

**GE3LS Bibliographic Essay for
the Canadian Potato Genome Project
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Methodology

The question is: what potato-specific issues and solutions are evident in contemporary literature, with emphasis on legal, political and philosophical issues with respect to protection of intellectual property and intellectual wealth generated by research into potatoes? I selected a few search terms to begin with (“potato” and “biotechnology”) which generated a large amount of literature. The task then was to sort through the literature and find more specific search terms. The result was a search index comprising of the following combination of terms:

Potato or tuber

And

Biological control or biotechnology or genetically engineered or precision farming or molecular farming or genomics or gene manipulation

And

Economics or ethics or environment or social or legal or commercialization or intellectual property or investment or biopiracy or conservation or food security or trade

I utilized several sources, including: the Canadian research Index, General Science Index, Government Printing Office, Applied Science and Technology Index, Nexus - Lexus legal index, Biological Abstracts, Agricola, Econolit, Science Citation Index, Academic Search Elite, Business Source Elite, Canadian Business and Current Affairs, Legal Trac, Government of Canada websites, and I also did a general web search. Here is what I found:

Acts, laws and Treaties Associated with GM Potatoes

Plant Breeders' Rights Act (PBRs)

According to Ronald Hirshhorn and Jock Langford, authors of *Intellectual Property Rights in Biotechnology: The Economic Argument*, prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, agricultural biotech firms that are involved in developing propagating materials, such as seeds, can apply for protection under the Canadian Plant Breeders' Rights Act, which falls under the responsibility of the Minister of Agriculture and Agri-food (unlike the Patent Act which is the responsibility of the Minister of Industry).¹ According to Murray Fulton et al., authors of *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*, prepared for the same committee, while there are four major types of intellectual property rights (IPRs) used in agriculture (patents, PBRs, trade secrets, and trademarks), patents and PBRs are the most important, but PBRs are not effective for protecting engineered genes in a plant.²

The authors go on to explain that:

PBRs, which apply to plants only, are a form of protection granted to plant breeders that allows them to exclude others from producing or commercializing material of a specific plant variety for a period of fifteen to thirty years. The PBRs system has traditionally allowed unauthorized use of protected varieties for two purposes: research or breeding, and reseeding by farmers. The research or breeders' exemption allows third parties to use the protected variety to create new varieties and/or to conduct scientific research. Under the farmers' privilege, farmers can retain seeds from the production of the protected variety for re-sowing on their own land.³

¹ Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>

² Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

³ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the

Patents

Fulton et al. goes on to explain how patents differ from PBRs: “Unlike PBRs, under patent law all unauthorized use of patented material, including on-farm seed saving of patented plant varieties, is prohibited” and while PBRs are not effective for protecting engineered genes in plants, “gene patents are presently possible in Canada.”⁴ Patents, according to Fulton et al:

are a temporary and partial monopoly granted to the inventor by society. In Canada, the length of patent duration is twenty years following application . . . In exchange for the partial monopoly, society receives a disclosure of the invention. Disclosure not only permits competition when the patent lapses; it also provides a storehouse of technical knowledge that would not otherwise exist.⁵

According to Lara Ewens, author of *Seed Wars: Biotechnology, Intellectual Property and the Quest for High Yield Seeds*, today most biotechnology inventions are filed as utility patents and not as plant patents.⁶ Instead of only protecting the plant, utility patents make protection of plant genes possible, as well as allow the breeder to protect the use of the genetic material of a

Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

⁴ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

⁵ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

⁶ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: F.H. Erbsich & C. Velazquez. *Introduction to Intellectual Properties*, in *Intellectual Property Rights in Agricultural Biotechnology* 3, 8 (F.H. Erbsich & K.M. Maredia eds., 1998). *supra* note 39, at 9. “Although note that because plant patents are not available for sexually reproducing plants, and utility patents are often very expensive and difficult to obtain, the PVPA is often still an attractive option.” See Peter J. Goss, *Guiding the Hand that Feeds: Towards Socially Optimal Appropriability in Agricultural Biotechnology Innovation*, 84 Cal. L. Rev. 1395, 1398 (1996), *supra* note 36, at 1414.

number of plants, and to protect for multiple uses such as pharmaceutical, pest protection, and herbicide resistance.⁷

Biodiversity Treaty

In 1992, Rio de Janeiro, Brazil was the site of the global convention on biodiversity.⁸ The three stated objectives of the Biodiversity Treaty are (1) the conservation of biological diversity, (2) the sustainable use of biological components, and (3) the fair and equitable sharing of the benefits arising from the utilization of genetic resources through (a) appropriate access to genetic resources, (b) appropriate transfer of relevant technologies, and (c) appropriate funding.⁹ Although the United States, under the Bush administration, did not sign the treaty—in large part due to concerns about adequate protection of U.S. intellectual property law and biotechnology interests¹⁰—162 other nations did sign the treaty, and it was ratified by the requisite number of nations, entering into effect on December 29, 1993.¹¹

General Agreement on Trade and Tariffs (GATT) and Trade Related Intellectual Property Rights (TRIPs)

⁷ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: John H. Barton, *Acquiring Protection for Improved Germplasm and Inbred Lines*, in *Intellectual Property Rights in Agricultural Biotechnology* 19, 22 (F.H. Erbisich & K.M. Maredia eds., 1998).

⁸ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: United Nations Convention on Biological Diversity, June 5, 1992, S. Treaty Doc. No. 103–20 (1993), *supra* note 90.

