property (IP)** system that allows today's "landlords" of technology to expropriate our intellectual commons, which is the knowledge and skills of farming and indigenous peoples both today and back through history.

The rationale for the new enclosure is disturbingly similar to the arguments made by landlords in Europe two centuries ago:

- A rapidly multiplying human population, say proponents of biotechnology, is in danger of running out of food and of destroying the viability

Ill fares the land, to hast'ning ills a prey,
Where wealth accumulates and men decay...

– Oliver Goldsmith, The Deserted Village, *1770*

of the entire planet. New, expensive, research-intensive biotechnologies must be employed to feed the poor and protect the planet.

- For the new biotechnologies to succeed, the private sector and transnational enterprises must be able to protect their massive research investment through the creation of monopolies that will enable them to control access to the inventions they generate on our behalf. Industry advocates argue that corporate science needs patents, trademarks, trade secrets, and plant breeders' rights (all intellectual property monopolies) in order to save the world from starvation.

Although many people have some understanding of computers and microelectronics that allow the manipulation of vast quantities of information, most of us are less familiar with biotechnology. Biotechnology works with the products, processes, and formulas of life. In the new biotechnologies, micro-organisms, plants, animals, and even human genetic materials are merely raw materials to be manipulated, mixed and matched for the production of new life products that might feed or cure us or clean up our polluted planet. When the power of computer technologies to manage information is placed at the service of the life-manipulation powers of biotechnology, industry can take charge of the most powerful revolution in human history. When industry is allowed exclusive monopoly control over life information through intellectual property, an "enclosure of the mind" occurs.

Until recently, this subject was confined to industry boardrooms and to an exclusive circle of trade negotiators. In light of recent international agreements, the new enclosure system has assumed enormous importance for governments and people of the South. Forty percent of the world economy is based upon biological products and processes. The world's poor rely on biodiversity for 85% to 95% of their livelihoods. All this is at stake in the global drive to allow the patenting of living organisms. For farming and other rural communities, the struggle against the new enclosures of the mind is a fight for survival.

Enclosing Diversity

Biodiversity, once thought to be a bottomless bounty, is now a diminishing resource. Like any resource in the commercial world, scarcity increases its value. As the so-called raw material of the new biotechnologies, biodiversity (specifically the genes and gene complexes within diverse plant and animal species, **microorganisms,** and even human

biotechnology
Techniques that involve the use and manipulation of living organisms to make commercial products.

Intellectual Property (IP) or Intellectual Property Rights (IPR)
Laws granting legal monopoly protection to those who create ideas or knowledge.

biodiversity
All living organisms, their genetic material and the ecosystems of which they are a part.

microorganisms
Tiny living organisms, only visible with a microscope, that include algae, bacteria, fungi and one-celled animals.

beings) is gaining in economic significance. The control of the remaining diversity has both ethical and economic dimensions.

We are losing 1% of the rain forest every year, 2% of our cereal crop diversity and 5% of our diversity in livestock breeds. Seventy percent of the coral reefs will be gone before the middle of the next century. Between a fifth and a half of all the rural cultures being practiced today will be extinct within another generation. Four fifths of the earth's biological resources or bioresources are found in the lands and waters of the South. The cash-poor but gene-rich tropical and sub-tropical regions of the world harbour a vast (if declining) cornucopia of living organisms in unique ecosystems ranging from rain forests to range lands to coral reefs. Within these ecosystems lie possible solutions to food security, livestock fertility, human senility, industrial lubricants, and textile dyes.

Finding the economically-important genetic combinations among tens of millions of species can be a daunting and expensive proposition. The cost-efficient route to biological resources, therefore, is to tap the knowledge of the farming and indigenous communities whose genius has nurtured and developed bioresources for hundreds of generations.

Industry's dependence upon the knowledge and advice of rural and farming communities is a source of considerable discomfort to corporations and Northern governments. Dependence implies debt and benefit-sharing. It is more convenient to promote the assumption that the most valuable biodiversity remains undiscovered and wild.

But, the biological resources of the South are seldom wild, unstudied, unmanaged or even unimproved. The people who live with and depend upon biodiversity for their survival know it well and are the best (often, the only) means to developing these resources for wider uses.

Enclosing Minds

The South's farmers were the first to domesticate almost all of the world's major crop and livestock species. Farmers shared and adapted these species across millions of micro-environments long before the 20th century era of so-called "scientific" breeding. In a world where agriculture is becoming monoculture and farmers' fields take on the appearance of factory production lines, it is only in the **centres of genetic diversity** of the South that fields retain the genetic diversity critical to global food security. The accumulated and intimate understanding of farming communities, not just of individual species but of the complex inter-relationships between species and the wider ecosystem, makes their knowledge invaluable.

American cabinet officials estimate that the annual value of the South's **germplasm** contribution to two leading US crops was at least US$10.2 billion.[1] Flows of crop genes from farmers' fields in the South to other

farmers in the North, mainly via cooperative international agricultural research programmes, is estimated conservatively at US$5 billion per year.[2] Many Northern scientists acknowledge that some major food crops in industrialized countries would disappear altogether were it not for regular infusions of crop genes from the South.

Recognition of the contribution of the South's farmers to the North's food security is coming almost too late. A century that began with almost all of human society living in rural areas will end with almost half of us living in cities. Of those still on the land, at least half have been forced to surrender their local ecological and technological understanding of agriculture and biodiversity for an externally-controlled system of industrial agriculture. As farming societies lose their language and culture, so goes their agriculture. Surely, it is long past time to conserve not just the planet's bioresources but also the ecotechnologies of its rural communities.

Enclosing Life

The economic force behind the new act of enclosure is the biotechnology industry, a conglomeration led by pharmaceutical and specialty chemical companies with markets ranging from seeds and pesticides to drugs and plastics. It is also known as the "genetics supply" industry. More accurately, however, it should be known as the **life industry,** consisting of a relatively few, multi-billion dollar enterprises which use bioresources and processes for commercial purposes.

With the advent of new genetic technologies, the structure of industry has changed dramatically. Though mergers, acquisitions and product diversification are hardly new strategies for corporate concentration, biotechnology has brought a new dimension to standard market monopoly practices. Genes or bioresources, whether from fields or fungi, can be engineered and adapted to a wide range of end-uses, including agricultural, pharmaceutical, or food processing products. Corporations have become **biopirates** in search of biological treasures found only through the road maps in the minds of farming communities.

With the new enclosure of life by the intellectual property system, the industrialized world is effectively cutting out these Southern contributors of seeds and expertise from commercial benefit, by granting its own inventors or breeders an intellectual property monopoly over plant and animal varieties.

Rural communities have contributed massively to the global pharmaceutical industry. In 1990, for example, about one quarter of the world's pharmaceuticals were derived from plants, with an annual sales value of US$43 billion.[3] About three-quarters of these drugs, with an estimated

centres of genetic diversity
Locations where the world's food crops are found to have the greatest genetic diversity.

germplasm
The total genetic variability, represented by germ cells or seeds, available to a particular population of organisms.

life industry
Multi-million dollar industry comprised of enterprises that use biological resources and processes for commercial purposes.

biopirates
Those who use intellectual property rights to legitimize the exclusive ownership, appropriation and control of biological resources and knowledge.

The 6 basic forms of intellectual property

- **Patents**
- **Plant breeders' rights**
- Copyright
- Trademarks
- Industrial designs
- Trade secrets

In recent years, these six types have seen a number of variations, designed to cover such things as microorganisms, computer circuitry and computer programmes. All operate by exclusion. They give a monopoly to the owner of intellectual property, who is granted the legal right to exclude others from making or using the protected creation without permission. Patents and plant breeders' rights are the two forms of intellectual property most relevant to living organisms.

yearly sales value of US$32 billion, were "discovered" by pharmaceutical corporations because of their prior use in indigenous medicine. Yet traditional healers and indigenous communities have seldom been recognized or compensated, despite their ongoing contribution to science and industry.

The proportion of the pharmaceutical trade that is plant-derived is predicted to grow. One quarter of the 500 million medical prescriptions written each year in the US involves a pharmaceutical derived from a leafy plant. The sales value of these prescriptions in 1990 was estimated to be US$11 billion a year.[4] Until recently, it was not permissible in many industrialized countries to patent drugs that were important to human well-being. In the new era of enclosure, all industrialized countries now allow patents on pharmaceuticals.

With the growth of biotechnology, industry and scientists are using intellectual property to gain monopoly control over biological resources and the knowledge of farming communities from the South for 17 to 25 years. This is biopiracy. For farmers and farming communities it may mean having to pay for the products of their own genius. It will certainly mean they go unrewarded for their contribution to corporate profits.

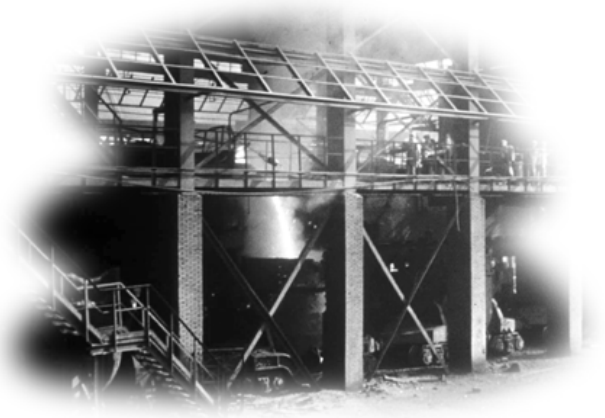
Enclosing Strategies

That biodiversity is declining, that corporations are becoming more concentrated, or even that the South's bioresources are being pirated, is something less than news. That something as esoteric as intellectual property plays a significant role in all this is probably more of a surprise.

Intellectual property encompasses a group of laws that were intended to protect inventors and artists from losing control over their intellectual creations, such as sewing machines, books, or pottery designs. Everyone from Galileo to Pasteur and Picasso has used intellectual property to make sure that others didn't steal their inventions or creations. The theory is that intellectual property laws give inventors and investors confidence that their work will be rewarded and not pirated. Without that assurance, IP supporters argue, inventors wouldn't invent and investors wouldn't put up the research funds they need.

Over time, intellectual property regimes have grown into mechanisms that allow corporations, not individual inventors, to protect markets rather than ideas. Rather than ensuring that inventors have an opportunity for reward, IP provisions now grant exclusive monopolies that are scale-biased to allow major enterprises to trade technologies among themselves and keep smaller enterprises out of the marketplace altogether.

The protection of knowledge is not unique to Europeans. Specialization of knowledge, and rules governing access to certain types of knowledge,



are found in virtually all societies. But patent laws are a European invention of the 19th century, and were designed to defend the factory machinery of the agricultural and industrial revolutions. Intellectual property laws were not intended to allow monopolies over the products and processes of life. Most national laws in Europe went to great lengths to exclude IP over living materials, foods or medicines. Yet in the past few decades it has become increasingly common for intellectual property to be granted in all of these prohibited areas.

This has happened in two ways:

- Plant breeders' rights (also known as "plant variety protection" laws) were introduced in most industrialized countries in the 1960s and 1970s. These laws granted legal monopolies (more limited than patents) to those who developed new varieties of plants such as wheat or bean varieties.
- Beginning in 1980, court decisions in the United States opened the floodgates to the patenting of all living organisms, including plants, animals, genes, microorganisms and even human genetic material.

Owning intellectual property over living things is not like owning individual cows or fruit trees, a vegetable garden, a rice harvest, or a fish pond. It is a different and more far-reaching form of ownership. The distinction can be likened to the difference between owning a bucket (or lake) full of water, and owning the chemical formula for water. A patent holder for water's chemical formula would have the right not only to decide who could have access to a particular lake, but to any water anywhere, and to the use of the chemical formula for any purpose.

When someone has intellectual property rights over a new wheat variety, for instance, anyone else who grows it must pay a royalty to the intellectual property holder. In fact, it is more and more possible for IP holders to prohibit farmers from saving seed for the next year's planting or to exchange seed with neighbours. Under patent laws, it is also possible to monopolize the parts of a plant or animal such as specific genes or genetic characteristics. If someone is granted a patent on a gene that determines an inherited plant or animal trait, or controls the onset of a human disease, they acquire enormous power in the marketplace because they set the conditions for access and sale of the patented technology. Others must obtain a license from the intellectual property holder to use it.

By legal sleight of hand, the inherited characteristics of living organisms, the building blocks of life itself, are defined as intellectual property. They are protected by monopoly rights and traded as commodities in the global market place. In recent years, in fact, intellectual property has become a trade and environment issue in international treaties.

patent
A form of intellectual property law that legally recognizes a product as novel, useful and "non-obvious".

plant breeders' rights
A form of intellectual property law that legally grants a plant breeders' certificate to those who develop new plant varieties.

Enclosing Global Conventions

Until very recently, intellectual property was subject only to national legislation. In the mid-1990s, however, it became an international obligation. After eight years of heated negotiation, 1994 saw the conclusion of the Uruguay Round of the **General Agreement on Tariffs and Trade (GATT)** and the creation of the **World Trade Organization (WTO)** which came into being in January 1995 to administer the multilateral accord. By January 1996, the WTO had 115 member states, most of them from the South.

For the first time in history, the WTO/GATT agreement includes a little-known section on **Trade-Related Aspects of Intellectual Property (TRIPS),** which represents the globalization of the intellectual enclosure system. The powerful WTO now obligates signatories who don't already have such legislation to adopt intellectual property laws for plant varieties and microorganisms. Many have observed that this is an assault on national sovereignty, in an area historically left to national discretion. Until TRIPS, all nations were free to determine whether and how they would recognize intellectual property.

Most developing countries, and some European states, had chosen not to permit patents on food, pharmaceuticals, or other human essentials. The new accord fundamentally undermines this sovereign right. The effect of this imposition will be to legalize and facilitate the North's appropriation of resources and knowledge from the South. Over 99% of all patents and plant breeders' certificates on living organisms are held in the North. Under TRIPS, the only intellectual property in the world that is not protected is the genius of farming and other rural societies. The WTO legitimates the piracy of community innovations on a global scale.

Not long before the WTO deal was signed, the **Biodiversity Convention** came into force, following its adoption in 1992 at the UN Conference on Environment and Development (UNCED or Earth Summit) in Rio de Janeiro, Brazil. The convention is a legally binding document that had been ratified by 128 governments as of October 1995. It makes several references to the conservation of indigenous knowledge in rural societies, and to the critical role that farmers can play in nurturing biodiversity. The Convention also includes clauses endorsing intellectual property over l i f e forms. Yet neither protection of farming communities' knowledge nor the implications of the Convention's intellectual property clauses have been fully spelled out by signatories to the agreement.

The Convention, like the WTO, facilitates the expropriation of biological resources and knowledge from the South, especially in its articles on access to genetic resources and technology transfer. It encourages one-to-one, bilateral arrangements between those (mostly corporations) who want access to resources and knowledge, and governments which are

General Agreement on Tariffs and Trades (GATT)
International negotiating forum, founded in 1947, for industrialized nations to regulate trade and tariff arrangements.

World Trade Organization (WTO)
International body which came into being on January 1st, 1995 to monitor GATT agreements and pursue global trade objectives.

Trade-Related Aspects of Intellectual Property (TRIPS)
GATT/WTO agreement negotiated in 1994 that requires member nations to conform to industrial country standards of intellectual property and sets down minimum requirements for intellectual property coverage of living organisms.

Convention on Biological Diversity or Biodiversity Convention
Legally-binding international agreement for conservation and sustainable use of biodiversity which came into force in December 1994.

bioprospectors
Companies and individuals who explore, extract and screen genetic diversity and indigenous peoples' knowledge for commercially-viable genetic resources.

deemed to have sovereign control over the resources that corporations may want. Yet the Convention proposes no binding multilateral para meters or internationally-accepted code of conduct for such negotia tions. Tragically, while granting sovereignty to governments over the indigenous knowledge and the resources of rural societies, the Convention fails to spell out any protection for community innovation systems. Farming communities risk being played off against one another by corporate **bioprospectors** and even by their own governments. Reviewing the Biodiversity Convention, a Ciba-Geigy (now Novartis) official wrote that the agreement could be interpreted to do a better job protecting intellectual property than the WTO.[5]

The WTO and the Biodiversity Convention could amount to a pincer movement, threatening the genius and genetic resources of farming communities. But the pincer is by no means closed. The Convention is now engaged in a multi-year process of negotiation over its approach to indigenous knowledge and intellectual property. The WTO will review its intellectual property chapter in 1999. No developing country is obliged to adopt IP legislation consistent with TRIPS until at least the year 2000. "Least-developed" countries (a term not yet defined by the WTO) have until 2004. There is scope for change and cause for optimism.

Chapter 2

Read this chapter to get more details about how Western intellectual property systems evolved, and the operation of the present international infrastructure of intellectual property. Key information includes

- a brief history of European patent laws and intellectual property systems
- the rationale behind the patent monopoly system in industrialized countries
- an overview of the key influences and agreements in the present global intellectual property system
- the issues at stake regarding access and control to knowledge under existing IP agreements.

Refer to **Appendix A: A Short History of the Patent System** and **Appendix B: Who Has Access to Western Intellectual Property Systems?** for more information on the development of intellectual property systems over time.

INTELLECTUAL PROPERTY MONOPOLIES
Systems of Greed

OVERVIEW

The world's present intellectual property system has its roots in 19th century European efforts to promote scientific and industrial growth. Patent laws gave inventors monopolies that brought economic benefits and discouraged competitors. Stiff resistance to the patent system saw patents as a barrier to the spread of new technologies. As a compromise, European nations agreed in 1873 to establish compulsory licensing of patents, but it did not last long. An international intellectual property infrastructure dominated by industrialized Northern nations has evolved up to the present day to include a range of conventions and agreements governing everything from industrial property to plants and other life forms in both North and South. Two recent and very significant agreements are the Biodiversity Convention of 1992 and the WTO/GATT TRIPS of 1994. These agreements protect the biotechnology industry and oblige signatories to pass intellectual property legislation. Farming communities and Southern countries are marginalized from the rewards and benefits of industrial intellectual property systems.

A Very Civil Monopoly...

The royal prerogative to grant monopolies is as old as written history. Cooks were granted one year monopolies over new recipes in the seventh century B.C. Monopolies over fishing and textiles were not unusual in ancient Rome. The Dutch and the Venetians granted competing patents for telescopes in the days of Galileo. Seventeenth century England employed a whole range of monopolies, including the charters granted to regional trading companies (the British East India Company and the Hudson's Bay Company, for example) and specific monopolies for mechanical inventions. Whether the monopolies were for trade or for inventions, the logic was the same: high-risk and high-cost work deserved special protection and rewards. If Eli Whitney took the time and trouble to invent a cotton gin, it was not fair that someone else could come along, copy the machine, and reap the rewards, having contributed nothing to the enterprise. State-imposed monopolies were seen to be an easy and inexpensive method of encouraging innovation and ensuring benefits for the inventor.

In fact, intellectual property, as the logical extension of private property, seemed to be a near-perfect mechanism to stimulate scientific progress:

- By limiting the monopoly to six or a dozen years, the patent system recognized that every invention is built upon people and ideas that have gone before. The temporary nature of the monopoly made sure that no one would have a permanent grip on an industry or a technology.
- The temporary monopoly encouraged secretive inventors to reveal their inventions rather than keeping them as trade secrets. To be patented, an invention had to be adequately described so that someone else could replicate the same idea. The actual invention had to be made publicly available for others to study and possibly improve upon.
- The monopoly would be useless unless it was commercialized. Patents did not guarantee wealth, they only ensured that an economically-useful invention, bought or used in a commercial context, would return profits to the inventor only. Having a patent did not mean having a guaranteed profit. If society did not find the invention helpful, the inventor would not be able to charge royalties and would not make money.
- Patent laws were established as part of civil law, not criminal law. If someone usurped an invention from the patent-holder, society did not come to the rescue with the police as they would over private property theft. The inventor would have to take the patent pirate to civil court.

…But times are alter'd, trade's unfeeling train
Usurp the land and dispossess the swain…

– Oliver Goldsmith, The Deserted Village, 1770

- All the costs associated with patent applications and litigation were to be borne by the patent-holder, not by society.

In short, by allowing inventors a brief monopoly over their own ideas, society could encourage scientific progress at no cost to the country.

Refer to **Appendix A** for a summary of how the patent system has evolved through time, including highlights of some of the precedent-setting incursions of intellectual property laws into plant, animal, microbial and now human life.

…Leads to a Very Uncivil Debate

For many, proof of the efficiency of the patent system lay in Britain. During the agricultural and industrial revolutions of the 18th and 19th centuries, Britain led Europe in technological development. Although France was acknowledged as the center of science and Germany was credited with many scientific principles of commercial application, Britain was the country that carried ideas into practice and won the commercial rewards. Struggling to find a reason for this, many Europeans concluded that it was the incentive provided by British patent laws. Technological historians doubt that this was so.

During the period of intense social upheaval that plagued continental Europe into the middle of the 19th century, including the French Revolution and the Napoleonic Wars, scientific progress in Great Britain leapt ahead. British industry was spared most of this unrest, so while the cream of French and German science marched either into war or up the steps to the guillotine, their English counterparts carried on. Yet some of the most important inventions of the period were never patented or were the result of British government competitions in which successful inventors were guaranteed a flat payment for devising a specific problem-solving innovation.

