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Why We Should Reject Biotech Patents from TRIPS

Scientific Briefing on TRIPS Article 27.3(b)

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1. Introduction

This Report examines the TRIPS Article 27.3(b), currently under review at the WTO, and its counterparts in the EU Patents Directive. We show that the Articles are couched in undefined terms, designed to allow the broadest categories of patents from genetic engineering and other new biotechnologies. We also argue why all classes of new biotech patents should be rejected from inclusion in TRIPs on one or more of the following grounds:

- All involve biological processes not under the direct control of the scientist. They cannot be regarded as inventions, but expropriations from life.

- The hit or miss technologies associated with many of the 'inventions' are inherently hazardous to health and biodiversity.

- There is no scientific basis to support the patenting of genes and genomes, which are discoveries at best.

- A range of patents are unethical; they destroy livelihoods, contravene basic human rights and dignity, compromise healthcare, impede medical and scientific research, create excessive suffering in animals or are otherwise contrary to public order and morality.

- Many patents involve acts of plagiarism of indigenous knowledge and biopiracy of plants (and animals) bred and used by local communities for millennia.

We shall begin with a 'glossary' in order to help negotiators understand the dubious 'logic' behind the Articles.

2. 'Glossary' of terms

A **micro-organism** is an organism that can be seen only under a microscope, usually, an ordinary light microscope. They are usually of the order of microns (millionths of a metre) or tens of microns in linear dimensions, and include bacteria, mycoplasm, yeasts, single-celled algae and protozoa. Multicellular organisms are normally not included, nor fungi apart from yeasts. Viruses are also not automatically included; many scientists do not classify them as organisms as they depend on cells to multiply.

A **cell line** is a supposedly genetically uniform population of cells derived from one individual, or it could be a clone (theoretically genetically identical descendants) of one original cell. The genetic identity of all the cells is a fiction, as the genetic material is subject to many 'fluid genome' processes which constantly make cells genetically different from one another.

A **genome** is the totality of all the genetic material (deoxyribonucleic acid or DNA) in an organism, which is organised in a precise, though by no means fixed or constant way. In the case of viruses, most of them will have ribonucleic acid or RNA as the genetic material.

A **gene** is a stretch of genetic material (DNA or RNA) with a defined function in the organism or cell. It usually codes for a protein. There are many genes within a genome. For example, the human genome is estimated to contain 100 000 genes.

A **DNA sequence** refers to the sequence of bases in a stretch of DNA. DNA is a linear molecule consisting of units strung together. There are 4 different units, each identified by the specific base contained. There are 4 different bases, which are simply represented by the alphabets, A, T, C and G. An example of a DNA sequence is as follows:

ATTTCCGCTACGCGTTA... A RNA sequence is similar, except that the alphabet T is replaced by U.

An "**essentially biological process**" is scientifically suspect. Does it mean a process that occurs naturally or which is carried out by organisms? Similarly, a "**non-biological process**" is difficult to define, as all processes in biotechnology, by definition, are biological. A weak case may be made on the ground that it is one that does not occur naturally, or which is not normally carried out by organisms.

A "**micro-biological process**" is presumably one that is carried out by micro-organisms.

3. Patents on life-forms and living processes

There are four categories of patents on life-forms and living processes covered by TRIPS:

1. Processes producing extracts of plants for medical or industrial/agricultural purposes,

2. Naturally occurring microorganisms, cell lines, genomes and genes isolated from natural organisms,

3. Transgenic techniques and constructs, and the resultant transgenic organisms,

4. Nuclear transplant cloning and other *in vitro* reproductive technologies.

All these patents, in our opinion, ought to be revoked and banned for one or more of the following reasons:

- - depends on biological processes, therefore little or no invention
- - claimed 'technology' unreliable, uncontrollable and unpredictable
- - 'technology' and products inherently hazardous
- - qualifies as a discovery, not invention
- - involves act of plagiarism and biopiracy
- - threatens livelihoods
- - violates basic human rights
- - is contrary to public order or morality
- - is contrary to public interests
- - lacks scientific basis

We deal with the four classes of patents below.