⁹ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: United Nations Convention on Biological Diversity, June 5, 1992, S. Treaty Doc. No. 103–20 (1993), p. 299.

¹⁰ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. President Bush, in a speech at the Rio Convention, voiced U.S. concerns, saying, “[The Convention] threatens to retard biotechnology and undermine the protection of ideas.” See also: Fiona McConnell. *The Biodiversity Convention A Negotiating History* 111 (1996); Charles McManis. *The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, 76 *Wash. U. L.Q.* 255, 255–56 (1998), *supra* note 15, at 256; 7 U.S.C. § 2402 (1988 & Supp. 1996); David Tilford. *Saving the Blueprints: The International Legal Regime for Plant Resources*, 30 *Case W. Res. J. Int’l L.* 373, 402 (1998), *supra* note 55, at 418.

¹¹ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: David G. Scalise & Daniel Nugent. *International Intellectual Property Protections for Living Matter: Biotechnology, Multinational Conventions and the Exception for Agriculture*, 27 *Case W. Res. J. Int’l L.* 83, 83 (1995), *supra* note 4, at 110.

The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs) was signed by 125 countries in 1994 as part of the new General Agreement on Tariffs and Trade (GATT). It established minimum standards of protection for all forms of intellectual property - patents, copyright, trademarks, geographical indications, industrial designs and layout designs for integrated circuits - and sets out measures to address enforcement.¹²

The TRIPs Agreement establishes specific standards on the availability, scope, and use of intellectual property rights.¹³ Articles 27(1) and 27(2) are the applicable articles for the area of biotechnology and plant varieties protection.¹⁴ Article 27(1) states that “patents [are] available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application.” All fields of technology is interpreted to include biotechnology, although transitional arrangements granted by TRIPs to developing countries and qualifying provisions in Articles 27(2) and (3) may allow concerned countries some control in areas where there is strong national or public interest.¹⁵ For instance, Article 27(2) modifies 27(1): “members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect ordre [sic] public morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment”¹⁶

¹² Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>

¹³ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also Charles McManis, *The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, 76 *Wash. U. L.Q.* 255, 255–56 (1998), *supra* note 15, at 266.

¹⁴ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: David G. Scalise & Daniel Nugent. *International Intellectual Property Protections for Living Matter: Biotechnology, Multinational Conventions and the Exception for Agriculture*, 27 *Case W. Res. J. Int'l L.* 83, 83 (1995), *supra* note 4, at 114. “Spurred on by a desire to protect against patent violations by developing countries, the United States was originally the main sponsor of TRIPs.”

¹⁵ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: Ruth L. Gana. *Prospects for Developing Countries under the TRIPs Agreement*, 29 *Vand. J. Transnat'l L.* 735, 753 (1996); Charles McManis. *The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, 76 *Wash. U. L.Q.* 255, 255–56 (1998), *supra* note 15, at 266.

¹⁶ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm

According to Niels Louwaars et al., authors of *North-South Policy Brief: Framework for the Introduction of Plant Variety Protection in Developing Countries*, the agreement requires in Article 27 (3) b the member states of the World Trade Organization (WTO) - the succeeding organization of GATT - to provide protection for plant varieties by patent or “an effective sui generis system, or a combination thereof.” Sui generis means “of its own class” or “tailor made.”¹⁷ All WTO members (145 as of February 2003) are obliged to implement the provisions of the TRIPs agreement. All developing countries other than those categorized as least developed countries (LDC’s) were required to provide intellectual property rights protection for plant varieties by January 1, 2000. The LDC’s have until January 1, 2006.¹⁸

International Convention for the Protection of New varieties of Plants (UPOV)

The International Convention for the Protection of New Varieties of Plants (UPOV), developed in 1961 to provide protection for plant varieties, underwent a major revision in 1991.¹⁹ The UPOV provides different forms of plant protection and allows “plant” inventors to choose the type of protection they wish to invoke (e.g., patents, plant breeders rights, or trade secret) and double protection is possible. According to Thomas Clarke, author of *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*, prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, Canada has not yet adopted the 1991 UPOV Convention that allows this choice.²⁰

According to Graham Laurie, author of *Intellectual Property Protection of Biotechnological Inventions and Related Materials: The UPOV Convention (1961, 1991)* provides for a separate form of protection for plants and related products. To obtain a PB right the new plant must be (a) new, (b) distinct, (c) uniform and (d) stable. The Plant Variety Protection Act (PVPA) of 1970 (amended in 1994) is based on the UPOV 1991 convention and

¹⁷ Niels Louwaars, Derek Eaton and ArndJan van Wijk. *Framework for the Introduction of Plant Variety Protection in Developing Countries*. North-South policy Brief, 2003, p.2. Available at: http://www.northsouth.nl/files/policy/policy_brief_2003_2.pdf

¹⁸ Niels Louwaars, Derek Eaton and ArndJan van Wijk. *Framework for the Introduction of Plant Variety Protection in Developing Countries*. North-South policy Brief, 2003, p.2. Available at: http://www.northsouth.nl/files/policy/policy_brief_2003_2.pdf

¹⁹ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>

²⁰ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>

provides protection to the breeder of any sexually or tuber propagated plant variety if the UPOV requirements for protection are met.²¹

Plant Variety Protection Act (PVPA)

Until 1970, the Plant Patent Act of 1930 (PPA) contained the only intellectual property rights available to protect new inventions that contained living matter.²² The PPA enabled plant breeders to obtain patent-like protection for their inventions but limited the protection to asexually reproducing plants (produced from cuttings or grafts but not grown from seed).²³ In 1970, Congress enacted the Plant Variety Protection Act (PVPA) to protect breeding innovations in sexually reproducing plants, thereby including most crops.²⁴ The PVPA provides patent-like protection for new, distinct, uniform, and stable plant varieties for twenty years.²⁵ The protection the PVPA grants is limited by two significant exceptions that have been narrowed in recent years.²⁶ These exceptions allow breeders to use protected seed to create new varieties and allow

²¹ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

²²Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Plant Patent Act, 35 U.S.C. § 161 (1988 & Supp. 1996).