European governments followed the lead of revolutionary governments in France and the United States and adopted their own variations of the British patent system during the first half of the 19th century. By mid-century, however, many scientists, industries and countries began to have their doubts. Patents seemed to give technology leaders more market advantage than anticipated. It was hard for others to catch up. In general, technology-importing countries saw little reason to adopt patent laws that would force them to export royalties to other countries. Technology exporters, on the other hand, were anxious to take out patents in every country that offered a market. Even the United States, which had entrenched patents in its constitution, was reluctant to recognize foreign patents since it too needed cheap access to British technology in order to develop.

Patents, Exclusive Monopoly and the Conditions of Sale

Legal linguistics aside, you can get a patent in most countries if your invention is:

- new (or can claim "absolute world novelty")
- non-obvious (that is, includes a real inventive step)
- useful (has commercial application).

In return for depositing a sample of the patented product or process and describing it so that others skilled in the art can do the same thing, inventors get the right to:

- exclusive monopoly over the invention for 17 to 25 years
- royalties (a surcharge above the normal sale price) on the use of their invention
- control access and set the conditions for the sale of the invention, meaning the right to deny or vary costs depending on the customer and the market conditions.

Under normal monopoly practices, patent-holders have the right to determine the price (and royalty rate) for access to their invention. Everyone who can pay can use the invention. This ensures that the inventor can obtain a return on the investment involved in developing the invention, if customers are interested.

Current patent regimes, however, allow for exclusive monopolies, meaning that patent-holders may arbitrarily set the conditions for access to their inventions. Patent-holders can set different conditions (price and other market considerations) for different companies and exclude some buyers outright. A life industry, for example, could license another company to use its pesticides in Asia, in return for the other firm's plant varieties in Latin America or its pharmaceuticals in Africa. New or smaller companies that don't have the market or industry breadth of the bigger firms can't make deals like that. Patents, therefore, are scale-biased in favour of multinationals.

Between 1850 and the early 1870s, technology importers in Switzerland and Germany ardently resisted every move to impose patent laws in their countries. The Dutch and even the British moved to reduce the patent monopoly, and parliamentary debates were vociferous in accusing patent monopolies of being barriers to progress.

Why the uproar? First, proving ownership over intellectual property or over ideas was no easy matter. Inevitably, disputes led to legal costs and legal costs meant that the individual (or company) with the deepest pockets had the best chance of winning in the courts. The vast gray area between a genuinely new idea and one which was just a minor variation on an old idea gave room for endless legal wrangling. Second, and more important, patents did not (as the public assumed) merely allow inventors to obtain royalties on their ideas. They established inventors'rights to use exclusive monopoly to set the conditions of sale for their inventions.

Exclusive monopoly allowed patent-holders to determine who would have access to technology and under what (often varying) conditions. This meant that a patent-holder, almost invariably a company, could vary the licensing cost to customers in return for certain non-cash favours or advantages. The inventor could even deny access to some customers regardless of their offer. Thus, companies could use the patent system to keep other companies or countries out of certain markets.

For the newly industrializing countries of Europe and North America in the 19th century, the patent system was clearly a barrier to new technologies and trade opportunities. Technology-dependent German companies found it hard to obtain British inventions at reasonable prices. Later, when Germany caught up to Great Britain, Swiss chemical and textile manufacturers complained that German technologies were inaccessible when patents were involved. By and large, American enterprises ignored European patents and took whatever technologies their economy required, while at the same time being sure to patent their home-grown discoveries.

The Great Capitulation

With patent-holders on the defensive, governments and industry met at the 1873 World's Fair in Vienna to resolve their differences. Industry proposed to accept **compulsory licensing** to make technologies available at equitable prices if competitors could prove that patents were not being "worked" to the benefit of society or were not accessible at prices that were reasonable.

Countries and companies initially opposed to the patent system assumed that compulsory licensing would ensure that patents would be available as public interest dictated. Over the ensuing quarter-century, governments in most Western countries and Japan adopted a uniform system of patent

protection. Those who had revoked patent laws re-instituted them, and the world looked forward to an era of unparalleled technological progress.

The Campaign to Patent Life

The late 20th century has seen further patent system developments around the patenting of life forms that are products of biotechnology and industrial manipulation of genetic materials.

- In 1980, the US Supreme Court ruled in the landmark case of *Diamond v. Chakrabarty* that genetically engineered microorganisms are patentable.
- In 1985, the US Patent and Trademark Office ruled that plants (previously protected by plant breeders rights) could qualify under industrial patent laws.
- In 1987, the US Patent and Trademark Office ruled that animals are patentable.

As a result of these decisions, virtually all living organisms in the United States, including human genetic material, became patentable subject matter, just like any other industrial invention. As one industry analyst explained: "Since 1980 it can no longer be said that something is not patentable just because it is living… (B)iotechnology has advanced so rapidly in recent years that there is now virtually no life form which does not have … potential as the subject of patent application."[7]

For the life industries that use sophisticated biotechnology techniques, living organisms and knowledge about their uses have become prized commodities. Companies seek to control them by claiming intellectual property rights. In the United States alone, biotechnology patent applications increased by more than 74% from 1988 to 1993. According to Dr. Alan Goldhammer of the American-based Biotechnology Industry Organization, total product sales for the US biotechnology industry rose from US$4 billion in 1991 to an estimated US$7 billion in 1994.[8] Similar trends were seen in other industrialized countries.

Biotechnology is a global industry, and intellectual property has become big business. Intellectual property laws in one country are of limited value to corporations without parallel recognition in others. That's why the US and other industrialized nations have lobbied aggressively in recent years for international harmonization of intellectual property legislation. With a global reach, intellectual property laws give transnational corporations extraordinary economic control in new markets, by allowing them to collect royalties and to set the conditions for access to new technologies.

Taking the Patent Cure

Are patent monopolies an efficient way for society to encourage beneficial research? According to the US Office of Technology Assessment (OTA), American pharmaceutical companies (in 1990 dollars) spent an average of US$194 million bringing new patented drugs to market in the 1980s. Is it worth it? Not according to researcher Anita Kunz: "Of the 348 drugs introduced by the 25 largest pharmaceutical companies between 1981 and 1988, only 12 (or 3 percent) were deemed important therapeutic advances by the [US Food and Drug Administration]." The vast majority (97%) offered little or no treatment advance. Sick Americans paid US$67 billion for this in 1990. Approximately one-fifth of this payment was in the form of patent royalties. The exact cost of monopoly pricing made possible by patents is a larger, but uncertain, figure.[6]

The US pharmaceutical industry stands even less ennobled when one considers a government report that 70% of the useful new drugs were based on government funding and/or public sector research, even though the patents were acquired by private companies.

Were most new American drugs simply useless, we might have cause to complain, but not to panic. As drug prices soared at four times the rate of inflation in the early 1990s, the US General Accounting Office revealed that more than half of all new drugs have serious, even life-threatening, risks, even after US government approval. Could not society find a less expensive and dangerous way to develop new drugs?

compulsory licensing
A legal mechanism that obliges patent holders to make their inventions available at equitable prices.

TABLE 1

The Debate over Intellectual Property Monopolies

ISSUE	IN FAVOUR
What is intellectual property?	A free market mechanism that allows private enterprise to develop and introduce new technologies and ideas with the aid of a temporary monopoly that costs taxpayers nothing.
Is IP a matter of human rights?	The right of inventors to protect their inventions and to benefit from them is a traditional human right recognized under the Universal Declaration of Human Rights.
Who are the inventors?	IP Systems afford equal protection to individual inventors and multinational corporations. If a single inventor working in her home develops a patentable idea, she can force even the largest corporations to honour her patent and pay royalties for its use.
Does investment need protection?	Inventors produce ideas that can easily be copied by others who have contributed neither time nor money to their development. Unless inventors have intellectual property protection, they have little hope of recouping their investment costs or of profiting from their work.
Why a monopoly?	Inventors have a temporary monopoly only for the 17 to 30 year period in which they pay registration fees for their discovery in most countries. The temporary nature of the monopoly acknowledges that the invention is based upon other ideas that have gone before. When the protection period expires, the invention is free to anyone who wishes to use it.
Why exclusive monopoly?	Given the enormous research investment in fields like micro-electronics and biotechnology, inventors must be able to obtain royalties and be free to set the conditions under which others will have access to their ideas.
Is the IP system scale-biased?	Patents are equally available to individuals and large corporations with patentable ideas. Independent patent offices adjudicate disputes under the rule of national law.
Do patents encourage innovation?	Without the opportunity to protect ideas, we would not have biotechnology, new pharmaceuticals, chemical agricultural inputs or advances in computers, communications and transportation.
Do patents encourage research investment?	Why would anyone invest in an idea if the idea could immediately be taken and exploited by others?
Do patents encourage dissemination of technology?	Patents encourage technology diffusion by: (1) requiring the inventor to fully disclose the patent so that another skilled person can reproduce the same invention; (2) ensuring the idea will be freely available to everyone when the patent expires; (3) giving the inventor confidence that the idea can be released in the marketplace without losing benefit.
Do patents encourage more inventors?	If creative people can expect to reap the benefits of their inventions and if they find favour in the marketplace, they will be more inclined to invent.
Do patents encourage competition?	Companies cannot live off one another's research, so they are encouraged to undertake their own research and improve on products and processes in the marketplace. This stimulates competition and benefits society.
Do patents encourage diversification?	Because patents encourage investor and inventor confidence, they are more likely to take risks and explore unorthodox areas of research. In some fields, companies are likely to diversify their research activities.

IN OPPOSITION

An artificial monopoly created by the State on behalf of private interests that allows industry to withhold ideas and charge monopoly prices for the ideas they make available.

Recognizing that every inventor and invention stands upon the shoulders of those who have gone before, society's right to inventions supersedes the rights of the inventor. The right to imitate is entrenched in the Universal Declaration of Human Rights.

Over 95% of all patents are held by large companies or government institutions.

Today's inventors work for corporations who use inventions to increase their production, efficiency or market access, and they receive an immediate and direct benefit from their investment as a result. The owner of a new invention usually has a two to three year lead time in the marketplace in which to establish her or his identity before competitors can copy the idea, so there is no need for monopoly.

There are many tricks that corporations use to extend the life of a patent, whether through placing the primary invention within a patent "family" and/or by adding supplementary patents on products or processes. Even a 20-year patent on a new technology can "cap" the knowledge that has gone before and lead to market domination for generations to come.

A fair return on investment can be achieved by setting a standard royalty rate for anyone seeking access to an invention. To allow companies to set the conditions and costs for access means that IP can be used as a non-tariff trade barrier against smaller firms or poorer regions. There is no economic reason for exclusive monopoly.

The average cost of a patent application in the United States is more than US$10,000 and the average cost of patent litigation is more than US$250,000. Patent power goes to the companies with the deepest pockets and the largest stable of lawyers.

Government studies in Canada, the United States and the UK have independently concluded that there is no evidence the patent system encourages innovation. There are no statistics to support the contention that granting exclusive monopolies encourages innovation. Reason suggests that monopolies, by their very nature, encourage complacency and discourage risk-taking.

There is no empirical evidence to correlate research activity with private investment. In industrialized countries, patents encourage the transfer of public sector research funds, personnel, and inventions to the private sector, so that society tends to pay twice, once for the basic research through tax dollars, and then for the applied research through royalties and monopoly pricing.

Throughout history, technology-importing countries (including the US and Switzerland) have opposed patents as a barrier to their access to technologies necessary for development. Only when countries become technology exporters do they favour patents.

Almost all the world's patents are granted to corporations not individuals. Statistics on the number of individual inventors are scarce, but in the case of the US Plant Patent Act, the ratio of plant breeders to the general population has declined steadily since the legislation was introduced 65 years ago.**

Rather than developing new ideas, most corporations spend money trying to "invent around" a competitor's idea. In agriculture, this approach is known as "chrome and tailfin" plant breeding, in which breeders make a minor alteration to an existing variety and then stake their own patent claim. Big companies can overwhelm the patents of little companies or single inventors.

No empirical data exist to show that patents encourage diversification. In American agriculture, the record of both the Plant Patent Act and the Plant Variety Protection Act indicates that corporate breeders concentrate on the high-value, established markets and do not move into high risk areas. Patents are used to consolidate old markets, not to create new ones.

**RAFI Communiqué, "Sixty Five Years of the US Plant Patent Act (PPA)", November/December 1995.

Patents From Plants to People

- There is a product and a process patent on the agro-bacterium that fixes soil nitrogen around the roots of one soybean variety.
- There are a half-dozen patents on specific genes conferring yield improvement and disease resistance in the soybean.
- There is a patent on the high-lysine characteristic in the plant's oil.
- There are patents on the inbred lines used to create an experimental hybrid soybean.
- There is a plant breeders' rights certificate on the entire plant variety.
- There is a species patent on transgenic soybeans.
- There is a patent on the cow (and her calf) that eat the soybean meal.
- There's another patent on the Bovine Growth Hormone that helps convert the plant to milk…
- There is yet another patent on the human cell line of the farmer…
- …and still another on DNA fragments related to her brain.

For example, in India over 70% of pesticides are applied to cotton and rice. The Indian government is hoping to develop a genetically engineered cotton that will be resistant to the cotton bollworm. They want to develop a cotton variety containing the insect-resistant Bt toxin gene. Bt or *Bacillus thuringiensis* is the most widely-used source of natural insect resistance in the research and development of **transgenic** crops. Monsanto Corporation, a giant agrochemical firm, reportedly offered to sell its patented Bt gene to the Indian government for US$7.74 million. The cost was too high, and the Indian government was forced to reject the deal.[9]

The World's Intellectual Property Infrastructure

As the concepts and use of intellectual property rights and patents have evolved, so has an international infrastructure to deal with intellectual property concerns. IP laws are national, but countries have negotiated international agreements which deal with various types of intellectual property. The **World Intellectual Property Organization (WIPO)** is an international body based in Geneva that administers 20 conventions and treaties adopted by the world community. In addition to those dealing with copyright, trademarks, industrial designs, and computer circuits, WIPO administers several international IP agreements that are now applied to living organisms. These include two patent agreements, one agreement that governs the deposit of microorganisms for patent procedure, and two for plant breeder's rights:

- The **Paris Convention for the Protection of Industrial Property** (whose signatories form the Paris Union for the Protection of Industrial Property).
- The **Patent Cooperation Treaty.**
- Two versions of the International Convention for the Protection of New Varieties of Plants (whose signatories form the **Union for the Protection of New Varieties of Plants or UPOV**) which governs plant breeders' rights.
- The **Budapest Treaty** on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure.

Each of these agreements has been revised over time, and each has its own list of signatories, who may or may not have signed the most recent version of the agreement.

Despite a dominant world trend to harmonize intellectual property rights, the European Parliament voted down legislation on March 1, 1995 aimed at removing all barriers to **life patenting** in the European Union. It rejected a proposal to introduce common standards in Europe for the patenting of plants, animals and human genes. The issue is again before the parliament in late 1996.

The Biodiversity Convention

The Convention on Biological Diversity is a multilateral agreement ratified by 128 governments as of October 1995. When the Biodiversity Convention was adopted by the Earth Summit in July 1992, the US made global headline news by refusing to sign it. The American biotechnology industry feared its activities would be constrained by the Convention's clauses on intellectual property. Several years later, the US remains conspicuous by its absence from the list of countries which have now ratified the legally binding agreement. Intellectual property rights remain one of the most contentious issues for the Convention's signatories.

Ironically, while Northern industry fears that its right to do business is curtailed by the Convention, many in the South believe it actually facilitates the appropriation of Southern biological resources and peoples' knowledge. As one Southern biodiversity advocate observed, "The Conference of the Parties to the Biodiversity Convention hopes to avoid the fact that prevailing intellectual property regimes *de facto* pirate the technologies of communities that have no resources to protect their knowledge, and are fundamentally opposed to exclusive monopoly over life forms."[10]

The Convention offers some leeway for "communities embodying traditional lifestyles" to negotiate protection of their knowledge and resources, at least as they relate to biodiversity conservation. Articles regarding *in situ* conservation (see Glossary in Appendix D) could be invoked to claim protection for farming communities whose lands and waters harbour biodiversity. But so far, the Convention has no teeth in this regard:

- No binding and universally-applicable code of conduct has been established to regulate bioprospectors, and no mechanism has been developed to control access by outsiders to farming communities' knowledge or biological resources. Instead, contracting parties (i.e. governments) are expected to arrive at "mutually agreed terms" regarding access to genetic resources. This strictly bilateral approach to access makes it likely that countries of the South will be played off against one another by wealthier, better-informed Northern interests. It leaves community knowledge-holders entirely at the mercy of governments.
- No method has been established to determine an "equitable sharing" of benefits derived from biodiversity.
- No account has been taken of the fact that intellectual property rights over living things are anathema to many of the peoples whose knowledge is the target of clauses about "communities embodying traditional lifestyles".
- The Convention sets a firmly entrenched, industry-biased system of intellectual property rights against some hypothetical protection of

transgenic organism
Any organism that has been genetically engineered using genes from another species, or its offspring.

World Intellectual Property Organization (WIPO)
Organization that houses all intellectual property conventions adopted by the world community.

Paris Convention for the Protection of Industrial Property
The principal intergovernmental body established to govern the patent system and determine the ground rules for granting of patents.

Patent Cooperation Treaty
Treaty to create a global patent system, to ensure that a patent granted in one country will be adopted in all member countries.

Union for the Protection of New Varieties of Plants (UPOV)
International intellectual property conventions covering plant breeders' rights.

Budapest Treaty
International treaty governing the deposit of microorganisms for the purposes of patent procedure.

life patenting
Patenting of any living organism or its component parts.

TABLE 2

What the Biodiversity Convention Says
Excerpts Relevant to Intellectual Property

The "contracting parties" in the text are the 128 ratifying nations to the Convention. The sections quoted here are especially relevant to biodiversity, indigenous peoples' knowledge, and intellectual property rights.

PREAMBLE point 12: [Recognizes] the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components.

ARTICLE 1 Objectives: The objectives of this convention … are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies…

ARTICLE 2 Use of Terms, point 13: 'In situ conservation' means the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

ARTICLE 3 Principle: States have … the sovereign right to exploit their own resources pursuant to their own environmental policies, and to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States…

ARTICLE 8 In-situ Conservation, clause (j): Each Contracting Party shall … (j) subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.

ARTICLE 10 Sustainable Use of Components of Biological Diversity, clause (c): Each Contracting Party shall … (c) Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation and sustainable use requirements …

ARTICLE 15 Access to Genetic Resources , clauses 4, 5, 6: 4. Access, where granted, shall be on mutually agreed terms … 5. Access to genetic resources shall be subject to prior informed consent… 6. Each Contracting Party shall endeavour to develop and carry out scientific research based on genetic resources provided by other Contracting Parties with the full participation of, and where possible in, such Contracting parties.

ARTICLE 16 Access to and Transfer of Technology, clauses 1 and 2: 1. Each Contracting Party, recognizing that technology includes biotechnology …undertakes … to provide and/or facilitate access for and transfer to other Contracting Parties of technologies that are relevant to the conservation and sustainable use of biological diversity and make use of genetic resources … 2. In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with adequate and effective protection of intellectual property rights …

ARTICLE 17 Exchange of Information, clauses 1 and 2: 1. The Contracting Parties shall facilitate the exchange of information … 2. Such exchange of information shall include exchange of results of technical, scientific and socio-economic research, as well as information on … indigenous and traditional knowledge as such and in combination with the technologies referred to in Article 16 … It shall also include … repatriation of information.

ARTICLE 19 Handling of Biotechnology and Distribution of its Benefits, clause 2: Each Contracting Party shall … promote and advance priority access on a fair and equitable basis by Contracting Parties … to the results and benefits arising from biotechnologies based upon genetic resources provided by those Contracting Parties.

indigenous knowledge-holders by governments, who themselves risk being played off one against the other. Intellectual property rights, which are much better suited to Northern industry than to developing countries governments or to farming communities, will be "adequately and effectively" protected.

The **Conference of the Parties to the Biodiversity Convention (COP)** met for the second time in Indonesia in November 1995. Intellectual property was high on the agenda, and so was the issue of indigenous knowledge, thanks largely to the work of non-governmental and indigenous peoples' organizations who insisted that it be part of any discussion of intellectual property. It was accepted at the meeting that intellectual property should be addressed in tandem with "indigenous knowledge", and signatories to the Convention are slated to consider indigenous knowledge at the third COP in Buenos Aires, Argentina, in November 1996. They will also consider several issues relating to agricultural biodiversity. Farming communities and other rural peoples are now organizing to participate in these discussions, and are developing proposals to defend Farmers' Rights (see Chapter Four) and the rights of indigenous knowledge holders within the Biodiversity Convention.