3.1 Patents on processes for which fraudulent claims are made for novelty and invention. These include the entire class of patents on extracts of plants which have been developed and used for millennia by indigenous communities for the purposes claimed in the patents. In many cases, the plants or seeds have also been stolen from the same indigenous communities. Examples are patents on extracts of the neem plant taken from India, and extracts of the bibiru and cunani from the Wapixana Indians in North Brazil. Some of the plants may come from ex situ seed banks held in botanic gardens in developed countries.

3.2 Patents on discoveries, such microorganisms, cell lines, genomes and genes which are derived from naturally occurring organisms. These are by far the biggest category of patents and include the following,

a. Microorganisms. These patents would have included all microorganisms isolated from Yellowstone Park in the US, for example, subject to an agreement that the US Government made with a biotech company which was subsequently successfully challenged by the Edmonds Institute and The Center for Technology Assessment in the US on behalf of civil society.

b. Cell lines belonging to indigenous peoples collected under the Human Genome Diversity Project, without proper informed consent, and in violation of basic human rights. A US company, Coriell Cell Repositories, lists Amazonian Indian blood cells in a DNA kit priced at $500, which is openly advertised on the internet. Another is the Biocyte patent granted on human umbilical cord cells which have been used freely for transplant purposes previously. The EU Patent Office revoked this patent on 8 June, 1999, after a successful challenge by The European Campaign on Biotechnology Patents, a coalition of European ngos.

c. Patents on human genomes and sequences, all of which violate basic human rights and dignity

- An effective monopoly on genomes of Icelandic population by DeCode Genetics, Iceland
- About 150 US patents have been granted on human genes associated with genetic diseases, cancer genes, etc., and 2500 similar patents are pending
- Expressed sequence tags (ESTs)(partical sequences of *unknown function*), 44 US patents have been granted and 1 200 000 are pending, all to Incyte, a US company based in California
- Single nucleotide polymorphisms (SNPs) (single base variants of genes) are ruled patentable by US Patent Office, supporting dubious 'personalised medicine' but may be relevant to genetic ethno-terrorism. A public/private partnership involving The Wellcome Trust and 10 companies are mapping SNPs in order to put the data immediately in the public domain, so they cannot be patented.

Many commentators have pointed out that patents on human gene sequences will compromise medical treatments and medical research. In a highly significant move in September 1999, British Prime Minister Tony Blair initiated an Anglo-American agreement with President Bill Clinton to protect the 100,000 genes of the human genome. The agreement aims to prevent entrepreneurs profiting from gene patents and to ensure that the benefits of research are freely available world wide to combat or even eliminate diseases. It will ensure that the world's largest medical charity, the British-based charity, Wellcome Trust, and the US government's National Institute of

Health, will publicise gene-sequences within 24 hours of their discovery so that the benefits accrue entirely to the public. It is thought that research institutions, universities or laboratories would be obliged to waive their rights to patent their work in the public interest. But private corporations are opposing this initiative.

d. Patents on genomes and genes of plants which will have adverse impacts on technology transfer and food security as they intensify corporate monopoly on food. These include

- whole plant genomes as they become available
- more than 600 patents on genes from 78 plant species of economic or scientific interest already granted, includes DNA sequences from plants taken from developing countries: nutmeg, cinnamon, rubber, jojobe and cocao, which amount to biopiracy, contravening CBD's stipulation of equitable benefit-sharing.

According to a spokesperson from the biotech industry, patents held on genes of plants also entitle patent holders to own the plants themselves, although this is not claimed in practice. These patents are further instances of biopiracy, contravening CBD's stipulation of equitable benefit-sharing. Even when benefit sharing is negotiated, the developing countries tend to receive a minute fraction of the benefit they justly deserve.

e. Patents on genomes of pathogenic bacteria and viruses, which are obstructing the prompt diagnosis and treatment of dangerous diseases such as meningitis and tuberculosis. Delays in diagnosis and treatment will result in unnecessary deaths.