²³ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm, *supra* note 54: The PPA grants that “Whoever invents or discovers and asexually reproduces any distinct and new variety of plant, including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state, may obtain a patent therefor . . .” 35 U.S.C. § 161 (1996).

²⁴ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: 7 U.S.C. § 2402 (1988 & Supp. 1996); David Tilford. *Saving the Blueprints: The International Legal Regime for Plant Resources*, 30 Case W. Res. J. Int’l L. 373, 402 (1998).

²⁵ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm, *supra* note 56: 7 U.S.C. § 2401(a). “Plants that do not exhibit the same traits when grown out over several generations (i.e., plants that are not stable) are not eligible for protection.” See also: 7 U.S.C. § 2402(a)(3). “Thus, hybrids are excluded from protection because they do not breed true after one generation.” Peter J. Goss. *Guiding the Hand that Feeds: Towards Socially Optimal Appropriability in Agricultural Biotechnology Innovation*, 84 Cal. L. Rev. 1395, 1398 (1996), *supra* note 36, at 1407 n.70.

²⁶ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Peter J. Goss. *Guiding the Hand that Feeds: Towards Socially Optimal Appropriability in Agricultural Biotechnology Innovation*, 84 Cal. L. Rev. 1395, 1398 (1996), *supra* note 36, at 1408–09.

farmers to save seed from crops grown with the protected variety and replant those seeds without compensating the protected plant breeder.²⁷

The Value of IP: Investment, Innovation and Technology Transfer

Industry

According to Ronald Hirshhorn and Jock Langford, authors of *Intellectual Property Rights in Biotechnology: The Economic Argument*, prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property and the Patenting of Higher Life Forms:

Economists have also long understood that, left to their own, markets will not lead to adequate innovation. The main source of market failure is the inability of individuals and firms to prevent others from making use of the new knowledge they produce. If firms cannot appropriate the full returns from producing knowledge, they will have less incentive to invest in knowledge-producing activities.²⁸

Hirshhorn and Langford go on to explain that intellectual property laws attempt to remedy the market failure and strengthen the incentive for private firms to undertake R&D.²⁹ In

²⁷ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm, *supra* note 58: The first exception is called the “research exception” and the second the “crop exemption” exception. In 1994, Congress passed amendments to the PVPA to limit the potential for abuse of both exceptions. For an example of judicial efforts to limit the scope of the crop exemption, see *Delta & Pine Land Co. v. Peoples Gin Co.*, 694 F.2d 1012 (5th Cir. 1983), which found that farmers who save seed must do so individually and not through intermediaries such as farm cooperatives; and *Asgrow v. Winterboer*, 513 U.S. 179 (1995), which determined that a farmer could sell to other farmers no more than the amount of seed the farmer would otherwise need to plant her crop for the next year. Congress has now removed any sale provision from the crop exemption—presently farmers can only sell seed for other than reproductive purposes (food or feed but not for planting). See Peter J. Goss. *Guiding the Hand that Feeds: Towards Socially Optimal Appropriability in Agricultural Biotechnology Innovation*, 84 Cal. L. Rev. 1395, 1398 (1996), *supra* note 36, at 1414.

²⁸ Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>

²⁹ Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property

fact, senior biotech executives reported that “acquiring a strong intellectual property portfolio was crucial to their efforts to raise capital and achieve competitiveness.”³⁰ One of Clarke’s venture capitalist interviewees stated that “A patent can be the most valuable asset a biotechnology company owns.”³¹ Likewise, according to Janet Lambert, president of BioteCanada, “Commercializing research projects is the No. 1 concern of the biotech industry.”³²

In fact, Hirshhorn and Langford found that:

Over a 5 year period, 57% of all Canadian biotechnology firms used patents to protect their proprietary technology, and 48% either licensed IPRs to or acquired IPRs from another firm. A recent survey of 46 Canadian biotechnology companies found that almost all use patents to protect their most valuable technologies.³³

Government

Likewise, governments find that patents are a valuable tool for inducing investment and innovation.³⁴ Article 1, Section 8 of the United States Constitution grants patents to inventors “[t]o promote the Progress of Science and useful Arts”³⁵ According to a study by the

and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>

³⁰ Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>

³¹ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>

³² Andy Holloway. *Welcome to the bioeconomy: advances in biology are changing the way the world does business, and Canada could rise to the top of the food chain in the new biotech economy. The missing link is money*. Canadian Business, Toronto, Sep 2, 2002, Vol. 75, Iss. 16; pg. 28.

³³ Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>, *supra* note 36.

³⁴ Robert B. Horsch. *Commercialization of genetically engineered crops*. Philosophical Transactions of the Royal Society of London B Biological Sciences, 1993; 342(1301): 287-291.