The World Trade Organization

The General Agreement on Tariffs and Trade (GATT) was established in 1947, and laid down the ground rules for international trade. It began as a club of 23 industrialized countries of Europe and North America, whose aim was to revive trade after World War Two by eliminating barriers and "distortions" to international trade. The original GATT agreement has been amended eight times. At the beginning of 1996, the GATT was subsumed by the new World Trade Organization (WTO). By the end of January 1996, it had grown to include 115 member states, of which 84 are developing countries by UNDP criteria. Other governments of the South are preparing to join.

Late in 1994, the most recent GATT revisions were adopted with the conclusion of the protracted Uruguay Round of negotiations (named after the country where they began in 1986). During the Uruguay Round, intellectual property was discussed as a trade issue in GATT for the first time. The United States and Japan argued that the absence of intellectual property protection in developing nations was an unfair trade barrier and should be subject to retaliatory measures. The United States maintained that there should be "no exclusions" to the subject matter protected under intellectual property laws, with biotechnology products and processes high on their agenda. Before the round was over, industrialized countries had succeeded in having intellectual property included in GATT, as the TRIPS agreement on the Trade Related Aspects of Intellectual Property.

Conference of the Parties to the Biodiversity Convention (COP)
All the countries that have ratified the Biodiversity Convention.

If there is some scope to protect farming communities' knowledge in the Biodiversity Convention, it is not considered in the WTO. It is clear that all WTO members must adopt (if they have not already done so) intellectual property legislation which conforms to the TRIPS provisions. Specifically, all signatories must

- provide patent coverage for microorganisms
- have some form of intellectual property legislation to cover plants.

They may decide for themselves about intellectual property rights over animals. Whatever people in the South may feel about patenting life forms, it is being legislated for the world by the WTO.

Under the WTO, all so-called developing countries, however, have at least until the year 2000 to implement the agreement's intellectual property clauses. Countries categorized as "least developed" have until 2004. In 1999, the World Trade Organization will review the new intellectual property provisions. Significant changes to the agreement could be achieved because of the five to ten year grace period, including changes that could benefit farming communities.

Refer to **Appendix B** for a comparison by potential users of access to Western intellectual property systems. It illustrates how the current system of intellectual property favours industry, while leaving public sector institutions and rural communities unable to compete.

TABLE 3

South Members of the World Trade Organization

Using UNDP definitions of developing and least developed countries, the table lists all WTO members as of January 1996 who are likely to fall into the category of developing or least developed. Least developed are highlighted in **bold.**

Antigua and Barbuda, Argentina, Bahrain, **Bangladesh,** Barbados, Belize, Bolivia, Botswana, Brazil, Brunei Darussalem, **Burkina Faso, Burundi,** Cameroon, **Central African Republic,** Chile, Colombia, Costa Rica, Côte d'Ivoire, Cuba, Cyprus, **Djibouti,** Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Gabon, Ghana, Guatemala, **Guinea, Guinea Bissau,** Guyana, **Haiti,** Honduras, Hong Kong, India, Indonesia, Jamaica, Kenya, Korea, Kuwait, **Lesotho, Madagascar, Malawi,** Malaysia, **Maldives, Mali, Mauritania,** Mauritius, Mexico, Morocco, **Mozambique, Myanmar,** Namibia, Netherlands (and Netherlands Antilles), Nicaragua, Nigeria, Pakistan, Paraguay, Peru, Philippines, Qatar, Romania, Saint Lucia, St. Vincent and the Grenadines, Senegal, **Sierra Leone,** Singapore, South Africa, Sri Lanka, Surinam, Swaziland, **Tanzania,** Thailand, **Togo,** Trinidad and Tobago, Tunisia, Turkey, **Uganda,** Uruguay, Venezuela, **Zambia,** Zimbabwe

Sources: WTO data, Canadian Department of Foreign Affairs, UNDP Human Development Report

TABLE 4

GATT TRIPs: Relevant Clauses

Section 5: Patents
Article 27 Patentable Subject Matter

1. … [P]atents shall be available for any inventions, whether products or processes, in all fields of technology, provided they are new, involve an inventive step and are capable of industrial application. … [P]atents shall be available and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced.

2. Members may exclude from patentability inventions … to protect order public or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that the exclusion is not made merely because the exploitation is prohibited by their law.

3. Members may also exclude from patentability:

(a) diagnostic, therapeutic and surgical methods for the treatment of humans or animals;

(b) plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, members shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof. The provisions of this paragraph shall be reviewed four years after the date of entry into force of the WTO Agreement.

Article 65 Transitional Agreements

1. … [N]o Member shall be obliged to apply the provisions of this Agreement before the expiry of a general period of one year following the date of entry into force of the WTO Agreement.

2. A developing country Member is entitled to delay for a further period of four years the date of application …

4. To the extent that a developing country Member is obliged by this Agreement to extend product patent protection to areas of technology not so protectable in its territory on the general date of application of this Agreement for that Member … it may delay the application of provisions on product patents … to such areas of technology for an additional period of five years.

Article 66 Least-Developed Country Members

1. In view of the special needs and requirements of least-developed country Members … such Members shall not be required to apply the provisions of this Agreement … for a period of 10 years from the date of application … The Council for TRIPs shall, upon duly motivated request by a least-developed country Member, accord extensions of this period.

Chapter 3

Read this chapter to get an overview of alternative perspectives to the Western intellectual property system, including

- how Western intellectual property systems differ from non-industrial or indigenous systems
- the challenges faced by non-industrial societies in defending their right to collectively use and nurture their knowledge of biological resources
- the key role of Southern farmer innovators in preserving and using global biodiversity
- case studies of how systems of generosity are being threatened by present intellectual property trends.

Refer to **Appendix C: Biopiracy and Bioprospecting Activities** for information on many of the corporations and research institutes that are tapping indigenous knowledge in their growing quest to develop new medicines and pharmaceuticals.

INTELLECTUAL INTEGRITY
Systems of Generosity

OVERVIEW

Western concepts of intellectual property differ radically from most rural and indigenous systems of knowledge and innovation. Most non-industrial societies see knowledge and innovation as a collective creation to be held in trust for future generations. This perspective is in direct contrast to industrial intellectual property systems that view natural resources, genetic materials and knowledge as commodities. When traditional systems of generosity are confronted with the new enclosure system, they face the challenge of preserving the integrity of their community knowledge despite mounting pressures to capitulate.

The Logic of Generosity

Rural societies differ greatly from one another in their views of knowledge-sharing and their approaches to innovation. Concepts of property, land, and nature also vary. Many communities look upon most property as communal. Others confer personal or family custodianship over land and living resources. It is not unusual for agricultural communities to permit de facto ownership over crops and livestock, including the succeeding generations of domesticated species. It is unheard of, however, for non-industrial farming communities to grant unlimited rights to land and resources, or to permit ownership of the processes of life. Concepts like stewardship or custodianship come much closer to rural realities than those such as exclusive monopoly, private property, or intellectual property.[11]

In most rural societies, knowledge and innovation are not seen as commodities but as community creations handed on from past to future generations. The earth and nature are used and managed but are not exclusively owned. In contrast, European-based intellectual property rights are founded on the belief that innovative ideas and products of human genius can be legally protected as private property. Plant breeders' rights and recent applications of patent law further assert that a vast array of living things are also products of human genius, subject to private monopoly controls.

There is logic to rural systems of generosity. Farmers understand that they must experiment and that new genetic combinations must be introduced into their fields in order to compete with diseases and pests. The freer the exchange, the greater the potential benefit. This simple truth has been lost in the industrialized countries where intellectual property has created secrecy and reduced scientific exchange.

Every society is complex and farming communities manage extraordinarily complex ecosystems. It is not surprising that knowledge specialization and apprenticeship systems are common, and that reward mechanisms ensure that knowledge is preserved, shared and enhanced. Patent lawyers like to compare these customary practices to the medieval European **guild system** that gave rise to intellectual property laws in the North. Although the comparison is fair, neither today's farming communities nor yesterday's guild members would recognize the intellectual property regimes being imposed by the World Trade Organization.

…But a bold peasantry, the country's pride,
When once destroyed, can never be supply'd …

– Oliver Goldsmith, The Deserted Village, 1770

Common Threads

All peoples have laws, customs and well-defined practices to regulate land ownership, land and resource use, and the acquisition of different types of knowledge. Yet within the vast cultural diversity of farming communities, there are striking common threads which unite them and distinguish their view of nature and innovation from the values and world view that are enshrined as law in industrial societies. Some of these are especially relevant to the intellectual property debate.

- **Knowledge and innovation cannot be isolated from land and culture.**

  "[When we talk about biodiversity] we are really talking about our whole world view, our cultures, our lands, our spirituality… These are all linked." (Stella Tamang, Federation of Nationalities, Nepal)[12]

  For farming communities and for all rural peoples, their relationship to land is an important part of their identity. The lands and waters they live with underpin who they are and are the foundation of their very survival. Over and over again, when reflecting on biodiversity or indigenous knowledge, rural people insist that living things cannot be understood separately from the land that nurtures them. Peoples' myriad uses of natural resources cannot be separated from their culture; their culture cannot be separated from the land.

  For them, this oneness of land, people, knowledge and culture is the only basis for meaningful consideration of biodiversity. The intellectual enclosure movement is dissecting knowledge and fragmenting flora and fauna into unrecognizable genetic bits and pieces. At stake is the intellectual integrity of rural communities.

- **Farming communities nurture biodiversity and respect the land.**

  Ninety percent of the earth's most biologically-diverse lands have no government protection, and are cared for exclusively by farming communities and other traditional resource users. Almost all of the earth's most biologically diverse "hot spots" are home to or bordered by the South's farming communities.

- **Stewardship not exploitation is the preferred relationship with natural resources.**

  Non-industrial agrarian peoples use land, manage natural resources, and pass on knowledge about them to future generations. Their relationship with nature is multi-dimensional and complex. In many rural societies, the earth itself and life are sacred. Monopoly control over the use and exploitation of living things, including food crops, is an entirely alien concept to many farming societies. The notion of intellectual property over living things is often a sacrilege.

guild system
Medieval European association of people with related work or interests (such as merchants or craftsmen), established to maintain standards and protect its members interests.

TABLE 5

Agricultural Innovation and Intellectual Property
Southern Communities Challenge the Perspective of Northern Plant Breeders

	The Industrial (North) Perspective	The Community (South) Perspective
Landraces: The term used by plant geneticists to describe literally thousands of varieties of seeds used by farmers the world over.	Landraces are essentially natural phenomena. They have resulted from a combination of environmental and human selection pressures, over millennia. Most of the credit goes to the environment and little goes to generations of farmers.	Landraces didn't just happen. They are well-adapted folkseeds that have been selected and bred by generations of farmers for specific micro-ecological niches. They are living examples of sustainable agriculture that function in balance with nature, providing relatively secure food, and requiring little or no external inputs.
Intellectual Property Rights (IPR) for Landraces	Granting IPR for a landrace would be like trying to patent the wheel a few thousand years after its invention. This would amount to an inexcusable monopoly under normal patent systems.	Folkseeds in the field are no less modern than the latest hybrid release. Each is the up-to-date manifestation of active plant breeding. Both involve human genius and both have value. Why should only the corporate breeder be protected and compensated?
The Invisible Inventor	How could you protect a landrace? Who would receive the protection? What farmer, from what country, determined at what point in history?	The collective contribution of farmers could be recognized. Compensation for using landraces need not be tied to individuals, communities, or countries but could be arranged through a global fund, on a program or project basis.
Commercial Irrelevance	Why bother protecting landraces? Almost none of those collected have any commercial value. It would cost at least as much to monitor germplasm flows from farmers to industry as farmers will ever receive in benefits from compensation schemes.	The same could be said of many inventions. Only one in a hundred patents has some value. One in a thousand has great value. The same is true of folkseeds, although a low commercial return for Northern industry may be a huge return for Southern farmers.
Hidden Genius	Where a landrace is used in a commercial plant variety, breeders almost always extract and adapt a gene or gene complex to become one of several hundred components in a new plant variety. The useful properties may not have been known, valued or even expressed in the farmers' field.	Recent biotech patent decisions (such as species-wide patents on cotton and Bt) imply that the patent holder need not know everything about the patented material in order to benefit.
"Free Access is Best"	Farmers are best served by a free flow of germplasm. Efforts to assign benefits and provide compensation for their raw material will just slow innovation and restrict the spread of future benefits.	Free access would be fine if the principle were applied uniformly. The genius of informal, community plant breeders is unprotected, while that of formal breeders is covered by IPR. Recognition and restricted access are granted to industrial innovators, but not to farmer-innovators. The North can't have it both ways. Free access must apply across the board.

Source: RAFI

- **Knowledge and innovation are collective creations.**

  Innovation and adaptation to change have been a part of rural societies for millennia, and knowledge has been passed on from generation to generation. While specialized knowledge about plants and crops is often entrusted to particular social groups or to honoured individuals, it is not their private property. The body of knowledge is usually held collectively and inter-generationally. Knowledge is carefully maintained in trust for future generations and added to for the benefit of the entire community. Individual ownership over living things or knowledge about them is unheard of.

Four Case Studies: Systems of Generosity and Greed in Conflict

What happens when systems of generosity are confronted with intellectual property regimes? The four case studies that follow contrast the values of many rural or indigenous societies with the present industrialized intellectual property system.

TABLE 6

The Role of Community Knowledge in Global Development

Health and Medecine	Food and Agriculture	Environment and diversity
Local: 80% of the South's medical needs are met by community healers using local medicine systems.	Almost 90% of the South's food requirements are met through local production. Two-thirds are based on community farming systems.	Almost 100% of the biodiversity "hot spots" are in areas nurtured by indigenous communities and/or bordering the South's farming communities.
Global: 25% (and growing) of western patented medicines are derived from medicinal plants and indigenous preparations.	90% of the world's food crops are derived from the South's farming communities and continue to depend on farmers' varieties in breeding programmes.	The wild relatives of almost every cultivated crop are found in biologically-diverse regions of the South and are nurtured by indigenous communities.
Market: The current value of the South's medicinal plants to the North is estimated conservatively at US$32 billion annually.	The direct commercial value derived from farmers' seeds and livestock breeds is considerably more than US$5 billion a year.	90% of the world's most biologically-diverse lands and waters have no government protection and are nurtured exclusively by rural communities.
Expertise: Well over 90% of all health practitioners are community healers.	99% of all plant breeders and other agricultural researchers are based in rural communities.	99% of all practiced biodiversity expertise resides in indigenous and other rural communities.
Risk: Almost all local knowledge of medicinal plants and systems, as well as the plants themselves, could disappear within one generation.	Crop diversity is eroding at 1% to 2% per annum. Endangered livestock breeds are vanishing at rates of 5% a year. Almost all farmers' knowledge of plants and research systems could become extinct within one or two generations.	Rain forests are coming down at a rate of 0.9% per annum and the pace is picking up. Much of the earth's remaining diversity could be gone within one or two generations.

Source: RAFI

"Indigenous people are willing to share our knowledge with humanity provided we determine when, where and how it is used. At present the international system does not recognize or respect our past, present and potential contributions."

(Final statement, Consultation on Indigenous Peoples Knowledge and Intellectual Property Rights, Suva, Fiji, 1995)

CASE STUDY ONE

Generosity... An Inherited Trait?

When Frank Majestic got involved with the Conserve Program in Mindanao in the Philippines, farmers in the region were fed up with the high input costs of **Green Revolution** rice. They were anxious to do their own breeding as they had done in the past. The problem was that the traditional rice varieties were no longer around. Majestic and the farmers wrote to the International Rice Research Institute (IRRI) and eventually received more than a hundred farmers' varieties that had first been collected in their area decades before. Older farmers, however, remembered many more.

Finally, Majestic organized an expedition into the surrounding hills to meet with Muslim farmers. Traditionally, the farmers associated with the Conserve campaign in the valleys had been in a state of semi-war with the hillside Muslims. Despite this, the Muslim farmers willingly gave them almost three hundred rice varieties never collected by IRRI. With these, the valley farmers launched their own intensive breeding programs once again. The new varieties they are developing are free to other farmers as long as they promise to keep them out of the hands of companies that might want to patent them.

CASE STUDY TWO

A "Wild" Idea?

For as long as anyone can remember, farmers in Panama have used sap from the stem of a local vine (*Omphalea diandra*) to protect their stored beans from beetle infestation. The same sap has also been used to heal wounds and relieve headaches. Once every several years a migratory moth venturing between Mexico and South America stops in Panama to feed from the vine leaves. On these occasions, the vine produces a powerful toxin making its leaves inedible to all save the moth that concentrates the toxin. The local community, observing this occasional migration effect, then harvests the toxin. Based on their information, Northern pharmaceutical companies are now evaluating the toxin (known as DMDP) as a pharmaceutical for use against AIDS, diabetes, and cancer, and as a food preservative.

CASE STUDY THREE

Endod Patents take the Public Spirit out of the Public Sector

Ethiopian mothers have bathed their children with a shampoo squeezed from their local endod or soapberry plant for as long as anyone can remember. Many have also used endod extract to purify water. Use of the plant seems to reduce the incidence of schistosomaisis among children who catch the disabling disease from a snail in river water.

For well over two decades, Dr. Aklilu Lemma and his colleagues in Ethiopia worked with funding from Canada's International Development Research Centre (IDRC) to see if endod could become a weapon against schistosomaisis worldwide. So successful was their work that Lemma was invited to the University of Toledo in the United States in 1990 to receive an honorary doctoral degree for his humanitarian efforts.

At dinner with university President Frank Horton and campus scientists the night before receiving his degree, Lemma was asked if endod might be effective against zebra mussels, a US$5 billion a year scourge affecting shipping on the nearby Great Lakes. Since endod successfully kills snails, Lemma assumed it might be effective against mussels and drew up an experiment on the spot using an endod sample he had brought from Ethiopia.

The next day, after receiving his degree, Lemma was informed that his experiment had worked. Four months to the day after the Ethiopian scientist won his doctoral prize, the University of Toledo filed for US patents on the use of endod against zebra mussels. The patents were granted in 1994.

In February 1995, Lemma—who heads the Ethiopian-based Endod Foundation, a non-profit research institute with branches throughout Africa—wrote to Frank Horton. He requested access to the patents in order to extend the Foundation's research on endod's use against schistosomaisis and banana and cassava pests, and to develop its commercial use in shampoos and detergents. There had been a "gentleman's agreement" that Ethiopia would share in royalties arising from patent products, that Ethiopian farmers would grow the crop for export to American manufacturers using endod against zebra mussels, and that the Foundation would also be free to continue its own research. Horton responded to Lemma, congratulating him and Ethiopia on their "high-minded" goals, but advising him that the two patents were available for a license fee of US$50,000 (plus 2.5% royalty charges and legal fees) or for outright purchase at US$125,000 plus legal costs.

CASE STUDY FOUR

Humanitarian Patents: The US Pioneers a New Approach to Foreign Aid

Early in the 1990s, the US National Institutes of Health (NIH) and the US Centres for Disease Control (CDC) sent medical expeditions out in search of remote human communities that might have variant strains of lymph cells useful in treating immune deficiency diseases including cancers and AIDS. In 1993, the Guaymi General Congress, an indigenous peoples' council, learned that a 26-year-old Guaymi mother of two living on or near a banana estate in western Panama was the subject of a US government patent claim. Her cheeks had been scraped, some hair follicles had been removed, and blood samples had been taken for examination by a long-term storage facility in the US. Medical doctors had not told her or the Guaymi community of their patent interests or her potentially bright commercial future.

With support from the Community Biodiversity Development and Conservation program, leaders of the Guaymi Congress flew to Geneva to question GATT officials and publicize the patent claim at a Biodiversity Convention meeting. The Guaymi wanted to know if the US government had the right to patent human **cell lines** under the proposed new GATT accord and if they could be protected under the new Biodiversity Convention. Within weeks, the US government announced i t was dropping the patent application, but only because it was not commercially viable.

Meanwhile, in the Pacific, other US medical teams had similarly surveyed communities in the Solomon Islands and Papua New Guinea. In early 1994, NGOs learned that patent claims were pending on the cell lines of individuals in both countries. When the UN Ambassador for the Solomon Islands complained to the US Secretary of Commerce (the formal applicant for external patent rights), he was told that the American government was perfectly within its rights to patent human material from citizens of other countries. Later US government officials advised the ambassador that the claims would be dropped. Yet in March 1995, the US Patent Office granted a patent to the US government on the cell line of a 20-year-old Hagahai man from Papua New Guinea.

When this news reached the Pacific late in 1995, governments protested at another meeting of the Biodiversity Convention. American authorities did not respond officially but informally reported that the claim had only proceeded because the Hagahai themselves had specifically requested it. According to American scientists involved in human genetic research, the government had made a royalty-sharing deal with the Hagahai, with approval of the PNG Government, because they needed humanitarian aid.

By May 1996, the US government had provided no written corroboration of a royalty-sharing agreement. No proof of the Hagahai's prior informed consent had been offered, and no official evidence was provided that the Solomon Islands patent had been dropped.

If the US is acting on the Hagahai's request, this is the first time a government has granted itself a patent on a foreign citizen's cell line for humanitarian reasons. The Hagahai might have preferred receiving the US$10,000 filing fee or the estimated US$250,000 in legal fees that are needed to maintain the average American patent. Unless real help comes soon, the only Hagahai left may be the one immortalized in the American patent repository.