3.3 Patents on transgenic techniques and constructs, and transgenic plants, animals and microorganisms resulting from the techniques, which are being construed as inventions and patentable in US, and recently also in the EU. This has led to disputes among different patent holders: those holding patents on the individual transgenic organisms, and others holding the patent on the transgenic process and constructs. Hundreds of millions of dollars are spent, unproductively, on litigations.

More seriously, the patents on transgenic seeds are preventing farmers from saving seeds for replanting unless they pay royalities to the companies. Seed monopoly will intensity and threaten livelihood of family farmers all over the world. Patents on transgenic animals are sanctioning techniques and practices that are contrary to animal welfare.

An important class of patents are the 'Traitor Tech' or 'Genetic Use Restriction Technologies' (GURT) based on the original 'terminator technologies' that engineer harvested seeds not to germinate, thus offering *de facto* patent protection of transgenic seeds. A newer version makes seeds dependent on the application of a chemical for germination, or for expressing the desired transgenic trait. These patents serve no other purpose than to intensity corporate monopoly on seeds and on food production. Monsanto has recently announced that they will not commercially exploit the terminator technology, but it is not clear whether they will continue research and development.

Transgenesis is not a precise technology. We argue that it is not a technology at all. It is extremely hit or miss, and generates a whole range of unexpected effects in plants, including toxins and allergens. The GURT technologies are even worse. They depend on 'site-specific' splicing of genes that is supposed to be precise, but far from the case in practice. These process-patents apply also to animals.

Large failure rates are typical in making transgenic animals and abnormalities are frequent even among the successes. It cannot be said to be an invention in the usual sense of the word. Transgenic animals are being created to supply pharmaceuticals or industrial chemicals in their milk or to supply spare organs for transplant into human beings. These involve unacceptable exploitation of animals which cause excessive suffering. We should encourage alternative approaches which are more ethically acceptable.

Most importantly, there is a running debate on the inherent dangers of the process of creating transgenic organisms, which is why UK and many countries in Europe are banning transgenic crops or imposing a moratorium.

Transgenic DNA has the potential to generate new viruses and bacteria that cause diseases, and may also cause cancer by integrating into mammalian cells. The British Medical Association has issued a report calling for an indefinite moratorium on transgenic crops, and further research on the possible health risks of GM foods, including new allergies, the spread of antibiotic resistance and the effects of transgenic DNA in animals and human beings.

The transgenic DNA from terminator or GURT technologies involve even greater risks, as they contain dangerous genes that prevent germination, which can nonetheless escape into other species. Furthermore, the technologies depend on gene-splicings that have to be engineered and regulated very precisely, but those requirements are beyond the capability of the genetic engineer. The hazards of the transgenic DNA resulting from GURT technologies are much greater, because the imprecisions of inserting multiple gene-constructs are multiplied, and because of the gene-splicing sequences and genes deliberately introduced. Gene-splicing has the potential to create new combinations of genes and to scramble genes and genomes when it is imprecise.

3.4 Patents on nuclear-transplant cloning and other *in vitro* reproductive techniques, and organisms resulting from those techniques. An example is the nuclear transplant technique that produced Dolly. This patent actually covers all species, including human beings. A human clone has already been created in June, 1999, by transferring the human genetic material into a cow's egg. It was destroyed on day 14, which is the current legal limit in the USA. Such interspecific nuclear transfer clonings are known to result in gross abnormalities. We deplore the deliberate cloning of human embryos for experimentation or for producing spare tissues and organs. There are already more ethically acceptable alternatives, such as regenerating tissues and organs from cells of the patients themselves.

The cloning process, again, is hardly a technology, as it also generates a large number of failures and abnormalities even among the 'successes'. A recent article ("Clone Defects Point to Need for 2 Genetic Parents" Rick Weiss, Washington Post, May 10, 1999) reports large numbers of fetal and neonatal deaths, abnormalities in the placenta, the umbilical cord and severe immunological deficiencies in cloned monkeys. In sheep and cows, clones

develop serious abnormalities in heart, lungs and other organs. Many die before birth, others succumb suddenly weeks or months after birth. In some cases, the surrogate mothers carrying the cloned fetuses are also affected. Three cows died while pregnant with clones, and autopsy revealed livers that were filled with fat, suggesting metabolic abnormalities induced by the clones. How can we regard this as a patentable invention when it is so hit or miss and unreliable? It is both scientifically flawed and ethically unacceptable to create so much suffering.