³⁵ The U.S. Constitution Online. Article 1, Section 8. Available at: http://www.usconstitution.net/xconst_A1Sec8.html

FAAR Biotechnology Group Inc. & Auditor Bioconsulting called *Canadian Biotechnology Strategy: Opportunities and Challenges for Application of Biotechnology in the Canadian Agri-food Sector*, “. . . a strong patent position is an inducement for investment. Indeed, patents, investment and products are all linked.”³⁶ The authors go on to explain that:

The limited monopoly inherent in IPRs is granted to companies and individuals to encourage innovation and the development and diffusion of new products and technologies to undertake research and to invest in intellectual property. From a public policy perspective, IPRs thus represent a trade-off between the short-run effects of resource misallocation because of the presence of market power and the long-run benefits from greater R&D.³⁷

The authors then point to the increase in private investment as a result of the establishment and strengthening of property rights in agriculture. “For example, private canola research in Canada has increased from less than \$1million per year in 1970 to over \$85 million in 1998 (Gray et al, 1999).” According to the authors, this large influx of investment has increased research output with over forty new varieties of canola being produced each year.³⁸ Likewise, Larry Martin and Vincent Amanor-Boadu, in *The Potential Impacts of Patenting Biotechnology on the Animal and Agri-Food Sector*, point out that “strong IP protection encourages investment.”³⁹ As a result, efforts in Canada have been directed towards strengthening IPRs.⁴⁰ However, Michael Blakeney et al, cautions that “there are difficulties in

³⁶ FAAR Biotechnology Group Inc. & Auditor Bioconsulting. *Canadian Biotechnology Strategy: Opportunities and Challenges for Application of Biotechnology in the Canadian Agri-food Sector*. Summary Document and Recommendations, April 28, 1998. Available at: http://www.carccrac.ca/english/cdn_biotech_strategy/cbs.htm

³⁷ FAAR Biotechnology Group Inc. & Auditor Bioconsulting. *Canadian Biotechnology Strategy: Opportunities and Challenges for Application of Biotechnology in the Canadian Agri-food Sector*. Summary Document and Recommendations, April 28, 1998. Available at: http://www.carccrac.ca/english/cdn_biotech_strategy/cbs.htm

³⁸ FAAR Biotechnology Group Inc. & Auditor Bioconsulting. *Canadian Biotechnology Strategy: Opportunities and Challenges for Application of Biotechnology in the Canadian Agri-food Sector*. Summary Document and Recommendations, April 28, 1998. Available at: http://www.carccrac.ca/english/cdn_biotech_strategy/cbs.htm

³⁹ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>. See also: Larry Martin and Vincent Amanor-Boadu. *The Potential Impacts of Patenting Biotechnology on the Animal and Agri-Food Sector*, Executive Summary, Ottawa, ONT: Industry Canada, January 1997, p.5. Available at: http://www.strategis.ic.gc.ca/epic/internet/inippd-dppi.nsf/vwGeneratedInterE/h_ip00003e.html

⁴⁰ Richard Carew. *Intellectual Property Rights: Implications for the Canola Sector and Publicly Funded Research*. Canadian Journal of Agricultural Economics, July 2000, v. 48, iss. 2, pp. 175-94.

documenting any significant gains from using IPR protection as a strategy for generating new, external funds for research.”⁴¹ According to Blakeney et al, “patents simply protect innovation and secure the potential rights for future development.”⁴² The likelihood, therefore, that national programs will “earn financial benefits from research comes mainly from working with the private sector and by providing for technology transfer.”⁴³

Nevertheless, in Canada, intellectual property is viewed quite highly as securing investments made in innovative biotechnology. According to Fulton et al., “the value of biotechnology is largely intellectual property . . .”⁴⁴ This statement is reiterated in an attempt to show the significance of creating trade agreements to secure investment in biotechnology:

The returns to investment in biotechnology will be determined, in part, by the size of the market and the life cycle of the product. Given the rate of technological change currently taking place in biotechnology, the life-cycle of any product is likely to be short, with new products with superior traits being developed quickly. This means that firms will require access to the largest possible market. Given that the *major value of biotechnology lies in its intellectual property*, access to foreign markets has two elements: firms can capture the value of intellectual property by embodying it in goods that are exported to foreign markets, or they can capture the value by licensing the product for foreign production or producing it in a foreign subsidiary.⁴⁵

⁴¹ Michael Blakeney, Joel I. Cohen, and Stephen Crespi. *Intellectual Property Rights and Agricultural Biotechnology*. Available at: http://www.isnar.cgiar.org/publications/pdf/biobook/V_18.pdf

⁴² Michael Blakeney, Joel I. Cohen, and Stephen Crespi. *Intellectual Property Rights and Agricultural Biotechnology*. Available at: http://www.isnar.cgiar.org/publications/pdf/biobook/V_18.pdf

⁴³ Michael Blakeney, Joel I. Cohen, and Stephen Crespi. *Intellectual Property Rights and Agricultural Biotechnology*. Available at: http://www.isnar.cgiar.org/publications/pdf/biobook/V_18.pdf

⁴⁴ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

⁴⁵ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

In an attempt to make the case for stronger patent laws in Canada, the authors highlight the importance of the commercialization of research finding:

Canada must expand its ability in order to be able to fully capitalize on the investments already made in the agri-food sector. Much of the expansion within the sector will come from the commercialization of innovative ideas first explored within public research institutions. If these innovations are successfully nurtured, the entire agri-food sector will benefit.⁴⁶