Green Revolution
A massive and controversial agricultural research and production strategy which aimed to increase the output of staple grains in the South starting in the 1960s.

cell line
A sample of cells removed from any organism that can sustain continuous, long-term growth in an artificial culture.

Chapter 4

Use this chapter to gain an overview of the new life industries and how they operate, including their methods of gathering genetic materials and gaining intellectual property rights in the areas of

- agriculture
- medicinal plants and pharmaceuticals
- microorganisms
- human genome research.

Other topics covered in this chapter include

- corporate concentration in the life industry
- intellectual property and ex situ conservation
- effects of bioprospecting and biopiracy on the governments and peoples of the South
- Northern corporate control of microbial collections
- ethical and practical implications of human DNA and genome patenting
- the activities of the Human Genome Diversity Project.

For additional information, see **Appendix A: A Short History of the Patent System,** showing some of the precedent-setting incursions of intellectual property regimes into animal, microbial, plant and human life. Refer to **Appendix C: Biopiracy and Bioprospecting Activities** for information on many of the corporations and research institutes that are tapping indigenous knowledge in their growing quest to develop new medicines and pharmaceuticals. See **Appendix D** and **Appendix E** for information on the top corporations involved in various life industry sectors.

THE LORDS OF LIFE

OVERVIEW

The new life industries are the main players in the business of intellectual property and biodiversity. They control present and possible future flows of genetic resources and knowledge from the South to the North, in four important areas of biodiversity: agricultural species, medicinal plants, microorganisms, and human genetic material. Corporate concentration is high in the life industries, and large corporations are now using intellectual property rights to appropriate community knowledge and privatize biological materials for their own profit. Recent efforts to patent human genetic materials gathered from indigenous peoples raise serious moral and ethical dilemmas.

Biotechnology and the Life Industries

Biotechnology research was initially conducted by small, specialized industry "boutiques" who were supported by big corporations on a contractual basis. In recent years there has been a gradual shift, with the giant corporations now playing a more direct and dominant role in biotechnology, and devoting more of their research and development to in-house biotechnology programmes. Equity investments and buy-outs of the smaller biotechnology companies by large corporations have become common.

For example:

- Hoffmann-LaRoche of Switzerland now owns Genentech, the largest biotech company in the USA.
- In 1994, Limagrain acquired 67% of Biotechnica International's farm seed business.
- In July 1996, Monsanto acquired controlling interest of Calgene, a leading agricultural biotechnology company.
- In September 1995, Pioneer Hi-bred entered a $51 million deal with Mycogen, a plant biotechnology company that specializes in biological pest control. This gives Pioneer easy access to Mycogen's **gene bank** of patented Bt genes.[13]

Corporate concentration and integration are not new. The 1970s and 1980s, for example, saw a steady reduction in the number of companies dominating agribusiness and the pharmaceutical trade. But in recent years, the new biotechnologies have led to dramatic changes in the structure of these industries. Scientists can and do transfer genes across the species barrier from humans and animals to microorganisms, and from animals to plants. This has blurred the distinctions between industry sectors, and single corporations have diversified into all fields which use living organisms for industrial production, such as food processing, seed production, plant breeding, agrochemicals, veterinary medicines, and human pharmaceuticals.

The life industry is perhaps best exemplified by Novartis, the titanic corporation formed by the $27 billion merger of Swiss giants Sandoz and Ciba-Geigy in early 1996. It's difficult to classify Novartis as "a pharmaceutical firm" or an "agrochemical company", Novartis is the world's number one agrochemical corporation, the second largest seed firm, the third largest pharmaceutical firm, and the fourth largest veterinary medicine company. Novartis also contracts with human genome companies in the quest to gain proprietary access to human genes. Approximately 59%

Proud swells the tide with loads of freighted ore,
And shouting Folly hails them from her shore;
Hoards, even beyond the miser's wish abound,
And rich men flock from all the world around.

– Oliver Goldsmith, The Deserted Village, 1770

of the company's revenues comes from drugs, 27% from agicultural products, and 14% from food products.

Agriculture

It is now well known that the world's main food and livestock species have their centres of genetic diversity in the South, thanks to generations of farmer-breeders who domesticated and then adapted food species to millions of micro-environments. But the significance of this has not yet been fully grasped.

Farmers of the South, who grow most of the earth's remaining agricultural genetic stock, hold the key to the world's food security. All the world's farmers, and all public sector and corporate plant breeders, ultimately depend upon what they grow. It is Southern farmers who cultivate the agricultural biodiversity that will enable the earth's food species to adapt to changes, whether evolving pests, diseases, climate change or human intervention. It is to farmers' fields in the South that plant breeders must return in search of plants with desired genetic characteristics.

The surest and cheapest way to keep this genetic diversity alive is to keep it growing in farmers' fields. ***In situ* conservation** is now recognized by the world's agricultural research establishment as an important element in the conservation of agricultural biodiversity and is promoted in the Biodiversity Convention. However, farmers face government policies and commercial pressures that constantly push them to replace their own varieties with high-tech, high-input, higher-yielding varieties of staple grains and livestock breeds.

But *in situ* conservation is not the only or most practiced conservation approach in the world of industrial agriculture. ***Ex situ* conservation** is much more common.

Most of the world's gene banks are in the North. Together they contain hundreds of thousands of seed samples, collected from farmers' fields and stored in giant refrigerators, for use by the seed industry and public sector plant breeders. About 40% of the world's most valuable *ex situ* agricultural genetic material is held in just twelve gene banks, whose seeds come largely from the South and whose funding comes mostly from industrialized country aid budgets.

These gene banks came under the legal control of the UN Food and Agriculture Organization (FAO) in October 1994. They are run by a network of International Agricultural Research Centres which make up the **Consultative Group on International Agricultural Research (CGIAR).**

gene bank
Humidity- and temperature-controlled facilities where seeds and other reproductive materials are stored for future use in research and breeding programs.

***in situ* conservation**
On-site conservation of ecosystems and natural habitats, and the maintenance and recovery of viable populations of species in their natural surroundings.

***ex situ* conservation**
Conservation of genetic materials outside their natural habitats.

Consultative Group on International Agricultural Research (CGIAR)
An informal network of sixteen International Agricultural Research Centres in Latin America, the Middle East, Africa, Asia and Europe.

Cotton is Still King in the World of Patents

Eli Whitney got the (cotton) ball rolling with his patent on the cotton gin, the premier invention of Britain's agricultural revolution. Whitney's machinery helped end India's textile exports to Europe, but the South's patent problems continued.

In 1990, an American entomologist named Sally Fox won two Plant Variety Protection certificates (also known as plant breeders' rights) for *Coyote* and *Green* coloured cottons, which she admits originated in Central America. Capturing the enthusiasm for natural colours, jean textile makers advertised that their cottons came "from the ancient peoples of the Americas". Nice as it was to receive the plaudits, indigenous farmers from Mexico to Peru received none of the profits.

A couple of years later, W.R. Grace, one of the world's largest specialty chemical companies, bought a biotechnology research company known as Agracetus (Agracetus was bought out by Monsanto in 1996) and picked up a patent on transgenic cotton. Grace's claim covered all transgenic cotton, regardless of the biotechnology method used to produce it or the germplasm involved. In short, W.R. Grace would have taken charge of the future of high-tech cotton breeding for the next quarter-century. The farm-gate value of the cotton crop, critical to the economies of scores of South countries, is over US$20 billion a year.

But the U.S. government revoked the patent. Outraged, the government of India also disallowed the patent. Unfortunately, as Indian scientists continued their own work on insect-resistant cotton, they ran afoul of a different patent held by Monsanto, one of the world's largest life industries. This one covered most insect-resistance for cotton. Indian farmers who have been breeding cotton for several thousand years can get a license from Monsanto to use its technology, if they can just come up with US$7.7 million … and the legal fees.

Refer to **Appendix D** for tables showing the top ten corporations in five industry segments: agrochemicals, seeds, food and beverages, pharmaceuticals, and animal health.

They have been used mainly for agricultural research in Asia, Africa and Latin America, but the North has also benefited handsomely from the agricultural genetic material they contain. RAFI has estimated that farm-gate prices in Europe, North America, Australia and New Zealand have risen by US$5 billion a year, thanks to seed improvements based on genetic material from these twelve gene banks alone.[14]

Intellectual property claims over plants have become a daily occurrence. Industries in the North now commonly use seeds from the South (including those from gene banks) to develop plant varieties that are subsequently protected by Plant Breeders' Rights or patents. About a decade ago, farmers and governments from the South started to point to the inequity of this. Why, they asked, are the plant varieties that have been bred by Southern farmers considered the common heritage of all people, when industry can claim exclusive monopoly rights over plant varieties derived from them?

Faced with mounting dissatisfaction, the FAO introduced the concept of Farmers' Rights in 1985 as a counter-weight to intellectual property claims over plants. In 1992 the Biodiversity Convention established that governments had sovereignty over the biodiversity within their borders and could control access to it. So far, however, Farmers' Rights is little more than a compelling idea, and the Biodiversity Convention excludes from coverage all the valuable *ex situ* collections that existed before it came into effect. Efforts are afoot to address both these problems within the Biodiversity Convention and at a series of international agricultural meetings in the late 1990s. Farmers' Rights and access to genetic resources are high on the multilateral agricultural agenda.

During negotiations over the final text of the Biodiversity Convention, Northern governments successfully lobbied to remove all material already held in *ex situ* biological collections from the Convention's scope. As a result, the material was deemed to belong to those who deposited it, and not to the countries it was taken from, as would be the case with material collected after the Convention came into effect. The CGIAR collections of Southern agricultural genetic resources were thus excluded from the Convention, but immediately after it was signed, steps were taken to clarify the legal status of these collections and ensure that they remained accessible in the public domain.

In October 1994, the CGIAR and FAO signed an agreement which made all the material in these gene banks the property of the FAO to hold in trust for the world community. When this agreement was signed, it was understood that the FAO would also move to place these collections under the Biodiversity Convention. Steps are now underway to do this, possibly at the Conference of the Parties to the Convention in Argentina in November 1996.

Intellectual property rights over the materials in these FAO/CGIAR collections remains a highly contentious issue. On one side, CGIAR researchers have felt the pressure of intellectual property trends in the private sector. Whether to protect their public sector research from appropriation by the private sector or to take advantage of commercial opportunities which they believe patents might facilitate, they have pushed to claim intellectual property rights over some of the plant materials they hold and develop. Others within the CGIAR centres, and many outside them, strongly oppose this direction, arguing that it would effectively privatize their agricultural genetic resources, whatever the motive for doing so.

Since the mid-1970s, critics have argued that patents on food crops are a threat to world food security, because they place the genetic base of the world's food supply in private hands. In recent years, extremely broad patent claims over entire agricultural species (including cotton, soybeans and *Bacillus thuringiensis* or Bt, a soil bacterium with pesticidal properties) have heightened these fears, and led to legal challenges in Europe, India and North America in 1994 and 1995.

Medicinal Plants

The medicinal knowledge of farming and indigenous communities is already being appropriated with impunity by Northern corporations. Yet the contribution of rural peoples to corporate profits goes largely unacknowledged, unprotected and unrewarded, while research into medicinal plants becomes one of the fastest growing sectors of the life industries.

A picture of piracy is emerging that indigenous knowledge holders are analyzing with great interest and growing dismay. As a result, indigenous peoples and rural communities are now doing research of their own and are organizing to protect their intellectual integrity in the face of an intellectual property system which currently offers them no protection.

Microbial Biodiversity

Intellectual property rights over agricultural biodiversity and medicinal plants is now on the agenda in international forums. But microorganisms (or microbes) have been virtually ignored in the debate about biodiversity and intellectual property, despite their immense importance in nature, their growing value to the biotechnology industry, and their specific inclusion under the World Trade Organization's intellectual property agreement. They should be considered as carefully as agricultural and medicinal plant species.

Unlike crop seeds and medicinal plants, microorganisms which have been isolated and characterized by scientists are much more easily and

What are Farmers' Rights?

The principle of Farmer's Rights, endorsed by the FAO in 1989, recognizes the fact that farmers and rural communities have contributed greatly to the creation, conservation, exchange and knolwdge of genetic resources, and that they should be recognized and rewarded for their past and ongoing contributions. Farmers' Rights acknowledge that farmers who have consciously selected and improved crop genetic resources since the origins of agriculture should be rewarded no less than plant breeders who benefit from Plant Breeder's Rights. Many governments and NGOs have embraced this principle of Farmers' Rights, in recognition of the innovative role that farmers and rural communities play in the conservation and further development of genetic resources, and of their right to benefit from it.

It is important to stress that Farmers' Rights extends beyond the issue of compensation for farmers and farming communities; it includes rights to land and secure tenure, the farmer's fundamental right to save seed and exchange germplasm, and the right of farming communities to "say no", by choosing not to make their germplasm and knowledge available.

It has been accepted, however, that farmers have the right to Germplasm, Information, Funds, Technologies and Farming/Marketing Systems (GIFTS). Others outside the FAO, including **Agenda 21** and the Biodiversity Convention, have also adopted the principle of Farmers' Rights, and the government of India is drafting legislation that would establish Farmers' Rights in law. The financing and implementation of Farmers' Rights will be addressed by several international agricultural meetings in the coming years.

Refer to **Appendix C** for an overview of many corporations and research institutes that are scouring the globe for plants and other commercially-useful organisms with medicinal properties. The table shows how industries are tapping indigenous knowledge in their growing quest to develop new pharmaceuticals.

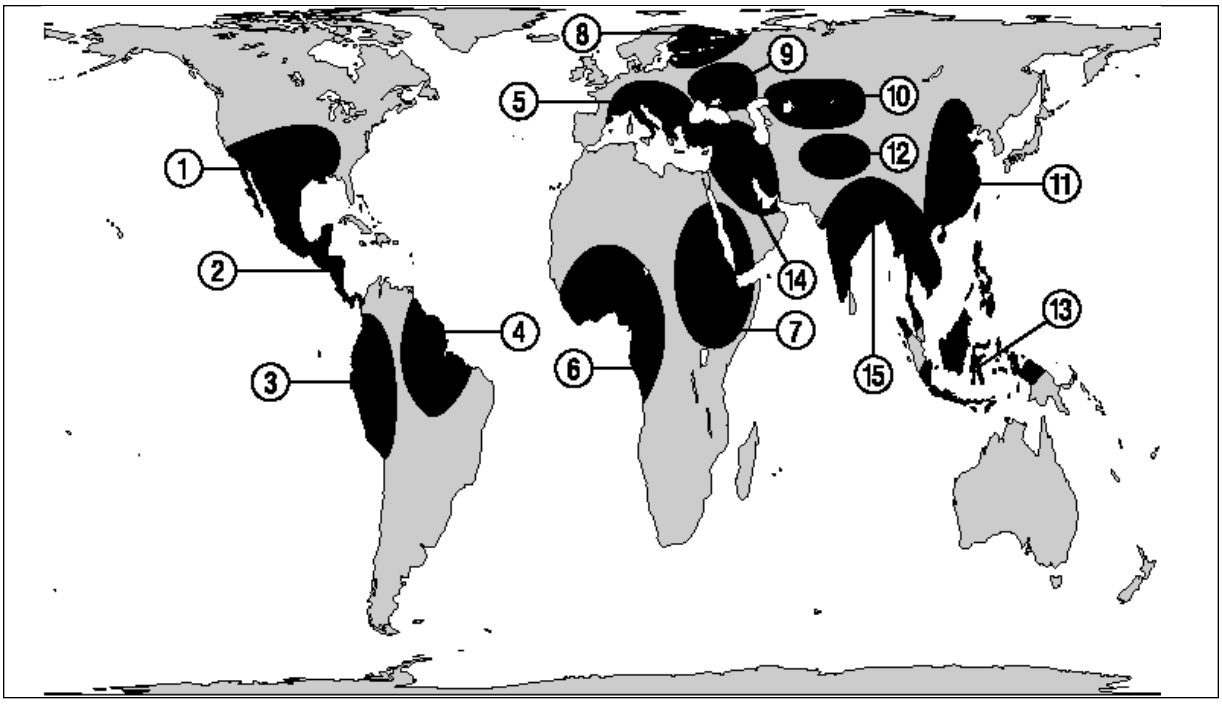
Agenda 21
A comprehensive action plan on the environment adopted at the Earth Summit in 1992.

TABLE 7

International Patent Culture Depositories under the Budapest Treaty

Institution	Country	Date of Status
1. Australian Government Analytical Laboratories	Australia	1988
2. Belgian Coordinated Collections	Belgium	1992
3. National Bank for Industrial Microorganisms	Bulgaria	1987
4. Czech Collection of Microorganisms	Czech Republic	1992
5. Collection Nationale de Cultures	France	1984
6. Deutsche Sammlung	Germany	1981
7. National Collection of Agricultural and Industrial Microorganisms	Hungary	1986
8. National Institute of Bioscience and Human Technology	Japan	1981
9. Korean Cell Line Research Foundation	Korea (Republic of)	1993
10. Korean Collection for Type Cultures	Korea (Republic of)	1990
11. Korean Culture Collection for Microorganisms	Korea (Republic of)	1990
12. Centraalbureau voor Schimmelculures	Netherlands	1981
13. All-Union Institute of Genetics and Industrial Cultivation	Russian Federation	1987
14. All-Union Centre for Antibiotics (VNIIA)	Russian Federation	1987
15. Institute of Biochemistry (IBFM-VKM)	Russian Federation	1987
16. Culture Collection of Yeasts	Slovakia	1992
17. Coleccion Espanola de Cultivos de Tipo	Spain	1992
18. Culture Collection of Algae and Protozoa	UK	1982
19. European Collection of Animal Cultures	UK	1984
20. International Mycological Institute	UK	1983
21. National Collection of Food Bacteria	UK	1990
22. National Collection of Type Cultures	UK	1982
23. National Collection of Yeast Cultures	UK	1982
24. National Collection of Industrial and Marine Bacteria Inc.	USA	1982
25. ARS Culture Collection	USA	1981
26. American Type Culture Collection	USA	1981

Source: World Intellectual Property Organization



adapted with permission from UNEP Global Biodiversity Assessment (1995) pp. 725

▲ **Centres of origin of domesticated plants and animals**

1 turkey, sunflower, tepary bean
2 avocado, cocoa, sweet potato, maize, runner bean, tomato
3 llama, guinea pig, alpaca, cotton, lima bean, peanuts, peppers, potato
4 pineapple, yam
5 goose, cattle, pig, grapes, barley, olive, rye
6 yam, watermelon
7 finger millet, sorghum
8 reindeer
9 horse
10 bactrian camel, alfalfa, millet, hemp
11 foxtail millet, soya bean
12 yak
13 coconut, breadfruit
14 barley, dates, onion, peas, wheat, ass, dromedary, sheep, goats
15 zebu, chicken, pig, water buffalo, banana, rice, yam, tea

reliably maintained under artificial conditions than in their natural habitat. *Ex situ* microbial collections are therefore of utmost importance to scientists and the life industries. Like *ex situ* seed collections, the world's microbial collections are mainly located in the North and hold biological material from all over the world. All microbial collections that predate the Biodiversity Convention fall outside its scope. This means that anything deposited in a biological culture collection before December 1994 is the property of the depositor, regardless of its country of origin or whether anybody in the country of origin knows it is there.

RAFI has examined deposit records from several microbial collections, and has carefully analysed those for the largest one of them, the American Type Culture Collection (ATCC) in Rockville, Maryland. Analysis reveals that thousands of biological specimens from the South are kept in the ATCC. Dozens of them are already patented by Northern corporations such a Bristol-Myers, Pfizer and Eli Lilly, and many others are under patent claim.[15] Though other microbial collections have not been analysed, it can be assumed that the same holds true for them.

All patent laws require inventors to fully disclose their inventions to the Patent Office. For biotechnology patents involving microorganisms, inventors must deposit a biological sample in a **patent culture depository** recognized internationally by the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of

patent culture depository
Recognized institutions in 15 countries that contain deposits of living materials which are

Patent Procedure. These deposit sites are administered by the World Intellectual Property Organization (WIPO) in Geneva. Twenty six institutions in 15 countries are officially recognized for the purpose of patent procedure, of which 23 are in the North. Together, they contain the living materials (microorganisms, genes, seeds, animal embryos, human and animal cell lines) that are the basis for virtually all biopatents. Each facility has a catalogue of its holdings which often indicates the source of the material. Researchers can find useful information about the sources of patented materials by analyzing the data in these collections.

Human Patenting

Refer to **Appendix A** for highlights of some of the precedent-setting incursions of intellectual property laws into plant, animal, microbial and now human life.

"Over the last 200 years, non-Aboriginal people have taken our land, language, culture, health — even our children. Now they want to take the genetic material that makes us Aboriginal people as well." (John Liddle, Director, Central Australian Aboriginal Congress).[16]

If intellectual property control over food species first raised ethical questions about trends in life patenting, it was patent claims over human genetic material that really moved people, especially indigenous people, to action. When news of patents and patent claims over human cell lines, genes and DNA fragments began to spill off the pages of obscure scientific and legal journals and into the wider media, ordinary people joined ethicists, public sector scientists and public-interest research groups to question the direction that intellectual property laws were headed. When they realized that intellectual property was quietly evolving to include monopoly control over inherited human traits, people all over the world began to see that patenting of human parts was the logical extension of a system that already permitted monopoly control over living organisms and their inherited traits.

the basis for virtually all life patents.