4. Articles related to patents in TRIPS and EU Directives

4.1 Article 27.3(b) of TRIPS states,

> Members may also exclude from patentability, (b) plants and animals other than microorganisms, and essentially biological processes for the production of plants and 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*.

As *all* biotech processes are biological, they should be excluded from patenting, and this applies also to microbiological processes. There is no sound reason to regard microbiological as anything but biological. Also, microorganisms *are* organisms, so there is no reason to treat them as patentable when plants and animals are excluded.

4.2 Articles 4 and 5 of the EU Directive state,

> **Article 4**
>
> **1.** The following shall not be patentable:
>
> **a.** plant and animal varieties
>
> **b.** essentially biological processes for the production of plants or animals.
>
> **2.** Inventions which concern plants or animals shall be patentable if the technical feasibility of the invention is not confined to a particular plant or animal variety.
>
> **3.** Paragraph 1(b) shall be without prejudice to the patentability of inventions which concern a microbiological or other technical process or a product obtained by means of such a process.
>
> **Article 5**
>
> **1.** The human body, at the various stages of its formation and development, and the simple discovery of one of its elements, including the sequence or partial sequence of a gene, cannot constitute patentable inventions.

2. An element isolated from the human body or otherwise produced by means of a technical process, including the sequence or partial sequence of a gene, may constitute a patentable invention, even if the structure of that element is identical to that of a natural element.

3. The industrial application of a sequenced or a partial sequence of a gene must be disclosed in the patent application.

"Essentially biological processes" could include transformation and transfection, processes used in creating transgenic organisms.

The "technical feasibility of the invention is not confined to a particular plant or animal" must be demonstrated, as without performing the actual experiment, it cannot be assumed that what works for one species works for another. In fact, this is very often not the case. Besides, as argued in Section 3, neither transgenesis nor cloning qualifies as an invention, as both fail to work less than 99 times out of 100. The description, "a microbiological or other technical process" is questionable, as a microbiological process is not a technical process, and neither the process nor the product resulting from it should be patentable.

4.3 Both the TRIPS and EU Directive articles are designed to allow for the patentability of all categories of life-forms and living processes listed in Section 3. One positive aspect of the EU Directive is Article 6, which excludes from patenting, commercial exploitation contrary to 'ordre public or morality', such as human cloning, use of human embryos for industrial or commercial purposes, cloning human beings, and modifications of animals causing substantial suffering without substantial medical benefit.

4.4 The EU Directive article 4.1b appears to strongly exclude plant and animal varieties, but 4.3 makes clear that transgenic plants and animals are patentable, as they are produced by "microbiological or other technical process". But the transformation and transfection used in making transgenic plants and animals *are* biological processes, and so transgenic plants and animals should not be patentable. It is important to recognise that the patentability often refers, not to the process, but to the product of the process. That is because in many cases, the process is standard, such as base sequencing, or it is covered by another patent, such as cloning.

4.5 Similarly, the EU Directive Article 5.1 appears to exclude the human body, cells and genes from patenting. But this is nullified by 5.2, where the copying process or the amplification process enables the copy of the gene, or the partial sequence of the gene, or the cell of the organism to be patented. This is highly questionable, as the distinction between the putative original gene and cell in the body and the copy is a legal fiction. The very identification of the gene or cell involves processes of copying or amplification, so that it is actually the copies that are identified.

4.6 The EU Directive also explicitly extends the patentability of a process, say cloning, or technology such as the transgenic technology to all plant or animal varieties. So, in the case of nuclear transplant, the patent is protected for all other animals (though EU Directive Article 6 excludes human beings). In the case of the technique using bt-toxin to protect

plants, that is also extended to all plant varieties. This should be strongly challenged for reasons given above, what works in one species may not work in another.