Likewise, Australia's Biotechnology Organization is trying to convince government officials to remove the numerous moratoriums placed on the commercialization of biotechnology in Australia. In a paper entitled *Backing Innovation: the way forward for Australian agriculture*, the organization argues that these moratoriums will "reduce investment in biotechnology" and notes "as a matter of priority" that State Governments put in place "a pathway forward from research and development to commercialization."⁴⁷ It would seem then that not being able to generate IP, therefore, is bad for any economy. However, as D. Koyek of the Institute for Agriculture and Trade Policy (IATP) makes clear, IP does not always lend itself to investment or inventive activity. In his article, *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*, Koyek points to a recent study by the International Food Policy Research Institute which shows that "30 years of PVP in the US have had no effect on private sector investment in breeding, nor on yields, in wheat – the country's most important food crop."⁴⁸ He goes on to explain that:

The few PVP impact studies available suggest that UPOV-type systems do not live up to the promises of their proponents. For example, they do not increase the quality or diversity of plant varieties released by the private sector. In his investigations,

⁴⁶ FAAR Biotechnology Group Inc. & Auditor Bioconsulting. *Canadian Biotechnology Strategy: Opportunities and Challenges for Application of Biotechnology in the Canadian Agri-food Sector*. Summary Document and Recommendations, April 28, 1998. Available at: http://www.carccrac.ca/english/cdn_biotech_strategy/cbs.htm

⁴⁷ Australia's Biotechnology Organization. *Backing Innovation: the way forward for Australian agriculture*. AusBiotech Ltd., 2004. Available at: <http://www.ausbiotech.org/policy/pdf/backing.pdf>

⁴⁸ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.8. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf. See also: Julian M. Alston and Raymond J. Venner. *The Effects of the U.S. Plant Variety Protection Act on Wheat Genetic Improvement*. EPTD Discussion Paper, Number 62, IFPRI, May 2000. <http://www.ifpri.cgiar.org/divs/eptd/dp/eptdp62.htm>

Indian researcher Dwijen Rangnekar found no clear correlation between the introduction of PVP and an increased rate of introduction of new plant varieties. He also found that when rates did increase, as with wheat in the UK, it did not lead to increased “inventive activity” . . . According to Rangnekar, much of commercial breeding is directed at “cosmetic differences” to serve market strategies, casting serious doubt on the claim that PVP stimulates innovation.⁴⁹

According to Koyek, “IPRs inhibit and easily destroy innovation on farms.”⁵⁰ While proponents of IPR claim that it is important for access and innovation, Koyek argues that this is a smokescreen. “If access was the issue, then the evidence stands against IPR: it restricts the flow of germplasm, reduces sharing between breeders, erodes genetic diversity, and, all in all, stifles research.”⁵¹ According to Koyek, “there are plenty of options for rewarding innovation that encourage pro-farmer research and development, but IPR is not one of them.”⁵²

Hirshhorn and Langford point out that there are other measures of knowledge and innovation that do not require legal rights:

IP law is only one of the instruments Canadian policymakers employ to support the creation of knowledge and help build a more innovative economy. The creation of IP rights is inappropriate for basic research findings, such as new discoveries in physics, which are important building blocks in the advancement of human knowledge.⁵³

⁴⁹ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.8. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf. See also: Dwijen Rangnekar. *A Comment on the Proposed Protection of Plant Varieties and Farmers' Rights Bill, 1999*, March, 2000, p.6.

⁵⁰ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.23. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

⁵¹ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.23. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

⁵² D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.24. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

⁵³ Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property

Technology Transfer

Besides stimulating the production of new knowledge, the IP system facilitates its dissemination. In return for the grant of a period of market exclusivity, patentees must disclose their invention. According to Hirshhorn and Langford, a “clear and complete description of the invention must be provided on the patent application, which, in Canada, is published 18 months after filing.”⁵⁴ The information disclosed in patents allows other to build on earlier inventions and helps avoid costly and wasteful duplication in research.⁵⁵ The FAAR Biotechnology Group Inc. & Auditor Bioconsulting highlights the importance of effective technology transfer:

A primary issue of concern for the commercialization of biotechnology products in the agri-food sector is the process of technology transfer. This is a complicated area which is further encumbered by the intricacies of the intellectual property maze that now affects the development of many new biotechnology processes and products. However, an effective technology transfer process is essential for Canadian industry to remain competitive.⁵⁶

Nevertheless, according to Clarke, the European Patent Office estimates that over \$22 billion dollars a year is wasted on research that has been done before.⁵⁷ In the case of plant

and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>

⁵⁴ Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>

⁵⁵ Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>

⁵⁶ FAAR Biotechnology Group Inc. & Auditor Bioconsulting. *Canadian Biotechnology Strategy: Opportunities and Challenges for Application of Biotechnology in the Canadian Agri-food Sector*. Summary Document and Recommendations, April 28, 1998. Available at: http://www.carccrac.ca/english/cdn_biotech_strategy/cbs.htm

⁵⁷ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>. See also: Todd Q. Dickinson. *Reconciling Research and the Patent System*. Issues in Science and Technology (Online), Summer, 2000, p.4. Available at: www.nap.edu/issues/16.4/dickinson.htm

biotechnology, Clarke notes, plant breeders rights are often not considered to be strong enough, and so inventors choose the “trade secret” route which is an impediment to the advancement of science, since it reduces the sharing of information among breeders about the underlying science.⁵⁸ According to Hirshhorn and Langford, “Secrecy is often favoured as the means for protecting process innovations.”⁵⁹ More importantly:

not all innovations that are eligible for IP protection are protected. Firms will only seek IP protection if the return from their investment in obtaining and enforcing patents or other IP rights is likely to exceed the return from investing in alternative means to appropriate the benefits from their inventive activity.⁶⁰