Human Genome Diversity Project (HGDP)
An international research effort to collect samples of human tissues from distinct populations worldwide.

Human Genome Project
An international endeavour among geneticists to identify and describe the estimated 100,000 genes that control inherited traits of human beings.

Human Genome Organization (HUGO)
The international organization that governs the Human Genome Project and the Human Genome Diversity Project.

genome
All of the genetic material in the chromosomes of

The scientific search for genetic causes and resistance to all manner of human conditions and diseases is picking up speed. Scientists in the industrialized world are hoping to find profitable cures for everything from cancers to asthma and obesity, from sickle cell anemia to diabetes and baldness. In the commercially-driven business of biomedical research, patents are now being sought and granted over human genetic material which researchers hope some day will have commercial value. Though patent laws in some countries prohibit the patenting of human beings, there is nothing in most countries' patent laws or in the WTO TRIPS agreement to prohibit patenting of human genetic material. Pieces of the human genetic code and human cell lines are being treated under patent law as if they were microorganisms like fungi and bacteria, and are now being patented in industrialized countries.

Patent database searches reveal that at least 100 human cell lines are currently the subject of patent claims in the United States. One company

estimates that the US Patent and Trademark Office has already issued more than 1,250 patents on human gene sequences.[17] All this is occurring in a policy vacuum.

In 1993, as the implications of life patenting were seeping into public consciousness, an international initiative called the **Human Genome Diversity Project (HGDP)** was launched and became a lightning rod for many of the concerns that people were raising about life and human patenting. Initially the brainchild of Northern anthropologists and geneticists, the project was later adopted by the multi-million dollar **Human Genome Project,** which in turn is governed by the **Human Genome Organization (HUGO).**

The HGDP's stated purpose was to broaden study of the human genome beyond the DNA of Europeans and North Americans, and to gather tissue samples that would help geneticists and social scientists trace the early migration of peoples around the globe. It initially proposed to collect some 15,000 samples of blood, hair and cheek scrapings, from 722 distinct ethnic groups which they dubbed "isolates of historic interest". Not surprisingly, the initiative aroused concern among its targets, the majority of them indigenous peoples, who had not been consulted about the project's intentions to sample and analyze their body tissues. Their concerns were far broader than intellectual property, but one of their fears was that indigenous people's genes would be patented for corporate profit.

As if to confirm their fears, three patent claims by the US government on cell lines from indigenous people in Panama, Papua New Guinea (PNG) and the Solomon Islands, were unearthed in late 1993 and early 1994. In March 1995, the PNG patent was granted (see Case Study Four in Chapter Three).

These revelations sparked opposition to human patenting by indigenous peoples'organizations around the world. They raised their concerns publicly, and took them to the WTO and the Biodiversity Convention. They joined many Northern organizations in calling for a comprehensive global review of life patenting, and human patenting in particular. Debate about human patenting is expected in several international forums in the years ahead. It has already been raised by UNESCO's International Bioethics Committee and was discussed at the Conference of the Parties to the Biodiversity Convention in Jakarta in November 1995. These two bodies, along with the World Health Organization, are all likely to debate the issue in 1996 and 1997.

Confronted with questions about whether human genes collected by the project could fall under patent monopoly, the HGDP has been unable to allay the fears of many people. The project's proponents have repeatedly shifted their position on patenting. Initially, they gave it no consideration and argued that the material would have no commercial value. In a 1993

The Human Genome Project

The Human Genome Project is a worldwide endeavour funded by Northern governments and launched in 1988 by scientists to map the human **genome.** Using new technologies, they set out to describe the chemical composition of each of the estimated 100,000 genes that control the inherited part of every person's makeup. The project erupted in controversy in 1992 when Craig Venter, a scientist working on the project, and his employer, the United States government's National Institutes of Health, staked a US patent claim on 2,750 DNA fragments from the human brain which Venter had identified but whose functions in the body were unknown.

Nobel laureate James Watson described the patent claim as "sheer lunacy", and other scientists expressed fears that the rush to patent and commercialize pieces of the human genome would hinder advances that should be the "prized possession of all humanity".[18] Venter's patent claim was rejected because it failed to meet the basic criteria for patentability, but not before it had sparked a virtual bidding war among genetic researchers. Research facilities in the United Kingdom and Japan followed Venter's lead and filed for similar patents on thousands more human DNA fragments. Many concerned scientists in Europe publicly opposed these patent claims, arguing that their work should remain in the public domain.

In December 1993, French researchers working on the Human Genome Project unveiled a first-generation map of about 90% of the human genome, stressing that they would continue make their research freely available.[19] In November 1993, the Medical Research Council in Britain announced that it would no longer seek patents on gene segments discovered as part of the Human Genome Project.[20] Craig Venter, in the meantime, became a multi-millionaire as one of many publicly-funded scientists who set themselves up in private business in an effort to profit from new human genome technologies.[21] The legal repercussions of Venter's patent claim are likely to be played out in the courts for years to come. The policy debate that it provoked has just begun.

document, they acknowledged that collected tissue samples would "provide valuable information on the role played by genetic factors in the predisposition or resistance to disease", but continued to argue that the material was unlikely to have any commercial value. They nonetheless agreed (in the unlikely event that the material proved commercially useful) that the HGDP itself would not seek patents. Then they proposed that if human DNA collected by the project did have a commercial application, the peoples involved should benefit financially. Observers found it hard to keep up with the shifting assumptions behind these statements. They asked how, in the absence of laws to enforce it, the HGDP could control whether others patented the material once it became publicly available.

Refer to **Appendix E** for information in recent alliances between human gene 'boutiques' and corporate partners.

Nobody, however, had trouble understanding the January 1995 conclusion of an international meeting of human genome scientists held in Paris, attended by HUGO's president. That meeting stated that the patent system was the "mechanism of excellence" for commercializing the results of the Human Genome Project.[22] The trend is clear. Intellectual property rights, if not checked, will soon be applied routinely to all living things, including people.

Chapter 5

Use this chapter to understand how and where to take action on intellectual property issues, both nationally and internationally. Based on the suggestions provided, farming communities, activists and policy makers can develop strategies for influencing the many institutions that are dealing with some aspect of intellectual property rights.

WHAT NEXT
Generosity or Greed?

OVERVIEW

Between now and the World Trade Organization's 1999 review of its intellectual property provisions, there are many opportunities to affect the evolution of intellectual property regimes and to propose alternatives both nationally and internationally. Actions can be taken within countries and internationally to protect the intellectual integrity of rural communities, and to open the life patenting debate to the public, governments and inter-governmental bodies.

Strategies and Options for Change

In one guise or another, intellectual property is now an issue for many international agencies. It is on the agenda for every government that has joined or is planning to join the World Trade Organization. For a short period of time, many opportunities exist to influence the evolution of intellectual property on the international level, and to propose alternatives to existing intellectual property concepts and laws.

Between now and 1999, however, it will require a concerted effort both nationally and internationally. To be effective, governments, non-governmental organizations and rural communities will have to mount a sustained and informed critique of existing intellectual property regimes. They will have to develop viable alternatives to the new enclosures and work together to address the issue of intellectual property rights in all its guises and in all relevant arenas.

It is impossible to anticipate or list all of the many places where concerns about intellectual property could be addressed. It is possible, though, to identify the categories of issues that are likely to be debated, including:

- Farmers' Rights
- bioprospecting, biopiracy and intellectual property
- patents and indigenous knowledge
- alternatives to intellectual property and new forms of protection for rural communities
- life patenting in general
- patenting of human genetic material.

Most of these issues suggest the type of forum where they might be addressed. All of them will have to be dealt with nationally, regionally, and internationally. Rural communities, peoples' organizations and NGOs around the world will have to work to ensure that these issues are addressed at the national level. National debates and policies in turn can effect regional and international decisions. Whatever the level of action, the objectives remain the same:

- to achieve tangible recognition for the intellectual integrity and innovation systems of rural communities and peoples
- to develop mechanisms to protect the intellectual integrity of rural and indigenous peoples
- to implement Farmers' Rights
- to achieve national and international agreements that entrench these achievements

Aid slighted truth, with thy persuasive strain
Teach erring man to spurn the rage of gain;
Teach him that states of native strength possessed,
Though very poor, may still be very blest …

– Oliver Goldsmith, The Deserted Village, 1770

National Level Strategies

Rural people's organizations and others outside government can play a critical role in convincing "developing" and "least developed" country governments that they have time to consider a range of intellectual property options before implementing the intellectual property provisions of the World Trade Organization. Their first real option is to make no legislative changes in the short term, and to take full advantage of the time they have to weigh the alternatives in the area of intellectual property. They might take account of the following considerations:

- The vast majority of patents originate in the industrialized world. A 1995 RAFI study of plant patents worldwide, for instance, revealed that 76% were held in the US, and that industrialized countries (European states, the US, Canada, Japan, Australia, New Zealand and Israel) accounted for nearly 100%. Corporations held 79% of the plant patents covered by this study. The South was under-represented despite the fact that much of the patented germplasm originated there. A few plant patents originated in the South, but in all such cases, the patent assignee (or owner) was a Northern corporation.[23]
- It is not necessary to establish utility patent legislation over plants in order to meet WTO requirements. Nor is it necessary to adopt legislation that is compatible with the existing plant breeders' rights conventions of the Union for the Protection of New Varieties of Plants (UPOV). Once a country joins UPOV, it may have difficulty resisting international pressures to strengthen the rights of commercial plant breeders.
- Every time plant intellectual property legislation has been amended in the industrialized world, it has extended the scope of protection and the rights of commercial breeders, at the expense of farmers, genetic diversity and society. Incentives for innovation in plant breeding and new technologies need not be based on the assumption of exclusive monopoly, as is the case with plant breeders' rights and patents.
- Under any intellectual property system, farmers should be guaranteed the absolute right to save and exchange seed, and to experiment with exotic germplasm. Any incursions into these rights will cut the heart out of global strategies for the conservation and enhancement of agricultural biodiversity. These considerations should be reflected in any strategy by rural peoples to influence how the WTO's intellectual property provisions are translated into national law.

National strategies should also be developed to:

- ensure that Farmers' Rights are protected nationally;
- ensure that national laws and regulations (like seed certification) do not undermine the critical role of farmers in *in situ* conservation; and
- prepare and monitor national government positions in regional and international discussions.

Regional Level Strategies

Many regional bodies, such as the Andean Pact, ASEAN in Asia, and the Southern Africa Development Coordinating Conference (SADCC) are also considering intellectual property. Rural communities, NGOs and peoples' organizations can also influence these discussions. Those who are monitoring intellectual property rights should learn about the discussions that are going on within their regions and seek appropriate ways to intervene.

International Level Strategies

National and regional efforts will underpin work at the international (inter-governmental) level, where many opportunities also exist to influence the direction of intellectual property as it relates to living organisms and knowledge about them. The World Trade Organization, and the Convention on Biological Diversity are principal targets.

Both the World Trade Organization and the Biodiversity Convention specifically protect the intellectual property interests of the biotechnology industry, the WTO by obligating signatories to pass intellectual property legislation over life forms, and the Biodiversity Convention by stipulating that such legislation must be respected. Farming communities are effectively marginalized from the rewards and benefits of industrial intellectual property systems. By strengthening the hand of the already-powerful against the weak and by setting the rules of trading to favour industry in the North, both the WTO and the Biodiversity Convention offer a gloss of legitimacy to the further appropriation by Northern industry of resources and knowledge from the South.

The Biodiversity Convention acknowledges "communities embodying traditional lifestyles", yet proposes nothing to protect their intellectual integrity. These inequities in the new enclosure system mean that all countries should consider alternatives to industrial models of intellectual property. The role of innovation in society should be re-examined in a multilateral forum before GATT is reviewed in 1999.

On the international level, governments, rural communities, farmers, peoples' organizations, and NGOs can influence intellectual property discussions that are already taking place. Several important forums

provide the framework for a concerted international effort to reverse global trends in intellectual property. By combining international action in these bodies with carefully developed national strategies, farmers' organizations and other activists can influence the direction of IPR. They can propose alternatives that better protect the intellectual integrity of rural communities.

WORLD INTELLECTUAL PROPERTY ORGANIZATION (WIPO), GENEVA

WIPO has 151 member states, including all industrialized countries and many countries of the South. The annual WIPO Council includes representatives from member states as well as observers. Each IPR Convention also has its own membership and forum under WIPO, whose Director General is usually the Secretary General of the individual conventions. Day-to-day operations are carried out by a specialist secretariat, effectively led by a Deputy Secretary General.

STRATEGIC POTENTIAL Many governments are now reviewing and/or preparing to adopt new IP legislation. Most have limited resources to consider legislative options. Governments, regional bodies or international agencies could ask WIPO to conduct studies, develop new IP concepts, or prepare legislative options. Requests could also be made to draft prototype laws concerning new areas of rights such as Farmers' Rights or indigenous knowledge, or areas prescribed by the WTO such as *sui generis* legislation covering plants. WIPO could be asked to apply concepts developed in its Model Law on Folklore (see UNESCO, below) to rural community knowledge and agriculture.

UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS (UPOV), GENEVA

UPOV was established in 1961 to deal with plant breeders' rights. It has 30 member governments and seven others have initiated proceedings to join. There are two operative UPOV Conventions dated 1978 and 1991. As of January 5th, 1996, Australia, Denmark, Israel and Slovakia had ratified the more restrictive 1991 Convention that makes plant breeders' rights more like patent protection and limits the right of farmers to trade protected seeds with their neighbours. The UPOV Council meets every October, after a series of inter-governmental and government/industry committee meetings that regulate the Conventions' evolution. Many countries of the South are preparing to join UPOV.

STRATEGIC POTENTIAL UPOV could be asked to conduct studies, develop new IP concepts, or prepare legislative options. Requests could also be made to draft prototype laws concerning new areas of rights such as Farmers' Rights or indigenous knowledge, or areas prescribed by the WTO such as *sui generis* legislation covering plants.

UN FOOD AND AGRICULTURE ORGANIZATION

- International Undertaking on Plant Genetic Resources
- FAO Commission on Genetic Resources for Food and Agriculture
- Farmers' Rights

The FAO's International Undertaking on Plant Genetic Resources was signed in 1983 and is currently being revised to make it consistent with the Biodiversity Convention. The FAO Commission on Genetic Resources was also established in 1983 to monitor and develop policies and programs related to plant genetic resources. The Undertaking is a framework agreement for the collection, conservation and exchange of plant genetic resources internationally. In 1985 the name was changed to the International Undertaking on Plant Genetic Resources for Food and Agriculture. In 1985 the Commission introduced the principle of Farmers' Rights as a counter-balance to plant breeders' rights, and to acknowledge farmers as past, present and future *in situ* agricultural innovators and conservers, and in 1991 the Undertaking was amended to include Farmers' Rights. Farmers are recognized as innovators entitled to intellectual integrity and to compensation whenever their innovations are commercialized. Compensation was anticipated via a global Gene Fund, paid into by the North for genetic conservation and improvement in the South.

STRATEGIC POTENTIAL The principle of Farmers' Rights sets a precedent for collective rather than individual rights, but it has not yet been implemented. No compensation mechanism has been established and few funds have been committed to make Farmers' Rights a reality. It is accepted that farmers have the right to Germplasm, Information, Funds, Technologies and Farming/Marketing Systems (GIFTS). Agenda 21 (the action plan of the Earth Summit) and the Biodiversity Convention have adopted the term, but must still interpret what it means over the coming years. The government of India is drafting legislation to establish Farmers' Rights in law. Several forums, including the FAO and the Biodiversity Convention, will discuss Farmers Rights in the late 1990s. Rural communities and farmers' organizations will need to participate actively in these discussions if the principle is to be translated into effective policy and practice.

UNESCO MODEL LAW ON FOLKLORE

In the early 1980s, UNESCO and WIPO developed a Model Law on Folklore as a new approach to intellectual property protection for indigenous communities. It explicitly excludes science and technology and focuses on traditional cultural activities. It does acknowledge community (not individual) inventors, and recognizes ongoing community ownership over innovations as long as communities continue to develop their cultural activity. They are assumed to have the right to financial benefit from their innovations.

STRATEGIC POTENTIAL Though developed for different purposes, the concepts of community inventor and community ownership are important precedents for farming communities to be aware of in the context of IP debates.

UNESCO INTERNATIONAL BIOETHICS COMMITTEE

In 1994 UNESCO set up an International Bioethics Committee to consider ethical issues related to research on the human genome. This committee solicited public opinion and drafted a report in 1995. The committee is to draft an international legal instrument to govern human genetic research in 1996.

STRATEGIC POTENTIAL This forum is particularly relevant for people wishing to influence the debate about human patenting. UNESCO has tended to be supportive of the South and of indigenous knowledge. It is therefore a forum to monitor closely and consider using in the IP debate.

WORLD HEALTH ORGANIZATION (WHO)

WHO takes a lead role in matters relating to medical ethics and medicinal plants. It is governed by the World Health Assembly that takes annually in May.

STRATEGIC POTENTIAL The WHO is a logical forum in which to raise concerns about human patenting. It is also a place where intellectual property in relation to medicinal plants and knowledge can be raised. WHO may provide medical concepts of prior informed consent that could be adapted to deal with access to traditional seed varieties, medicinal plants, and community knowledge about them.

CONVENTION ON BIOLOGICAL DIVERSITY

When the Convention was adopted in May 1992, delegates identified issues that needed further attention, including intellectual property rights, Farmers' Rights and methods of compensation, and the status of biomaterials collected before the Convention came into force in December 1993. The Convention held two inter-governmental meetings before the first official Conference of the Parties (COP I), held in the Bahamas in late 1994. COP II was in Jakarta in November 1995. COP III is scheduled for Buenos Aires, Argentina, in November 1996. By the end of 1995, 118 countries had ratified the Convention and had the right to participate in COP meetings. The US has not ratified the Convention, but plays a significant role from the sidelines. It is expected to join in 1997.

STRATEGIC POTENTIAL All the original outstanding issues remain unresolved and all future COP meetings will be opportunities to influence their resolution. At COP I and II, peoples'organizations and NGOs worked actively for recognition of Farmers'Rights, and publicized concerns about biopiracy and human patenting. Human patenting was raised formally at COP II by the governments of Papua New Guinea and the Solomon Islands. COPIII will include a major focus on agricultural biodiversity and related concerns. NGOs and indigenous peoples'organizations are already developing their strategies to influence future meetings. With an expected budget of several hundred million dollars a year, the Convention offers a realistic opportunity for the compensation of indigenous knowledge, inside or outside existing IP accords.

WORLD TRADE ORGANIZATION (WTO)

The WTO was created in April 1994 at the end of the Uruguay Round of GATT. It became operational on January 1st, 1995 to manage and monitor the GATT agreement and pursue global trade objectives. It is likely to become a dominant forum for determining the future of intellectual property worldwide. All developing country governments have at least until 2000 before they must implement the WTO's intellectual property provisions. Least developed countries have until 2004. The WTO's IPR provisions are to be fully reviewed in 1999.

STRATEGIC POTENTIAL The 1999 WTO review of intellectual property is a critical target date for strategies on IP. It will be important to monitor the implementation and review processes associated with the Uruguay Round, and to develop strategies as appropriate. Governments of the South should remember they can proceed slowly before implementing the WTO's IPR provisions. They can use the leeway that exists for IPR implementation to explore options and consider alternatives. NGOs can bring this to the attention of their governments.

INTERNATIONAL COURT OF JUSTICE (WORLD COURT)

The World Court (The Hague, Netherlands) has existed in its present form since 1946 as the principal legal organ of the United Nations. It has 15 judges from different countries and legal systems, elected by the UN. The Court decides legal disputes between states and gives advisory opinions to specific UN agencies in accordance with international law. Only states may be parties to disputes before the Court. Advisory opinions are given only to public international organizations.

STRATEGIC POTENTIAL In December 1994, after an NGO-led campaign, the UN General Assembly adopted a resolution asking the World Court for an Advisory Opinion on the legality of the threat or use of nuclear weapons. Inspired by the nuclear weapons example, NGOs have begun to mount a similar strategy to bring two life patenting issues to the UN General Assembly and then to the International Court of Justice. Both would seek an Advisory Opinion from the Court. One would be on the morality of life patenting in general, and the patenting of human genetic material in particular. The second would be on the predatory nature of the WTO's requirement for governments to introduce intellectual property laws, given their implications for sovereignty and Farmers' Rights.

ENDNOTES

1 United States Secretary of State Warren Christopher in a letter of August 16th, 1994 urging the US Senate to ratify the Biodiversity Convention. The letter is supported by the Secretary of Agriculture and the Secretary responsible for the Environmental Protection Agency.

2 *Declaring the Benefits,* RAFI Occasional Paper, Volume 1, Number 3, October 1994: Ottawa, Canada.