5. Critique on the patentability of genes or nucleic acid (DNA or RNA) sequence

5.1 The patentability of genes and other nucleic acid sequences is justified on the ground that they have been subject to a microbiological or nonbiological process, ie, gene sequencing, which is itself a standard process patentable and patented under existing patent laws for invention. So, the actual patented entity is the nucleic acid sequence itself and its putative function.

5.2 However, the DNA or RNA sequence is subject to change by mutation, deletion, insertion and rearrangement. Does it mean that, for example, if the sequence patented is, ATCCAGGAACCTA, then variously mutated sequences such as A A CCAGGAACCTA (single base substitution), ATAGGAACCTA (deletion of two bases), ATCCA TC GGAACCTA (insertion of two bases), A GACCT GAACCTA (inversion of 5 bases) are no longer covered? The confusion is multiplied when single nucleotide polymorphisms (SNPs) are ruled to be independently patentable by the US Patent Office. Thus, the patent for the gene and the patent for the gene variant will legally clash.

The same arguments of mutability of entire genomes raise the question as to which genome is being patented. If the patent is on one DNA base sequence, does it cover genomes differing in DNA base sequence?

For a DNA sequence of 1000 bases, the possible number of variants is 41000.

5.3 The "industrial application" stated in the EU Directive Article 5.1 involves the functional side of the gene sequence, and presumably qualifies it as an invention. It is important to realise, however, that the nucleic acid molecule by itself can do nothing. It can only have a function in a living cell or an organism. However, its function depends on which kind of cell it is in, where in the genome it is inserted (not under the control of the human genetic engineer), in what kind of genome and in which environment. In other words, its function is uncertain and unpredictable. For example, the acetyl-CoA carboxylase gene, which confers herbicide resistance in monocots, is claimed primarily for regulating oil content in a patent. Under some circumstances, again beyond the control of the genetic engineer, the gene is silenced, so it has no function whatsoever. Thus, the patentability based on function is equally unscientific.

The patenting of genomes raises the question of the function of the genomes. Again, the isolated genome can do nothing by itself, while its "function" in the organism cannot be considered separately from the totality of the organism.

6. Conclusion

All patents on life-forms and living processes detailed in this paper should be rejected from inclusion in TRIPs on the following grounds:

- All involve biological processes not under the direct control of the scientist. They cannot be regarded as inventions, but expropriations from life.

- or miss technologies associated with many of the 'inventions' are inherently hazardous to health and biodiversity.

- is no scientific basis to support the patenting of genes and genomes, which are discoveries at best.

- of patents are unethical; they destroy livelihoods, contravene basic human rights and dignity, compromise healthcare, impede medical and scientific research, create excessive suffering in animals or are otherwise contrary to public order and morality.

- patents involve acts of plagiarism of indigenous knowledge and biopiracy of plants (and animals) bred and used by local communities for millennia.

7. References and Reports consulted

1. *Genetic Engineering Dream or Nightmare? The Brave New World of Bad Science and Big Business*, Mae-Wan Ho, Gateway Books, UK, and Third World Network, Penang, 1998, 2nd ed. 1999.

2. The Gene Giants, Masters of the Universe? *RAFI Communique*, March/April, 1999.

3. Traitor Tech. The Terminator's Wider Implications. *RAFI Communique*, Janurary/February, 1999.

4. Genetic engineering and patenting. A Disaster in the making for the developing world. Actionaid, February, 1999.

5. *Selling suicide, farming, false proises and genetic engineering in developing countries*, Christian Aid, London, 1999.

6. The Impact of Genetic Modifications on Agriculture, Food and Health - an Interim Statement, British Medical Association, May 1999.

7. Plant DNA patents in the hands of a few. Thomas, S.M., Brady, M. and Burket, J.F., *Nature*, 399, 405-6, 1999.

8. Vive la difference. A unique alliance is racing to map genetic variability. Matt Walker, *New Scientist*, 17 April, p.12, 1999.

9. Hot property. It pays to understand the real currency of our times. Editorial, *New Scientist*, 17 April, p. 3, 1999.

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