According to the FAAR Biotechnology Group Inc. & Auditor Bioconsulting, the “increasing influence of US patents and trade issues also restrict the ability of the research and development community to transfer technology . . .”⁶¹ Laurie notes that while the requirement that the invention be novel is tested by reference to the state of the art, this is a technical legal expression which has differing meanings in Europe compared to other jurisdictions. “In Europe, the state of the art means the sum total of human knowledge available by any means anywhere in the world. In the United States, the state of the art merely refers to the sum total of knowledge available in the United States.”⁶²

⁵⁸ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>

⁵⁹ Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>

⁶⁰ Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>

⁶¹ FAAR Biotechnology Group Inc. & Auditor Bioconsulting. *Canadian Biotechnology Strategy: Opportunities and Challenges for Application of Biotechnology in the Canadian Agri-food Sector*. Summary Document and Recommendations, April 28, 1998. Available at: http://www.carccrac.ca/english/cdn_biotech_strategy/cbs.htm

⁶² Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003, p.8. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

Emmanuel Duguet and Megan MacGarvie use evidence from French innovation surveys to determine how well patent citations measure flows of technology. They find that while, “patent citations are indeed related to firms' statements about their acquisition and dispersion of new technology, . . . the strength and statistical significance of this relationship varies across geographical regions and across mechanisms for technology diffusion.”⁶³ They note that while there does exist a growing body of research employing patent citations, “there exists little evidence on the validity of using patent citations as a measure of knowledge flows.”⁶⁴ The only existing research on this question is a survey of patentees undertaken by Jaffe, Trajtenberg and Fogarty (2000). The authors surveyed inventors of cited and citing patents, and found that “citations are an extremely noisy measure of communication between inventors, with about half of them lacking any relevance with regard to knowledge flows.”⁶⁵

⁶³ Emmanuel Duguet and Megan MacGarvie. *How Well Do Patent Citations Measure Flows of Technology? Evidence from French Innovation Surveys*. Revised, September 2003. Available at: <http://cisad.adc.education.fr/reperes/telechar/wp/eurequa/dug0399.pdf>

⁶⁴ Emmanuel Duguet and Megan MacGarvie. *How Well Do Patent Citations Measure Flows of Technology? Evidence from French Innovation Surveys*. Revised, September 2003. Available at: <http://cisad.adc.education.fr/reperes/telechar/wp/eurequa/dug0399.pdf>

⁶⁵ Emmanuel Duguet and Megan MacGarvie. *How Well Do Patent Citations Measure Flows of Technology? Evidence from French Innovation Surveys*. Revised, September 2003. Available at: <http://cisad.adc.education.fr/reperes/telechar/wp/eurequa/dug0399.pdf>

Patenting Life: A Case from Morality

United States

According to Ewens, prior to 1980, the U.S. Patent and Trademark Office (PTO) and the federal courts were reluctant to allow utility patents to extend to living matter.⁶⁶ This practice ended when, in *Diamond v. Chakrabarty*, the U.S. Supreme Court recognized the patentability of living inventions.⁶⁷ Chakrabarty, a microbiologist, and employee of Genentech, a San Francisco-based corporation dedicated exclusively to biotechnology⁶⁸, challenged a denial of his patent application for a bacterium he invented that broke down crude oil.⁶⁹ The Court held that Chakrabarty's bacterium was a product of human labor, contained characteristics "markedly different" from any found in nature, and showed the potential for "significant utility," thus making Chakrabarty's bacterium eligible for a patent.⁷⁰ Genetic engineering's prospects immediately soared. Several countries, including West Germany and Great Britain, announced they would target biotechnology for research and development. That same year, Genentech's

⁶⁶ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: David G. Scalise & Daniel Nugent. *International Intellectual Property Protections for Living Matter: Biotechnology, Multinational Conventions and the Exception for Agriculture*, 27 Case W. Res. J. Int'l L. 83, 83 (1995), *supra* note 4, at 95. Scalise and Nugent write:

Despite anomalous patents, such as that issued to Louis Pasteur in 1873 for his purified culture of yeast, the courts invariably rejected patents that pertained to living matter. The most effective weapon was the products of nature doctrine, as discussed in the American Fruit Growers case. When that doctrine failed, the PTO and private plaintiffs relied upon the plant protection acts of 1930 and 1970 as evidence that Congress intended that only living organisms qualifying under one of the acts were to be afforded intellectual property rights.

⁶⁷ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: *Diamond v. Chakrabarty*, 447 U.S. 303 (1980).

⁶⁸ Shafer Parker Jr. *Superspid flexes its muscles*. Alberta Report / Newsmagazine, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

⁶⁹ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also *Diamond v. Chakrabarty*, 447 U.S. 305 (1980).