3 RAFI calculation from 1990 trade statistics, cited in *Conserving Indigenous Knowledge: Integrating Two Systems of Innovation,* RAFI/UNDP, 1994.

4 J. Srivastava, John Lambert, and N. Vietmeyer, *Medicinal Plants: An Expanding Role in Development,* World Bank, 1996.

5 John Deusing in May 1992 after the adoption of the Nairobi Final Act of the Biodiversity Convention.

6 Anita Kunz, "Unhealthy Alliances" in Omni, Volume 16, February 1994, p.36.

7 Sally I. Hirst, "Biopatents: A Sense of Order" in Trends in Biotechnology, Volume 10, August 1992.

8 Personal conversation with Hope Shand of RAFI, July 1994.

9 Ghayur Alam in *Biotechnology and Sustainable Agriculture: Lessons from India,* OECD Development Centre Technical Papers, Number 103, December 1994, p. 34.

10 Alejandro Argumedo, coordinator of the Indigenous Peoples' Biodiversity Network, at the Conference of the Parties to the Biodiversity Convention in the Bahamas, November 1994.

11 Indigenous peoples' legal systems are discussed in a paper by Antonio La Viña entitled "The Indigenous Peoples of Asia and Intellectual Property Rights: Responding to a Challenge", presented to the Asian Regional Consultation/Workshop on the Protection and Conservation of Indigenous Knowledge, Tambunan, Sabah, East Malaysia, February 24–27, 1995, pp. 28–31.

12 As stated at the Asian Regional Consultation/Workshop on the Protection and Conservation of Indigenous Knowledge in Sabah, East Malaysia, February 1995.

13 Industry sources, press and journal articles.

14 *Declaring the Benefits*, RAFI Occasional Paper, Volume 1, Number 3, October 1994: Ottawa, Canada.

15 *Microbial Biopiracy: An Initial Analysis of Microbial Genetic Resources Originating in the South and Held in the North*, RAFI Occasional Paper, Volume 1, Number 2, June 1994 (updated April 1995) contains an analysis of ATCC deposits by country. See also *Microbial Genetic Resources*, RAFI Communiqué, January–February 1995 for an overview of microbial patenting by industrialized countries.

16 Quoted in David Nason, "Tickner warns over Aboriginal gene sampling", The Australian, Sydney, January 25, 1994, p. 3.

17 Human Genome Sciences Inc., 1993 Annual Report, p. 12.

18 "Declaration on Patenting of Human DNA Sequences" issued by scientists attending an international Human Genome Conference in Brazil, May 1992. The Declaration is quoted in Robin Herman, "The Great Gene Gold Rush", Washington Post Magazine, June 16, 1992, p. 14.

19 Dr. Daniel Cohen, Director of the Centre d'étude du polymorphisme humaine (Paris) is reported to have said: "Our goal has been to deliver this map as quickly as possible, even if it needs refinement, so that it can begin to benefit geneticists and ultimately humanity." Quoted in Ricki Lewis, "French Team Completes Physical Map of Human Genome", Genetic Engineering News, January 1, 1994, p. 35.

20 New Scientist, November 6, 1993.

21 Lawrence M. Fisher, "Profits and Ethics Collide in a Study of Genetic Coding", New York Times, January 30, 1994, p. 16.

22 Quoted in "Patent system gets vote of support from gene workers", Nature, Volume 373, February 2, 1995, p. 376.

23 *Utility Plant Patents: A Review of the US Experience*, RAFI Communiqué, July–August 1995, p. 4.

APPENDIX A

A Short History of the Patent System

Early History

Although monarchs sometimes granted patent monopolies as a royal privilege, until the British Statutes of Westminster governments tended favour the right of the people to have access to inventions over the right of inventors to have exclusivity.

480 Emperor Zeno of Rome rejects the concept of monopoly.

1474 City State of Venice establishes the first patent law, but adds the rule that a patent must be "worked" or forfeited.

1623 English Statute of Monopolies establishes modern patent law.

1790–94 Fledgling US government establishes patents as a constitutional right while the revolutionary government in France passes patent legislation affirming that an inventor has a monopoly as a "natural right". Austria accepts patents but describes patents as an "exception" to the natural right of citizens to have access to inventions.

The Patent Push

With the end of the disruption caused by the Napoleonic Wars, Europe lagged behind the United Kingdom. Believing that their lack of innovation was because they lacked patents, many countries scrambled to adopt British patent laws.

1825-50 Companies press for strong patent monopolies in the UK, Germany, Spain, and Switzerland. The US Patent Office launches the first formal government expedition to collect exotic plants abroad, which continues for almost a century.

Patent Resistance

The Dutch, Germans and Swiss, scrambling to overtake England's technological lead, quickly discovered that their adoption of patents reduced their access to critical inventions and increased costs. Technology importers organized to oppose the patent system.

1851-53 Swiss legislature rejects another attempt to establish a patent system. British Parliament begins investigation of complaints against patents. The concept of compulsory licensing for inventions is raised in both the UK and Germany.

1862-65 British Parliament attacks abuses of the patent system as scientists demand compulsory licenses. German Congress condemns patents as "injurious to public welfare", while German chambers of commerce call for abolition of all patent monopolies. Swiss legislature describes the principle of patents as "pernicious and indefensible." Scientific organizations in the UK repeat their call for compulsory licenses. Italy, Portugal and New Zealand adopt patent laws.

1869-1872 British House of Lords passes a bill calling for compulsory licenses and applies other tough restrictions on monopoly rights. Prominent British politicians call for abolition of patents. Dutch parliament repeals its patent law claiming that "a good law of patents is an impossibility." Canada and Japan adopt patent laws.

"Compulsory" Capitulation

Faced with mounting opposition, technology-exporting countries proposed to restrict their patent monopoly by permitting compulsory licenses to be imposed by states if royalty rates or access were deemed to be unfair. Patent opponents accepted the compromise. Within decades, however, the compulsory license concept was almost universally discarded under corporate pressure.

1873 Patent Congress at the Vienna World's Fair adopts compulsory licenses as a solution to the monopoly dispute. Opposition crumbles with the compromise. Japan repeals its patent law as a result of economic depression.

1874-77 Patent reform bill passed in the British House of Lords is withdrawn in the House of Commons. Germany adopts a new patent law. Switzerland continues to resist.

1883 Paris Union establishes an international patent regime.

1885-1900 "Industrial property" is defined to include agricultural products including grain, fruit, and cattle. In the following years, Norway, Denmark and Finland adopt patent laws while Japan re-introduces its suspended law. Switzerland finally capitulates to international pressure but still excludes chemicals and textiles from patentability.

1903-10 The Netherlands re-introduces patents and Australia adopts a patent law. Under pressure from Germany, Switzerland capitulates on chemicals and textiles .

Early Moves to Patent Life

Louis Pasteur had been granted a patent on a microorganism and French rose breeders wanted the same right. Ornamental breeders got their wish by arguing they would never patent food crops.

1922 German Supreme Court upholds a process patent on a bacterium derived from a turtle, useful in tuberculosis treatment. London meeting of industrial patent lawyers discusses need for protection of plant varieties.

1930 US Congress passes a unique Plant Patent Act allowing the monopolization of asexually produced fruits, trees and ornamentals. Potatoes and other asexually p roduced vegetables are excluded.

1934 Paris Union is amended in London and "industrial property" definition is broadened to include "flowers and flour".

1948 Italian High Court declares plants patentable, but legal confusion leads to a call for special plant variety law.

1952 Vienna session of the International Association for the Protection of Industrial Property fails to act on German proposal on plant breeding.

1957 In Paris, the International Association of Plant Breeders for the Protection of Plant Varieties accepts a French invitation to host a conference on plant breeders' rights, to circumvent apathy in the industrial patent system.

1959 New breeds of agricultural animals and some industrial plants are declared subject to certificates of invention in the USSR.

1961 The International Union for the Protection of New Varieties of Plants (UPOV) is established in Paris.

New Era of Reform Arises

Mid-century reviews by American, British, and Canadian governments all cast serious doubt on the efficiency and equability of patents. Led by UNCTAD, the South joined the debate, expressing the same concerns as the Swiss, Germans and Dutch a c e ntury earlier. Some industrialized country importers of technology sided with the South until politicians were pressured to change their minds.

1958-62 Fritz Matchlup's study for the US Senate gives a landmark position rejecting the "natural right" concept for patenting. Seymour Melman's study for the same body claims that innovation would continue in public and private sectors "with or without a patent system." Canada's Isley Royal Commission affirms Matchlup's view that there is no economic evidence that the patent system is justifiable, adding t h a t patents should not be extended to plants. The Rahl study of the patent system notes: "It is not freedom of competition which requires apology. It is interference with freedom which must always be explained." Brazil challenges the fairness of the Paris Union in the United Nations General Assembly.

1967 The Banks Committee in the UK affirms the value of patents through an "innocence by association" argument that patents and industrial development appear to share a common history. The Committee concedes that no empirical data exists on the merits of patents. Paris Union is amended and strengthened in Stockholm.

1974 UNCTAD study rejects the "natural right" concept. Fur-bearing animals become subject to certificates of invention in the Soviet Union.

1976-80 Canadian Working Paper on Patent Law Revision rejects the validity of the patent system for a new act with a "sunset clause". Canada, Spain, Ireland and G reece oppose the patent system and align themselves with the Group of 77 at a critical Nairobi Conference. Shortly after, Canadian officials are removed or replaced, and a pro-patent policy is adopted by government.

1982 UNCTAD Trade and Development Board vigorously attacks its Secretariat's efforts to reform the patent system, led by British and American diplomats. UNCTAD initiative grinds to a halt.

Back to Life

Patents for ornamental plants quickly grew to become plant breeders' rights for food crops. Compulsory licenses were history and the push was on to permit the patenting of all living things.

1969 In the landmark Red Dove decision, German Federal Supreme Court rules that a process for breeding animals may be patentable. New Hungarian patent law expressly permits the patenting of animal breeds under criteria similar to UPOV rules.

1970 In Washington, 35 countries sign the Patent Cooperation Treaty to ease the patent application work of companies by adopting a more uniform approach among industrialized states. The US Plant Variety Protection Act is passed during the Christmas season of a dying Congress. For the first time cereals and vegetables are patentable.

1972 & '78 UPOV Convention is strengthened.

1975 Microorganisms are ruled patentable in German Bakers' Yeast case.

1980 In a five to four decision, the US Supreme Court allows General Electric to obtain a patent on a microorganism under regular industrial ("utility") patent law. In another Christmas battle, the US Congress amends the 1970 Act to include six major vegetables previously excluded.

1980-1984 American patent applications by publicly-funded universities and hospitals for inventions containing human biological material increase by more than 300%. American doctors for leukemia patient John Moore receive a patent on a cell line derived from his cancerous spleen which produces high levels of useful and profitable proteins. Moore files a lawsuit claiming his blood cells were misappropriated and demanding a share in the potentially multi-billion dollar profits derived from use of these cells.

1985 US Patent Office rules that plants can be patented under industrial patent laws.

1987 US Patent Office announces it will allow industrial patenting of higher life forms, including pets and livestock. A patent official leaves open the possibility of patenting human "traits". Genome Inc. announces it will try to copyright the base pairs of the human genome.

1988 US Patent Commissioner reveals a new policy allowing livestock patent holders to charge royalties on the offspring for the patent's duration. DuPont obtains an American patent on the first transgenic mouse (created with human genes), genetically engineered for its susceptibility to cancer. A Commission of the European Community drafts a decree on the "legal protection of biotechnological inventions" that would go beyond US decisions, making patents on all life forms possible (including progeny of patented plants or animals). The proposal would reverse the burden of proof, to better protect inventors from infringement.

1990 California Supreme Court rules that John Moore (from his 1984 case) had no rights of ownership over his cells after they were removed from his body, but has the right to sue his doctors for failing to inform him of the potential commercial value of his cell line.

1991 UPOV revises its 1978 Convention, to extend the protection granted to corporations and reduce the rights of farmers. It includes clauses on essentially derived varieties.

1992 The legally binding International Convention on Biological Diversity is signed in Brazil affirming the legitimacy of intellectual property over life forms. The US National Institutes of Health files for patents on thousands of gene sequences related to the human brain whose function is not yet known, sparking worldwide protest. Nobel Laureate James Watson describes the patent application as "sheer lunacy". US Patent Office grants two patents to W.R Grace subsidiary Agracetus for all genetically engineered cotton.

The Years of Living Dangerously

As GATT entrenches life patenting, Cargill's offices in India are burned down and patents are granted on entire crop species in Europe and the United States. Other patents are granted on human cell lines over the protest of religious leaders. The debate could go either way. Ownership of life is in the balance.

1993 Mass protests and riots erupt in India as farmers become aware of the impending impact of GATT on the ownership of life forms. Brazilian farmers, indigenous peoples and religious leaders organize against American pressure to toughen patent laws in that country. An American government attempt to patent the cell line of a Guaymi woman in Panama is blocked by indigenous peoples' organizations.

1994 GATT Uruguay Round is concluded. For the first time intellectual property is considered a trade issue, governed by the World Trade Organization. Signatory states are required to provide for patents on microorganisms and some kind of IPR coverage for plants. The European patent office grants Agracetus/W.R. Grace a patent on all genetically engineered soybeans. After public and industry protest, the US Patent Office revokes two Agracetus patents on all genetically engineered cotton (though the patent remains valid until all avenues of appeal are exhausted). The Prime Minister of India announces India will withdraw species patents on cotton.

1995 The US Supreme Court interprets "farmer exemption" narrowly, to limit the amount of proprietary seed which can be saved and possibly sold by farmers. In a landmark decision, the European Parliament rejects legislation that would remove all barriers to life patenting in the European Union. An international meeting of leading human genome scientists concludes that the patent system is the "mechanism of excellence" for commercializing the results of the Human Genome Project. Eighty American religious leaders from all major faiths issue a statement opposing patents on human and animal genes as a violation of the sanctity of life. Led by Third World Network, an international campaign against patents on the neem tree is launched. European Patent Office concurs with Greenpeace that plant variety patents are not acceptable. US government grants itself a patent on the cell line of a Hagahai man in Papua New Guinea and awaits a second patent on the cell line of an indigenous person in Solomon Islands. Pacific Island governments, Canada and Sweden protest at the Biodiversity Convention.

Sources: The Laws of Life: Another Development and the New Biotechnologies (Dag Hammerskjold Foundation, 1988); RAFI Communiqués; scientific and trade journals; Neil Hamilton, Possible Effects of Recent Developments in Plant Related Intellectual Property Rights in the US, (1995).

APPENDIX B

Who Has Access to Western Intellectual Property Systems? A Comparison by Potential Users

ISSUE	TRANSNATIONAL ENTERPRISES
Inventor: In Intellectual Property (IP) law, an inventor is a named individual or a group of named individuals.	Enterprises have contractual arrangements to ensure that named inventor(s) surrender all or most of their rights to the company.
Invention: With exceptions, most patentable inventions are highly specific micro-improvements that may have macro-applications.	Enterprises generally invent to improve their own production and/or market, and secondarily to license their invention to competitors.
Requirements: In most IP systems, criteria for patents include: 1) stand a rds of consistency (uniformity and stability over time); 2) non-obviousness or novelty; and 3) creativity (evidence of an "inventive step").	Enterprises generally deal with micro-improvements, and find these patent criteria difficult but manageable.
Preparation: Isolation, purification and description of biomaterial in a technically arduous manner is critical to the success of the patent application.	Enterprises have scientific personnel, laboratories and experience to meet technical demands easily.
Cost of Advice: Advice from highly-specialized patent lawyers on biomaterials costs from US$20,000 to US$40,000 in different jurisdictions.	Enterprises have in-house legal departments and ready access to specialist consultants.
Cost of Applications: Forms are complex and fees vary among countries. Fees can range from a few hundred to a few thousand dollars.	Enterprises have no problem with high fees.
Coverage: There are no universal patents. Generally, biomaterials are patented in the US, Europe and Japan. It is entirely legal to exploit someone else's patent in a country that does not register the patent.	Enterprises usually apply for patents in every feasible country, often applying in more countries than necessary.
Deposit: Usually, biomaterials under patent claim must be deposited in an institution designated by the patent office. At the American Type Culture Collection, the annual cost of deposit is about US$500.	Enterprises meet this obligation routinely.
Disclosure: To obtain a patent, the inventor must disclose the full invention so that others can duplicate the process or results.	Enterprises often establish a number of related patents ("patent families") to prevent full disclosure and maximize their opportunity for profit.
Exemption: In order to encourage scientific investigation, IP laws encourage access to patented technologies for basic research.	Enterprises make use of this "research exemption" to invent around patented ideas.
Maintenance: Usually patents lapse if maintenance fees are not paid annually. Fees generally rise as the patent ages. It is estimated to cost US$250,000 to enforce a patent over its life span.	Enterprises have no difficulty financing or administering their patents through their legal departments.
Licensing: Strategies for licensing patents to others are central to the effective maximization of patent benefits.	Enterprises tend to "cross-license" to one another across different industries and geographic markets. Those unable to offer multi-technology and multi-market opportunities will benefit less.
Infringement: Intellectual property falls under civil not criminal law. It is up to patent holders to police and defend their patents, which can be extremely expensive and time consuming. If patent holders cannot defend their patents, others will breach them with impunity.	Enterprises are often aggressive in defending patents and using patent claims as a means of declaring their market turf.

PUBLIC SECTOR INSTITUTES	FARMING COMMUNITIES
Institutes can have similar arrangements with their research scientists, depending on their arrangements with governments.	IP law does not recognize community invention. The concept of an individual inventor is sometimes alien to communities, and can cause difficulties.
Institutes tend to have less targeted research goals. The products of their discoveries are not usually as patentable.	Communities often develop complex macro-technology inventions that may apply only in micro-markets, or in situations highly specific to the community. This makes patenting more problematic.
Institutes, for reasons of experience and funding, are often less able to manage these criteria.	Since these criteria have little or nothing to do with the actual use of an invention, communities will probably find the criteria difficult to meet.
Institutes may or may not have the necessary personnel and equipment. Many institutes lack experience.	Community expertise and experience is radically different from the technical requirements for patent claims. They generally have to trust or pay others to do this work.
Institutes generally have little in-house legal capacity, and limited access to inexpensive legal expertise.	Communities cannot usually afford or obtain either basic or specialist legal advice.
Institutes may find application fees onerous.	Communities may find most application fees too expensive, since they must be paid in advance of any anticipated royalties.
Institutes often make the mistake of patenting only in their own country, or in one of the major markets. An interested competitor could exploit the institute's invention from a country that does not honour the patent.	Communities find it difficult to manage multi-state patents, for language and financial reasons.
Institutes can usually meet this obligation, though cost is often a consideration.	Communities may be concerned that a deposit could lead to a misuse of their invention. Communities may also find the cost high.
Institutes dedicated to public scientific exchange generally make full disclosure in one patent claim, exposing themselves to imitation.	Communities risk exposing their macro-innovation in one patent, and then find it the subject of numerous micro-patent claims by others.
Institutes often find that others are inventing around their patented inventions, while they are enjoined by enterprises not to infringe on company claims.	Communities generally view themselves as sellers and not buyers of inventions. Research exemptions strengthen the hand of buyers over sellers.
Inexperienced public institutes may allow patents to lapse because of administrative oversight or cost concerns.	Communities can encounter language and cost problems in administering patents from year to year.
Institutes often operate in a single industry segment and have a limited capacity to negotiate with counterparts in other parts of the world.	Communities find it difficult to judge the fairness of licensing proposals and will not be able to offer patent trades with prospective partners.
Institutes tend not to have a strong patent defense and sometimes accede to political pressure not to challenge the private sector.	Communities find it almost impossible to monitor and confront patent infringements around the world.

Source: RAFI

APPENDIX C

Bioprospecting and Biopiracy Activities

Company/Organization	What Collecting?	Geographic Location
Abbott Laboratories (USA)	microbes, plants	
Adheron Corporation (USA)	marine bacteria and other organisms	
American Cyanamid (USA)	arid land plants for crop protection agents and pharmaceutical development	Chile, Argentina, Mexico
AMRAD Corporation (Australian Medical R and D)	drug discoveries from marine organisms	Australia, oceans
AMRAD Corporation (Australia)	drug discoveries from marine organisms and microbial soil sources	Antarctica
AMRAD Corporation (Australia)	Australian Aboriginal bush medicines, microbial and soil samples from Bathhurst and Melville Islands	Australia, South East Asia
Aphios Corporation (USA)	marine microorganisms	US territorial waters
Boehringer Ingelheim (Germany)	plants, microbes	
Bristol-Myers Squibb (USA)	insects and related species	Dry tropical forests of Guanacaste Conservation Area in Costa Rica.
Bristol-Myers Squibb (USA)	rainforest plants with medicinal properties, especially Ancistrociadus (source of anti-HIV agent) and anti-malarials	Cameroon (Korup forest range) and Nigeria (Oban Hills rainforest)
Bristol-Myers Squibb (USA)	fungi, microbes, plants, marine organisms	
Bristol-Myers Squibb (USA)	rainforest plants for drug development, plus non-medicinal plants for sustainable commercial harvest	Suriname
Caapi Associates (USA)	Amazonian medicinal plants	Brazil
Ecogen Incorporated (USA)	entomoparasitic nematodes for biocontrol agents	Malaysia
Ecopharm (USA – division of Pharmagenesis)	microorganisms associated with medicinal plants	worldwide
Ecoscience Corporation (USA)	screening of soil samples for fungal strains to be used in pest control	China
Eli Lilly Co. (USA)	plants, algae	
Ethno-Medicine Preservation Project (Peru)	plants	Peruvian Amazon
Foundation for Ethnobiology (UK)	medicinal plants worldwide, drug and agricultural applications	South America, Asia
Glaxo Group (UK)	plants, fungi, microbes, marine organisms	Asia, Latin America, possibly other areas
Instituto Nacional de Biodiversidad – InBio (Costa Rica)	plants, insects, microbes	Guanacaste Park and other protected areas in Costa Rica

Use of Indigenous Knowledge/Indigenous Peoples or Territories	Additional Information and/or Intermediary
	Program reportedly terminated in 1995.
	US$5 million research agreement with University of Maryland.
Priority given to plants with rich ethnobotanical background.	ICBG agreement with University of Arizona, Institute of Biological Resources of Buenos Aires, National University of Patagonia, Catholic University of Chile, National University of Mexico, Purdue University, Louisiana State University.
	Collaborating with Australian Institute of Marine Science to provide AMRAD with 20,000 samples over the next five years.
Special focus on organisms from harsh environments.	Collaborating with Antarctic Cooperative Research Centre (Hobart, Tasmania). Special focus on organisms from harsh environments.
Targets plant medicines used by Australian indigenous people, specifically anti-viral, immunomodulatory, and anti-cancer compounds.	Deal signed with the (Aboriginal) Northern Land Council to pay US$12–$15 per sample and undisclosed royalties if drugs are developed. Agreement with US-based Panlabs Inc.
	Research agreements with Bristol Myers Squibb (USA), Harbor Branch Oceanographic Institute, and CalBioMarine Technologies.
	Agreements with University of Illinois and New York Botanical Garden to obtain plants.
	US government supported ICBG agreement with National Biodiversity Institute (InBio) of Costa Rica and University of Costa Rica.
Ethnobotanical information from traditional medical practices will be used to prioritize collection of plants.	US government-supported ICBG agreements must include benefit sharing with source countries, but terms are not available to the public. Also participating: Walter Reed Army Institute of Research (US government), Smithsonian Insitution, University of Yaounde, World Wildlife Fund, Nature Conservancy, World Resources Institute, Shaman Pharmaceuticals.
	Ranked second largest US pharmaceutical corporation. Contracts with third parties to collect specimens, including Scripps Institute and Oncogen.
Ethnobotanical uses of plants by indigenous peoples to be documented. Terms of benefit-sharing agreement not public. Conservation International will set up Shaman's Apprentice program.	US-government supported ICBG project with Virginia Technical University, Missouri Botanical Garden, National Herbarium of Suriname, Bedrijf Geneesmiddelen & Conservation International. Indigenous Peoples' Fund receives benefits, but is largely non-indigenous.
Primary focus to collect medicinal plants and provide work for the poor, presumably drawing upon indigenous people for both identification and labour.	Claims that its marketing of plant extracts may solve Brazil's financial troubles, deter mining, help teach the Brazilian government the value of its resources, and prevent the destruction of the Amazon.
	Research and development agreement with Malaysian Research and Development Institute.
	Explores potential pharmaceutical leads from nonpathogenic microbes living in mutually beneficial relationships with medicinal plants.
	Ecosicence will pay Chinese Institute of Biological Control.
	Major pharmaceutical corporation that has recently purchased Sphinx Pharmaceuticals.
Seeks out "new and important weapons in the age-old battle against disease" by working with traditional healers.	Aims to preserve knowledge by encouraging a new generation of healers.
Specifically targets indigenous peoples' knowledge, including Surinamese people and Karen people in Thailand.	The Foundation purports to be an academic endeavor. Its president holds two patents on drugs isolated from Amazonian medicinal plants. Works with companies with financial interests in plant resources.
	Has obtained materials from Kew Royal Botanical Gardens, Biotics Ltd., University of Illinois, National Cancer Institute. Contracts with Carnivore Preservation Trust to collect plants in Laos.
Possibly collecting in Talamanca Indian reserve, but it is unclear to what extent infomation is obtained from indigenous peoples.	Private organization that has entered into high profile contracts with Merck, Bristol Myers Squibb, and possibly other major pharmaceutical companies.

Company/Organization – cont.	What Collecting? – cont.	Geographic Location – cont.
International Marine Biodiversity Development Corporation	deep ocean research to collect exotic species for biotech applications	international waters
International Plant Medicine Corporation (USA)	Amazonian medicinal plants	Ecuador
International Organization for Chemical Sciences in Development (IOCD – chartered in Belgium)	"rare trees, bushes, insects, amphibians, fungi, microbes, and other natural species"	Plans to start work in Africa or Latin America, and then move worldwide.
Ix Chel Tropical Research Foundation (Belize)	plants	Belize
Johnson & Johnson (USA)	novel chemical compounds	
Knowledge Recovery Foundation International (USA)	Proposal to gather and analyze indigenous knowledge to explore the potential for developing new drugs.	Amazon Basin region, Tropical Asia
Magainin Pharmaceuticals (USA)	African reptiles, marine fish & organisms	
Marine Biotechnology Institute (Japan)	marine organisms	Micronesia
Martek Biosciences Corporation (USA)	microalgal strains for developing nutritional, pharmaceutical, and diagnostic products	worldwide
Maxus Ecuador Incorporated (part of Maxus Petroleum-USA and owned by YPF-Argentina)	1200 plant species have been gathered, of which 18 are new to scientific world and 200 are new species in Ecuador.	Ecuadorean Amazon
Merck and Co. (USA)	fungi, microbes, marine organisms, plants	Latin America
Missouri Botanical Gardens (USA)	plants (extremely large scale)	worldwide, especially tropics
Monsanto Corporation (USA)	plants	Peruvian Amazon
Myco Pharmaceuticals (USA)	screening of fungi for drug development	worldwide
National Cancer Institute (USA government agency)	Plants, microbes, marine organisms. NCI's natural products repository contains over 500,000 samples collected primarily in Africa, Asia and Latin America.	worldwide
New York Botanical Garden (USA)	everything	worldwide, special focus on Latin America
NPS Pharmaceuticals Incorporated	Animals, insects (especially spider and scorpion toxins)	Madagascar
Oceanix Biosciences Corporation (USA)	enzymes from marine sources	deep sea thermal vents, polar waters
Paracelsian Incorporated (USA)	plants	China
Pfizer Incorporated (USA)	plants	USA
Pfizer Incorporated (USA)	plants	Ecuador (proposed)
Pfizer Incorporated (USA)	plants	China
Pharmacognetics (USA)	natural products for drug development	Latin America

Use of Indigenous Knowledge/Indigenous Peoples or Territories – cont.	Additional Information and/or Intermediary – cont.
	Ten year research project undertaken with Russian Academy of Sciences.
Targets indigenous peoples' knowledge of medicinal plants, and seeks to obtain Tagaeri plant knowledge.	Has proposed to forcibly extract medicinal plant information from indigenous people.
Will depend on indigenous people for leads and promises to deal with them "equitably and ethically" by mobilizing local capital to "sustain bioprospecting at a commercial scale".	Says it "is working to establish the Biotic Exploration Fund, a new world-level agency that aims to catalyze a great increase in the quantity of bioprospecting in developing countries." Claims marketing samples will be motor of local development beneficial to indigenous people.
Exports samples of plants identified by traditional healers. Has exported 1,500 such plants.	Participant in US National Cancer Institute's phytomedical screening program. NCI discoveries are transferred to US companies where they may become patented pharmaceuticals.
	Funds chemical prospecting at Cornell University and trains scientists from the South in bioprospecting.
	Proposes to develop a well-documented, well-preserved library of plant extracts that can be "rented" to pharmaceutical firms.
	Developing human pharmaceuticals from African clawed frog and antibiotic steroid from dogfish shark.
	Consortium of Japanese government and 21 Japanese corporations.
	Merck and Co. will screen extracts from Martek's collection of more than 1600 microalgal samples. Merck pays Martek to supply extracts.
Plant collection and inventory traverses Yasuní National Park and Waorani Ethnic Reserve.	Contracts with Missouri Botanical Garden for plant collection and inventory during construction of 120 km road in tropical moist forest.
Indigenous knowledge from Urueu-wau-wau of Brazil. Merck holds a patent on anti-coagulant derived from their plant material.	Major pharmaceutical corporation. Has contracts with N.Y. Botanical Garden, MYCOSearch, Martek Biosciences, including a high-profile contract with InBio of Costa Rica involving an up-front payment of US$1.2 million.
Does not officially emphasize indigenous knowledge, but indigenous people used to assist its work. Collaborates with ethnobotanists as well as loggers and oil companies.	One of the world's largest collectors of plants. Does not conduct its own product-oriented research, but assists and provides plant samples to researchers.
Exclusive focus on indigenous peoples' medicinal plants.	Plans to receive 1,000 samples with accompanying ethnobotanical information via Washington University (St. Louis, USA) as part of US government-sponsored ICBG-Peru program. Local indigenous peoples' organization opposes the project.
	Company will identify, develop and commercialize drug leads, and is also developing screening technologies.
Uses indigenous knowledge to identify some materials.	Contracts with University of Illinois to collect in Southeast Asia, Missouri Botanical Garden to collect in Africa, and N.Y. Botanical Garden to collect in Latin America. Marine organisms collected by Coral Reef Research Foundation in Indo-Pacific. Microbes collected by various organizations.
Leading centre for ethnopharmacology and ethnobotany research, uses indigenous knowledge to collect.	Contracts with many private companies for collection of biomaterials. Personnel prominent in the field.
	Malagasy government has given NPS exclusive rights to research animal resources for medical uses.
	Has joint research agreement with University of Maryland. Seeks a variety of exotic enzymes, including treatments for central nervous system diseases.
Exclusive focus on traditional medicines.	Company is seeking US government approval for anti-HIV drug derived from Chinese medicine, and is iscreening at least 2,800 samples of traditional Chinese medicines.
Collections based partly on existing ethnobotanical leads.	Three year, US$2 million research collaboration with N.Y. Botanical Gardens.
May use indigenous people as "parataxonomists" to assist plant collection and identification.	Company proposed to pay US$1 million to receive a comprehensive set of samples from each of Ecuador's major biomes and their exclusive rights. Ecuadorean government rejected Pfizer's proposal.
Exclusive focus on traditional medicines.	Has agreement with Academy of Traditional Chinese Medicine in Beijing to study traditional herbs as sources of potential new drugs for human and animal health.
Company hopes to rely entirely on leads from indigenous peoples in identifying plants and is interested in developing a line of cosmetics based on indigenous peoples' products and uses.	Company founded 1993 and partly owned by Pan American Development Foundation, a non-profit organization that works with rural and indigenous groups. Will use these connections to organize plant collection and identification.

Company/Organization -cont.-	What Collecting? -cont.-	Geographic Location -cont.-
Pharmagenesis (USA)	plants	Asia
PharmaMar (Spain)	bioactive materials from marine sources to develop drugs for cancer and AIDS	worldwide
Phytera Incorporated (USA)	plants	worldwide
Phyton Catalytic Incorporated (USA)	plants	Africa, Asia, Europe, Americas
PhytoPharmaceuticals Corporation (subsidiary of Escagenetics Incorporated, USA)	plants	negotiating agreements with groups in Africa, Brazil, China, India, Eastern Europe
Research Corporation Technologies (USA)	bacteria	Latin America
Rhone-Poulenc Rorer (France)	microbes, plants, marine organisms	
Sabinsa Corporation (USA)	plants	India
Shaman Pharmaceuticals (USA)	plants for drug development	Latin America, Africa, Asia
SmithKline Beecham (USA)	microbes, plants, marine organisms	
Sphinx Pharmaceuticals (subsidiary of Eli Lilly, USA)	fungi, algae, plants, marine organisms	
Sterling Winthrop (USA)	microbes, plants, marine organisms	
Syntex Laboratories	microbes, plants	
University of Utah (USA)	plants	Panamá
Upjohn Company (USA)	microbes, plants	
Xenova Limited (UK)	microorganisms and plants	worldwide

Use of Indigenous Knowledge/Indigenous Peoples or Territories -cont.-	Additional Information and/or Intermediary -cont.-
Focus on traditional medicinal plants, especially Chinese.	
	PharmaMar researchers travel aboard the ships of Pescanova, one of the largest fishing fleets in the world.
	Specializes in plant cell technology and holds one of world's largest plant cell collections. Uses technology to provide large quantities of a compound from small tissue samples.
	Focuses on production and supply of plant-derived compounds through cell culture.
	Will acquire plant samples from collaborating institutes that will retain rights on drugs developed from plant materials and receive royalties. Filed for bankruptcy in January, 1996.
	Brokering bacteria with nematocidal and antifungal properties isolated from Costa Rican soil sample.
	Samples obtained from University of Hawaii, Shanghai Medical University, Beijing Medical University, and Tianjin Plant Institute.
Focus on plants with established medicinal uses in Indian cultures.	New company hopes to introduce and broker botanical and pharmacological resources of India in North America. Will develop, process and market standardized extracts of Indian plant materials.
Shaman's strategy is to identify promising plants by using indigenous knowledge, with traditional healers as primary informants. Shaman has non-profit Healing Forest Conservancy to facilitate reciprocal flow of benefits and support conservation.	Shaman has had remarkable success in identifying potentially valuable drug leads based on indigenous knowledge. Has received two patents on drugs in clinical trials (anti-fungal and anti-viral). Strategic alliances with Eli Lilly, Merck, Bayer, and Inverni della Beffa of Italy.
	In-house collectors, but also obtains materials through Biotics, Kew Royal Botanical Gardens, University of Virginia, Scripps Institute of Oceanography, Morris Arboretum, and MYCOsearch.
	Has obtained materials from Biotics.
	Has obtained materials though Mississippi State University, Brigham Young University, and N.Y. Botanical Garden.
	Has obtained materials from the Chinese Academy of Sciences.
Plans to target plant knowledge of the Emberá people and farmers. Claims that drug finds will make indigenous people "more likely to value the forest".	Proposed project with the University of Panamá, Smithsonian Tropical Research Institute, Natura Foundation, and an unidentified "indigenous organization". No concrete plans for compensating local people.
	Major pharmaceutical corporation. Has obtained materials through the Shangai Institute.
	Company has collection of 23,000 live microorganisms (lichen, bacteria, fungi), both in-house and in labs of collaborators. Alliances with Genentech, Warner-Lambert Company, Genzyme and Suntory Limited, and other academic institutions.

Note: Initial incarnations of this list compiled by RAFI with assistance from Jack Kloppenburg, GRAIN, Accis.

APPENDIX D

LORDS OF LIFE
Leading Enterprises in Five Major Life Industry Segments

World's Top 10 Agrochemical Corporations

Company	Headquarters	1995 Sales (US)	Comment
Novartis	Switzerland	4,410 million	combined Ciba Geigy and Sandoz
Monsanto	USA	2,472 million	
Bayer	Germany	2,373 million	
Zeneca	UK	2,363 million	
AgrEvo	Germany	2,344 million	formerly Hoechst and Schering
Du Pont	USA	2,322 million	
Rhone-Poulenc	France	2,068 million	
DowElanco	USA	1,962 million	
American Home Products/ American Cyanamid Cyanamid	USA	1,910 million	American Home Products acquired American
BASF	Germany	1,450 million	

Source: RAFI, based on AGROW, No. 253, March 29, 1996.

The top 10 agrochemical corporations accounted for $23.6 billion, or 81% of all agrochemical sales in 1995.

World's Top 10 Seed Corporations

Company	Headquarters	Estimated Sales (US)	Comment
Pioneer Hi-Bred Intl.	USA	1, 500 million	
Novartis	Switzerland	900 million	formerly Ciba Geigy and Sandoz
Limagrain	France	525 million	French cooperative
Seminis	Mexico	500 million	owned by Empresas La Moderna (Mexico) and George J. Ball (USA)
Zeneca/Van der Have	The Netherlands	460 million	pending merger
Takii	Japan	450 million	vegetable/flower/maize/ turfgrass
Dekalb Plant Genetics	USA	320 million	Monsanto is a large shareholder (approx. 40%)
KWS	Germany	315 million	
Sakata	Japan	300 million	vegetable/flower/turfgrass
Cargill	USA	250 million	privately-held

Source: RAFI, based on information provided by Kent Group Inc.

The commercial seed industry is worth approximately (US) $15 billion per annum. The top 10 corporations account for $5,520 billion, or 37% of the worldwide market.

World's Top 10 Food and Beverage Corporations

Corporation	Headquarters	1995 annual sales (food and drink) US$ millions	food & drink as % of total sales
Nestle SA	Switzerland	$46,400	99%
Philip Morris Inc.	USA	$33,035	50%
Unilever PLC/NV	UK/Netherlands	$25,300	56%
ConAgra, Inc.	USA	$20,345	84%
Coca-Cola Co.	USA	$18,018	100%
PepsiCo Inc.	USA	$16,123	53%
Mars Inc.	USA	$13,500	100%
Cargill Inc.	USA	$12,929	28%
Archer Daniels Midland	USA	$12,672	100%
Kirin Brewery Co.	Japan	$12,626	97%

Source: DataMonitor

World's Top 10 Pharmaceutical Corporations

Company	Headquarters	1995 Sales US$ millions	Comment
Glaxo Wellcome	UK	$11.80	
Merck	USA	$10.96	
Novartis	Switzerland	$10.94	Ciba-Geigy and Sandoz combined
Hoechst	German	$9.42	
Roche	Switzerland	$7.82	
Bristol-Myers Squibb	USA	$7.81	
Pfizer	USA	$7.07	
SmithKline Beecham	UK	$6.60	
Johnson & Johnson	USA	$6.30	
Pharmacia & Upjohn	Sweden	$6.26	

Source: Wall St. Journal, 7 March 1996. Company sales exclude sales of nondrug products.

RAFI estimates that the total world pharmaceutical market is approximately $197 billion per annum. The top 10 companies account for approximately 43% of the total.

World's Top 10 Veterinary Pharmaceutical Corporations

Corporation	1995 Sales US$ millions
Pfizer Inc. (US)	1,200
Merck Agvet	830
Bayer	775
Novartis	750
Rhone Merieux, Inc.	600
Hoechst roussell Vet	520
Elanco Animal Health	510
Mallinckrodt Veterinary Inc.	460
Ft. Dodge Laboratories	440
Pharmacia & Upjohn	380

Source: Feedstuffs, 29 July 1996

The global market for animal health industry is almost $15 billion. In 1995, the top 10 corporations accounted for 43% of global sales.

APPENDIX E

The Pharmaceutical Industry & Human Genome Companies

Genomic Company	Corporate Partners	Comment
Canji Inc. (USA)	Schering Plough	Schering Plough acquires Canji.
Darwin Molecular Corp. (USA) founded 1992	William Gates and Paul Allen (Microsoft) Rhone Poulenc Rorer Inc.	Gates & Allen make $10 million equity investment.
GeneMedicine, Inc. (USA) founded 1992	Corange Intl. Ltd. Genentech, Inc. (Hoffman-La Roche)	Corange Intl. makes $100 million research agreement; Genentech makes equity investment.
Genetic Therapy Inc. (USA)	Novartis	Sandoz (Novartis) acquires GTI) in 1995 for $295 million.
Genome Therapeutics Corp. (USA) founded as Collaborative Research in 1961, changed name in 1994	Astra AB Boehringer Mannheim Schering-Plough	
Genset (France) founded 1989	Synthelabo (France)	Large-scale sequencing of human genome. Synethelabo (France) makes $69 million research agreement and equity investment of $9.7 million. Focus on prostate cancer.
Human Genome Sciences Inc. (USA) founded 1992	Genetic Therapy (Novartis) ISIS Pharmaceuticals Pioneer Hi-Bred Intl. Hoffman-La Roche SmithKline Beecham Takeda	SmithKline Beecham made $125 million research agreement in 1995. Pioneer Hi-Bred has $16 million deal to map maize genes.
Incyte, Inc. (USA) founded 1991	Abbott Labs Hoechst Marion Roussel Hoffman-La Roche Johnson & Johnson Novo Nordisk Pfizer Pharmacia & Upjohn Zeneca	All subscribe to Incyte's proprietary gene sequence databases. Incyte claims its database partial sequences of nearly 100,000 genes (May, 1996). Pfizer and Pharmacia & Upjohn are major investors in the company.
Millennium Pharmaceuticals Inc. (USA) founded 1993	Eli Lilly & Co. Hoffman-LaRoche Astra AB	Eli Lilly has 5-yr. agreement valued at $69 million related to atherosclerosis.
Myriad Genetics Inc. (USA) founded 1991	Bayer Ciba-Geigy (Novartis) Eli Lilly & Co.	Bayer – obesity, asthma and osteoporosis gene discovery; Novartis – cardiovascular drugs; Eli Lilly – license on breast cancer gene.
Sequana Therapeutcis founded 1993	Boehringer Ingelheim Corange Intl. GlaxoWellcome Genentech (Novartis)	Glaxo has 5-yr. R&D agreement on Type II diabetes and obesity genes.

source: RAFI

APPENDIX F

Glossary

Many of the following terms are highlighted in bold type the first time they appear in the text.