⁷⁰ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: *Diamond v. Chakrabarty*, 447 U.S. 310 (1980). The court also examined the committee reports of the 1952 recodification of the patent laws which, in the court's view, made clear Congress's intent that the statute include "anything under the sun that is made by man."

initial public offering set a Wall Street record for the fastest price-per-share increase (\$35 to \$89 in 20 minutes).⁷¹

Although *Chakrabarty* was the groundbreaking case, the question remained of whether the PTO and courts would grant patents that extended protection to complex living organisms such as plants or animals.⁷² In *Ex parte Hibberd*, the PTO originally rejected Hibberd's application for a patent on a maize plant that possessed an extremely high level of amino acids, determining that the existence of the PVPA indicated that plants do not qualify for standard utility patents.⁷³ The PTO's Board reversed the decision and held that "neither the PPA nor the PVPA expressly excludes any biological subject matter from protection under Section 101 [utility patents]."⁷⁴ Thus, new plant varieties became eligible for utility patents under *Ex parte Hibberd*.⁷⁵

According to Laurie, "[t]here is no prohibition on the patentability of biotechnological inventions in the United States if the standard criteria such as novelty, inventive step and utility are satisfied."⁷⁶ He goes on to explain:

The main controversy in the US has been the need to demonstrate the 'utility' of an invention, i.e. - the applicant must show a credible and substantial use for his invention that represents an advantage over the existing state of the art. It is for this reason, and not on the grounds of immorality, that partial gene

⁷¹ Shafer Parker Jr. *Superspod flexes its muscles*. Alberta Report / Newsmagazine, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

⁷² Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: David G. Scalise & Daniel Nugent. *International Intellectual Property Protections for Living Matter: Biotechnology, Multinational Conventions and the Exception for Agriculture*, 27 Case W. Res. J. Int'l L. 83, 83 (1995), *supra* note 4, at 98.

⁷³ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: *Ex parte Hibberd*, 227 U.S.P.Q. 443, 444 (1985).

⁷⁴ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: *Ex parte Hibberd*, 227 U.S.P.Q. 444 - 45 (1985).

⁷⁵ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Peter J. Goss, *Guiding the Hand that Feeds: Towards Socially Optimal Appropriability in Agricultural Biotechnology Innovation*, 84 Cal. L. Rev. 1395, 1398 (1996), *supra* note 36, at 1405.

⁷⁶ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003, p.15. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf.

sequences with no known function have been refused protection.⁷⁷

Canada

The Supreme Court of Canada in the case of *Monsanto vs. Saskatchewan farmer Percy Schmeiser*, set a precedent that higher life forms are incapable of patent protection:

In short, properly construed, Monsanto's claims both for products and processes are valid. Neither extends patent protection to the plant itself, a higher life form incapable of patent protection. In order to avoid the claim extending to the whole plant, the plant cell claim cannot extend past the point where the genetically modified cell begins to multiply and differentiate into plant tissues, at which point the claim would be for every cell in the plant, i.e., for the plant itself. Therefore, Monsanto's valid claims are solely for genetically modified chimeric genes and cells in the laboratory prior to regeneration -- and for the attendant process for making the genetically modified plant.⁷⁸

This ruling was made regardless of the objections raised by Canadians who are involved in the transfer and/or commercialization of biotechnology in Canada. Thomas Clarke, author of *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*, prepared for the Canadian Biotechnology Advisory Committee (CBAC) Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, outlines these objections.

One school believes that Canada's stance on the patenting of higher life forms, in particular, is having a long-term deleterious effect on Canadian companies' ability to attract investment and R&D dollars. According to a Senior University TT Advisor, "From an economic point-of-view, Canadian patents are not relevant."⁷⁹ The CEO of Canadian biotech company briefing to the CBAC also voiced concern that Canada's lack of harmonization with other countries' patent rules was sending a negative message to foreign investors and senior managers of foreign multinational companies in Canada that would result in reduced investment: "Our lack

⁷⁷ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003, p.19. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

⁷⁸ *Monsanto Canada Inc. v. Schmeiser*, 138-39. Available at: <http://www.lexum.umontreal.ca/csc-scc/en/rec/html/2004scc034.wpd.html>.

⁷⁹ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>

of harmonization is having a chilling effect on the international perception that Canada is a good place to invest in biotechnology.”⁸⁰

Other interviewees felt that it was making it difficult to do business smoothly across the Canada - U.S. border. According to a CEO, “the Harvard mouse controversy is a real show stopper. We are out of step with the rest of the world.”⁸¹ Sharing this view, Dr. John Rudolph, in his review of issues related to the patentability of biotechnological subject matter, believes that Canada’s refusal to patent higher life forms is a factor in preventing Canada from becoming a world leader in biotechnology.⁸² In fact, everyone who was interviewed for this study had no qualms about the patenting of higher life forms and most felt that ethics had no place in the patent system. According to Clarke, having social, moral or ethical considerations as an intrinsic part of the patent system was uniformly rejected by most of the interviewees.⁸³

The real concern for Canadians involved in the transfer/commercialization of biotechnology is that the patents system is not limited by moral considerations. According to a government TT officer, “patents are an economic tool. There are other fora to deal with social and ethical issues.”⁸⁴ Moreover, a university technology transfer interviewee felt that the inability to patent animals (i.e., research mice) was making it very difficult for them to enforce their patents on animal models in Canada: “We can patent the use of the animal, but it is very hard to enforce the patent if you can’t patent the whole animal.”⁸⁵ Nevertheless, in the Monsanto

⁸⁰ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>

⁸¹ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>

⁸² Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>. See also: John Rudolph. *A Study of Issues Relating to the Patentability of Biotechnological Subject Matter*, Prepared for the Intellectual Property Policy Directorate, Ottawa, ONT: Industry Canada, January, 1997. Available at: <http://strategis.ic.gc.ca/epic/internet/inippd-dppi.nsf/vwGeneratedInterE/ip00193e.html>