Agenda 21
A comprehensive action plan on the environment adopted at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil, in June 1992.

bilateral agreement
An agreement signed by two parties, including governments.

biotechnology
A variety of techniques that involve the use and manipulation of living organisms to make commercial products. These techniques include cell culture, tissue culture, embryo transfer and recombinant DNA technology (genetic engineering).

biological diversity or biodiversity
All living organisms, their genetic material and the ecosystems of which they are a part. It is usually described at three levels: genetic, species and ecosystem diversity.

Genetic diversity is the variation of genes between and within species. It is all the genetic information contained in the genes of all individual plants, animals and microorganisms on earth. Genetic diversity within a species permits it to adapt to new pests and diseases, and to changes in environment, climate, and agricultural methods.

Species diversity is the total number or variety of species in a given area.

Ecosystem diversity is the total variety of ecosystems or interdependent communities of species and their physical environment. Ecosystems may cover very large or quite small areas. They include such natural systems as grasslands, mangroves, coral reefs, wetlands and tropical forests, as well as agricultural ecosystems that depend on human activity but have characteristic assemblages of plants and animals.

biopiracy
The use of intellectual property to legitimize the exclusive ownership and control of biological resources and knowledge, without recognition, reward or protection to informal innovators.

Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure
An international treaty administered by the World Intellectual Property Organization (WIPO) that has been signed by 32 countries.

cell line
Cells removed from humans, or other organisms that are manipulated to sustain continuous, long-term growth in an artificial culture. So-called immortal cell lines have been cultured to live indefinitely under artificial conditions, where temperature and nutrient requirements are strictly controlled. Cell lines provide an inexhaustible supply of the DNA of the organism they are taken from (see Human Genome Diversity Project below).

centres of genetic diversity
The locations where the world's most common food crops are found to have the greatest genetic diversity. Often called the Vavilov Centres after the Russian scientist who identified them in the early 1900s, they tend to be areas where crops have been cultivated longest and most widely, but are not necessarily the centres of origin of crop species.

compulsory licensing
A legal mechanism that obliges patent holders to make their inventions available at equitable prices if competitors can prove that patents are not being "worked" to the benefit of society or are not accessible within a reasonable price range.

Conference of the Parties (COP) to the Convention on Biological Diversity
All the countries which have ratified the Biodiversity Convention. The COP meets periodically to discuss and shape the implementation of the Convention. Meetings were held in the Bahamas in 1994 and in Indonesia in 1995. The 1996 meeting is scheduled to take place in Argentina.

Consultative Group on International Agricultural Research (CGIAR)
An informal network of sixteen International Agricultural Research Centres whose gene banks came under the control of the UN Food and Agriculture Organization in October 1994. The centres are:

- CIAT: Centro Internacional de Agricultura Tropical/International Centre for Tropical Agriculture, Colombia
- CIFOR: Centre for International Forestry Research, Indonesia
- CIMMYT: Centro Internacional de Mejoramiento de Maíz y Trigo/International Centre for the Improvement of Corn and Wheat, Mexico
- CIP: Centro Internacional de la Papa/International Potato Centre, Peru
- ICARDA: International Centre for Agricultural Research in the Dry Areas, Syria
- ICLARM: International Centre for Living Aquatic Resources Management, Philippines
- ICRAF: International Centre for Research in Agroforestry, Kenya
- ICRISAT: International Crops Research Institute for the Semi-Arid Tropics, India
- IFPRI: International Food Policy Research Institute, United States
- ILRI: International Livestock Research Institute, Kenya
- IIMI: International Irrigation Management Institute, Sri Lanka
- IITA: International Institute of Tropical Agriculture, Nigeria
- IPGRI: International Plant Genetic Resources Institute, Italy
- IRRI: International Rice Research Institute, Philippines
- ISNAR: International Service for National Agricultural Research, Netherlands
- WARDA: West Africa Rice Development Association, Ivory Coast

Convention on Biological Diversity or Biodiversity Convention
A legally binding international agreement for the conservation and sustainable use of biodiversity. Its final text was adopted in Nairobi on May 22, 1992. It was signed by over 150 countries at the UN Conference on Environment and Development in Rio de Janeiro, Brazil, in June 1992 and was ratified by 128 governments as of October 1995. The Convention came into force on December 29, 1994. The US had not ratified it as of early 1996.

copyright
An intellectual property right intended to protect artistic and cultural works, such as books, illustrations, photographs, and television programs, from being duplicated or transmitted without the author's permission. Copyrights do not give exclusive right to the ideas in protected material, but rather to the specific format in which they appear.

DNA (deoxyribonucleic acid)
The molecule in chromosomes that is the repository of genetic information in all organisms (with the exception of a few viruses in which the hereditary material is ribonucleic acid or RNA). The information coded by DNA determines the structure and function of an organism.

***ex situ* conservation**
Literally, conservation "off-site" or outside an organism's natural habitat. Gene banks and botanical gardens are examples.

Farmers' Rights
In 1985, the UN Food and Agriculture Organization (FAO) Commission on Plant Genetic Resources (now the FAO Commission on Genetic Resources for Food and Agriculture) introduced the principle of Farmers' Rights. The FAO's International Undertaking on Plant Genetic Resources was amended in 1991 to include Farmers' Rights. The amendment recognizes farmers as past, present and future *in situ* agricultural innovators who collectively have conserved and developed agricultural genetic resources around the world. Farmers are recognized as innovators entitled to intellectual integrity and to compensation whenever their innovations are commercialized. Farmers have the right to Germplasm, Information, Funds, Technologies and Farming/Marketing Systems (GIFTS). Compensation was anticipated via a global Gene Fund, paid into by the North for genetic conservation and improvement in the South. Agenda 21 and the Biodiversity Convention have also adopted the principle of Farmers' Rights. The government of India is drafting legislation that would establish it in law. The financing and implementation of Farmers' Rights will be addressed by several international agricultural meetings in the coming years.

General Agreement on Tariffs and Trade (GATT)
The GATT was established in 1947 and grew from a club of 23 industrialized nations to an agreement between 115 signatory states. Following the Uruguay Round of negotiations (concluded in 1994), GATT came under the management of the multilateral World Trade Organization on January 1st, 1995 (see below). The Uruguay Round included an agreement on intellectual property as a trade issue, known as Trade Related Intellectual Property Rights or TRIPS (see below).

gene
The functional unit of heredity. A gene is a section of DNA that codes for a specific biochemical function in a living being. Genes are physically located on chromosomes.

genetic engineering
The use of high technology processes to manipulate the DNA of living organisms in order to create new, different organisms in a laboratory.

genome
All the genetic material in the chromosomes of a particular organism or species.

gene bank
A form of *ex situ* conservation for plant, seed, and animal germplasm. Gene banks are usually humidity- and temperature-controlled facilities where seeds and other reproductive materials are stored for future use in research and breeding programs. Gene banks that stock crop germplasm are also called seed banks. Though very important, they are a poor replacement for the maintenance of crop genetic diversity *in situ* or on-site.

germplasm
The total genetic variability, represented by germ cells or seeds, available to a particular population of organisms.

Green Revolution
A massive and controversial agricultural research and production strategy which aimed to increase the output of staple grains in the South starting in the 1960s. Initially funded by the Rockefeller Foundation, it was later supported by aid from Northern governments. The Green Revolution was based on the belief that world hunger was basically a technical problem which could be fixed by raising agricultural production through higher-yielding varieties. This assumption and approach have dominated agricultural aid for three decades. The Green Revolution's critics have pointed out the political and economic causes of hunger, the need for land reform, and the need for other structural changes in agriculture and consumption worldwide. At its peak, the Green Revolution produced high-yielding varieties of a few staple crops. Unlike most farmer's varieties, however, these new plants were designed to be highly dependent on expensive and often environmentally unsound chemical inputs. Large scale, capital-intensive agriculture reaped the benefits while smaller farmers were marginalized, increasing social tensions and working against *in situ* conservation. Many of the agricultural research centres of the Consultative Group for International Agricultural Research (see above) contributed to or were formed as a result of the Green Revolution.

Human Genome Project
An international collaborative endeavour among geneticists to "map the human genome" by using new technologies to describe the chemical composition of an estimated 100,000 genes that control the inherited part of human beings' makeup.

Human Genome Diversity Project (HGDP)
"A collaborative research project … being developed on a global basis under the auspices of the Human Genome Organization." Its goal is "to arrive at a … more precise definition of the origins of different world populations by integrating genetic knowledge … with knowledge of history, anthropology and language." One of its expected uses is to provide information on the role played by genetic factors in the predisposition or resistance to disease. Concretely, the HGDP plans to draw and immortalize human cell lines from hundreds of indigenous peoples worldwide.

Human Genome Organization (HUGO)
The international umbrella organization that manages the Human Genome Project. In the US it is primarily funded by the Department of Energy and the National Institutes of Health. In Europe, HUGO is funded by the European Commission.

***in situ* conservation**
Literally, conservation "on site." *In situ* conservation is the conservation of ecosystems and natural habitats, and the maintenance, recovery and development of viable populations of species in their natural surroundings. In the case of domesticated livestock or cultivated crop species, it is their conservation in the surroundings where they have developed their distinctive properties.

Intellectual Property (IP) or Intellectual Property Rights (IPR)
Laws that grant monopoly rights to those who create ideas or knowledge. They are intended to protect inventors against losing control of their ideas or the creations of their knowledge. There are five major forms of IPR: patents, plant breeders' rights, copyright, trademarks, and trade secrets. (See other entries in the Glossary for definitions of each.) All IPRs operate by exclusion, granting temporary monopoly rights which prevent others from making or using the creation. IP legislation is national, although most countries adhere to international conventions governing intellectual property.

International Undertaking on Plant Genetic Resources for Food and Agriculture
A multilateral instrument called the International Undertaking on Plant Genetic Resources was adopted by the United Nations Food and Agriculture Organization in 1983. In 1995 the name was changed to the International Undertaking on Plant Genetic Resources for Food and Agriculture. The Undertaking is currently being re-negotiated to bring it in line with the Convention on Biological Diversity. It is a voluntary agreement intended to provide an international framework for the collection, conservation, exchange and utilization of plant genetic resources for food and agriculture.

life industry
An industry that has arisen through mergers and cooperative agreements among corporations to profit from the manipulation and ownership of living organisms. With the development of biotechnology and the increased use of intellectual property systems, these previously discreet agrochemical, seed, pharmaceutical, and food industries increasingly depend upon a similar set of technologies and laws which allow the monopoly control of living organisms.

microorganisms (or microbes)
Tiny living things that are not visible except with a microscope. These include algae, bacteria, fungi (including yeasts), certain protists (one celled organisms that are not bacteria), and viruses. For the purpose of patent protection, the term microorganism often applies to other types of biological material, including cell lines of plants and animals, and human genetic material. There is considerable uncertainty regarding the scope of the term.

multilateral agreement
An agreement among many parties, such as an international agreement signed by many of the world's governments.

Paris Union on Industrial Property
The principal inter-governmental body established to govern the patent system and determine the ground rules for patents. In recent years its regulatory capacity has been overwhelmed by national patent office decisions in the United States and Europe. It is likely to be further undermined by the new TRIPS agreement (see below).

patent
A legal monopoly that covers a wide range of products and processes, including life forms. To be patentable, inventions must meet three basic criteria. They must be: (1) novel , that is, they must not have been known previously to the public; (2) useful, that is, they must do what they claim, though they need not necessarily be practical; and (3) non-obvious, that is, they must have an "inventive step" and constitute some notable extension of what was previously known. Patents provide exclusive legal protection to patent holders, usually for 17 to 25 years. Anyone wishing to use a patented invention must receive permission from the patent holder and often must pay a royalty. In exchange for this monopoly, the patent holder must disclose or describe the invention.

Patent Cooperation Treaty
An effort to create a global patent system to ensure that a patent granted in one country will be adopted in all member countries. It has not yet achieved its goal. The treaty has 77 member states, including all industrialized countries, ten former French colonies in Africa, two countries from the Americas and eight from Asia. It is likely to become less relevant with the adoption of TRIPS under the World Trade Organization (see below).

Patent Culture Depository
An institution for the deposit of microorganisms subject to patent claims. Twenty six such institutions in 15 countries have been recognized by the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure (see above). These institutions contain the living materials (microorganisms, genes, seeds, animal embryos, human and animal cell lines, etc.) that are the basis of virtually all patents on living material.

plant breeders' rights (PBR)
A form of intellectual property law that grants a plant breeder's certificate to those who breed new plant varieties. Plant breeders' rights generally contain breeders' and research exemptions that allow non-commercial use of protected varieties. In the US, recent court decisions have threatened these exemptions. There are currently two international agreements governing PBR, both of them under UPOV, the International Convention for the Protection of New Plant Varieties (see below).

***sui generis* legislation**
Literally "of its own kind", that is, in a class alone. This refers to any unique form of intellectual property legislation specifically designed to meet certain needs.

trade secret
An intellectual property right used when inventors do not wish to patent in order to protect themselves from competitors. Unlike patents, trade secrets do not require inventors to publish and have no time limit. They can be maintained, for example, by contracts with company employees who are legally bound not to disclose the protected information.

trademark
A form of intellectual property right that provides legal monopoly for a name, or a linguistic or visual symbol.

transgenic organism
Any organism that has been genetically engineered to contain a gene from another organism, usually from a different species.

Trade Related Intellectual Property Rights (TRIPS)
TRIPS is a GATT agreement, now administered by the World Trade Organization (WTO), stipulating that all signatories must conform to industrial country standards of intellectual property law. TRIPS requires signatories to introduce patent coverage for microorganisms and to have some form of intellectual property coverage for plants. Developing countries have until at least the year 2000 to implement the agreement's intellectual property provisions. Least developed countries have until 2004, with a possible extension. The WTO will review the TRIPS agreement in 1999, and it could be modified as a result.

Union for the Protection of New Varieties of Plants (UPOV)
A Geneva-based organization established under the World Intellectual Property Organization in 1961 to deal with plant breeders' rights. It has 30 members and seven others have initiated proceedings to join. There are two operative UPOV Conventions dated 1978 and 1991. The 1978 Convention allows farmers to save and replant PBR-protected seed from their harvest. The 1991 version restricts the right of farmers to save seed and makes plant breeders' rights more like patents, extending the scope of the monopoly granted to the certificate holder. As of January 5th, 1996, Australia, Denmark, Israel and Slovakia had ratified the more restrictive 1991 Convention. The UPOV Council meets every October, after a series of inter-governmental and government/industry committee meetings that regulate the Conventions' evolution. Many countries of the South are preparing to join UPOV.

World Intellectual Property Organization (WIPO)
The Geneva-based organization that houses 20 intellectual property conventions adopted by significant parts of the world community, including conventions on patents, plant breeders' rights, and the Budapest Treaty on IPR over biological materials. WIPO has 151 state members, including all industrialized countries and many countries of the South. The annual WIPO Council includes all members and observers. Each convention has its own membership and forum under the WIPO umbrella. The Director General of WIPO is usually the Secretary General of the individual conventions, but day-to-day operations are generally carried out by a specialist secretariat led by a Deputy Secretary General.

World Trade Organization
A body created at the conclusion of the Uruguay Round of GATT in 1994 to monitor the GATT agreement and pursue global trade objectives. It became operational on January 1st, 1996. It now has the potential to become the dominant forum for determining the future of intellectual property laws worldwide.

APPENDIX G

Addresses

Centre for Traditional Resource Rights,
Oxford Centre for the Environment, Ethics and Society, Mansfield College,
University of Oxford
Oxford OX13 TF
England

phone: 44-850-865-27467
fax: 44-865-327358
e-mail: posey@vax.ox.ac.uk

GRAIN
Girona 25 pral,
E 08010 Barcelona,
Spain

phone: 34-3-301-1381
fax: 34-3-301-1627
e-mail: grain@bcn.servicom.es

Indigenous Peoples' Biodiversity Network/
Indigenous Knowledge Programme,
c/o Cultural Survival Canada,
200 Isabella Street,
Ottawa, ON K1S 1V7
Canada

phone: 613-237-5361
fax: 613-237-1547
e-mail: ipbn@web.apc.org

International Development Research Centre (IDRC),
250 Albert Street,
Ottawa, ON K1G 3H9
Canada

phone: 613-236-6163
fax: 613-238-7230
e-mail: info@idrc.ca

Rural Advancement Foundation International (RAFI),
#504 – 71 Bank Street,
Ottawa, ON K1P 5N2
Canada

phone: 613-567-6880
fax: 613-567-6884
e-mail: rafican@worldlink.ca

South and Meso American Indian Rights Centre (SAIIC)
P.O. Box 28703,
Oakland, CA 94604
USA

phone: 510-834-4263
fax: 510-834-4264
e-mail: saiic@igc.apc.org

Resources

General Background

Cary Fowler, E. Lachkovics, Pat Mooney and Hope Shand, *The Laws of Life: Another Development and the New Biotechnologies* , Development Dialogue, Dag Hammarskjold Foundation, Volumes 1–2, 1988.

The Geopolitics of Biodiversity: a Biodiversity Balance Sheet, RAFI Communiqué, January/February 1996.

Intellectual Property, Agriculture and Farmers' Rights

The Crucible Group, *People, Plants, and Patents,* International Development Research Centre, Ottawa, 1994.

Towards A Biodiversity Community Rights Regime, GRAIN Dossier, December 1995.

GRAIN Seedling, available from GRAIN. Monthly publication provides regular analysis, information and updates.

RAFI Communiqué, available from RAFI.

Bio-Piracy: The Story of Natural Coloured Cottons of the Americas, November 1993.
"Species" Patent on Transgenic Soybeans Granted to Transnational Chemical Giant W.R. Grace, March/April 1994.
Utility Plant Patents: A Review of the US Experience (1985–1995), July/August 1995.
Sixty-five Years of The US Plant Patent Act, November/December 1995.

RAFI Occasional Papers, available from RAFI.

RAFI Challenges W.R. Grace (Agracetus) "Species Patent" on Soybeans at European Patent Office, Volume 1, Number 5, December 1994.
The Benefits of Biodiversity: 100+ Examples of the Contribution by Indigenous and Rural Communities in the South to Development in the North, Volume 1, Number 1, March 1994.
Declaring the Benefits: The North's Annual Profit from International Agricultural Research is in the Range of $US4–5 Billion, Volume 1, Number 3, October 1994.

Intellectual Property and Medicinal Plants

Endod: A Case Study of the Use of African Indigenous Knowledge to Address Global Health and Environmental Problems, RAFI Communiqué, March 1993.

COPs… and Robbers – Transfer-Sourcing Indigenous Knowledge: Pirating Medicinal Plants, RAFI Occasional Paper (co-published with the Indigenous Peoples' Biodiversity Network), Volume 1, Number 4, November 1994.

Intellectual Property and Microorganisms

Microbial Genetic Resources, RAFI Communiqué, January/February 1995.

Microbial BioPiracy: An Initial Analysis of Microbial Genetic Resources Originating in the South, and Held in the North, RAFI Occasional Paper, Volume 1, Number 2, July 1994.

Intellectual Property and Human Genetic Material

RAFI Communiqué

Patents, Indigenous Peoples, and Human Genetic Diversity, May 1993.
The Patenting of Human Genetic Material, January/February, 1994.
"Gene Boutiques" Stake Claim to Human Genome, May/June 1994.
Gene Hunters in Search of "Disease Genes" Collect Human DNA from Remote Island Populations, May/June 1995.
New Questions About Management and Exchange of Human Tissues at NIH, March/April 1996.

Intellectual Property and Indigenous Peoples

First International Conference on the Cultural and Intellectual Property Rights of Indigenous Peoples, T*he Mataatua Declaration on Cultural and Intellectual Property Rights of Indigenous Peoples*, Aotearoa/New Zealand, 1993.

Darrell Posey and Graham Dutfield, *Beyond Intellectual Property: Towards Traditional Resource Rights for Indigenous Peoples and Local Communities*, IDRC, Ottawa, 1996. Note: Posey has written extensively on indigenous peoples' traditional resource rights. Available from the Centre for Traditional Resource Rights.

RAFI Communiqué

Bioprospecting/Biopiracy and Indigenous Peoples, November 1994.
Biopiracy Update: A Global Pandemic, September/October 1995.

South and Meso American Indian Rights Centre (SAIIC) will release a book in late 1996 on biodiversity and indigenous peoples. It will include chapters on agricultural biodiversity, bioprospecting and intellectual property rights, land demarcation and access to biodiversity, the Human Genome Diversity Project, and relevant conventions and laws. Available from SAIIC.

RAFI, *Conserving Indigenous Knowledge: Integrating Two Systems of Innovation* , an independent study by RAFI for the United Nations Development Programme, 1994.