⁸³ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>

⁸⁴ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>

⁸⁵ Thomas Clarke. *Impact of Canada's Patent System and Public Sector Technology Transfer System on the Growth of the Biotechnology Industry in Canada*. Prepared for the Canadian Biotechnology Advisory Committee Project

case, the Supreme Court of Canada upheld its decision: "While the "rights available under the *Plant Breeders' Rights Act* fall well short of those conferred by patent, both in comprehensiveness and in duration" (*Harvard College, supra*, at para. 63), they may be all that Monsanto is entitled to."⁸⁶

Europe

According to Laurie, the permissibility of patenting genetically engineered plants was considered by the Enlarged Board of Appeal of the EPO which held that only claims to 'plant varieties' *as such* are protected. While this extends to genetically engineered plant varieties it does not rule out the possibility that 'plant-related products', including plants themselves, can receive patent protection. In Europe, however, objections can be raised on moral grounds.⁸⁷ Article 53 of the European Patent Convention provides that: European patents shall not be granted in respect of:

- a) inventions the publication or exploitation of which would be contrary to *ordre public* or morality, provided that the exploitation shall not be deemed to be so contrary merely because it is prohibited by law or regulation in some or all of the contracting states;
- b) plant or animal varieties or essentially biological processes for the production of plants or animals; this provision does not apply to microbiological processes or the products thereof.⁸⁸

Laurie explores the decision in Europe, *PGS/Glutamine Synthetase Inhibitors* [1995] EPOR 357:

This was a decision of the Technical Board of Appeal concerning a patented invention to develop plants and seeds which were resistant to a particular class of herbicides (glutamine synthetase inhibitors). DNA had been inserted into the genome of the plants which encoded for a protein capable of neutralising or inactivating the effect of the herbicides. Opposition was raised on the basis of Article 53, primarily on the grounds that it was immoral to patent 'life' and that it was contrary to

Steering Committee on Intellectual Property and the Patenting of Higher Life Forms, February 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00403e.html>

⁸⁶ Monsanto Canada Inc. v. Schmeiser, 169. Available at: <http://www.lexum.umontreal.ca/csc-scc/en/rec/html/2004scc034.wpd.html>.

⁸⁷ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

⁸⁸ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003, p.16. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

‘ordre public’ to sanction the production of organisms which, if released into the environment in an uncontrolled way, could cause untold damage to the ecology of the planet.(6)

The proper role for morality objections in Europe, therefore, lies not with whether higher life forms should be patented, but with the question of whether a monopoly right should be granted over a particular invention based on foreseeable consequences.⁸⁹ This terminology, Laurie notices, is reflected in Article 27 of the TRIPS Agreement which allows, but does not require signatory countries to exclude from inventions from patentability on moral grounds.⁹⁰ According to Laurie, while this “divergence of approach has been criticized as being contrary to the economic interests of European states, European law at least recognizes that patenting is not a morally neutral exercise . . .”⁹¹ even if “the objection to patenting on moral grounds is frequently founded on a misconception of the function of the patent system and the value of a patent.”⁹² According to Laurie:

A patent is merely a right to control new information that has been contributed to the state of the art. In particular, it is only a right to prevent others from using this information in direct public competition. It is not a property right over life as is so often claimed, nor is it a means to regulate the science and technology industries.⁹³

According to Laurie, these fallacies are perpetuated by European objections to patenting on morality grounds:

At their core is a desire to prevent the creative process itself. But the patent system cannot do this.

⁸⁹ Padmashree Gehl Sampath, Richard G. Tarasofsky. *Study on the Inter-Relations between Intellectual Property Rights Regimes and the Conservation of Genetic Resources*. Prepared for the European Commission Directorate-General, Environment. Final Report, December 2002. Available at: <http://www.biodiv.org/doc/meetings/abs/abswg-02/information/abswg-02-inf-ext-en.pdf>

⁹⁰ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

⁹¹ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003, p.19. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

⁹² Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003, p.19. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

⁹³ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003, p.19. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf. See also: G.T. Laurie. *Biotechnology and Intellectual Property: A Marriage of Inconvenience?* in McLean, S.A.M. *Contemporary Issues in Law, Medicine and Ethics*, Aldershot, Dartmouth, 1996, chapter 12 (pp.237-267).

The refusal to grant a patent does not preclude the act of creation. Indeed, paradoxically it might encourage creation because a patent is merely a right to stop others exploiting an invention. If, then, such a right is denied, there is no check on the use of the science that lies at the heart of the invention.⁹⁴

World Trade and Biopiracy

Motivation for TRIPs

According to Hirshhorn and Langford, the inclusion of TRIPs under to WTO was an attempt to strengthen IP protection in developing economies and reduce the disparity in global IP standards and was part of a “broader global development that has included reductions in trade and investment barriers and other international policy reforms aimed at enhancing and spreading the benefits of globalization.”⁹⁵ According to Laurie, however,

[t]he motivation for the implementation of TRIPs is almost entirely economic. It was driven by the concerns of Western Industrial countries, and most notably, the United States, who could not countenance the multi-billion dollar trade in unauthorized intellectual property that had developed over the years . . .⁹⁶

Likewise, according to Fulton et al, the inclusion of the TRIPs agreement under the WTO was at the insistence of developed countries who wanted a means of coercing developing countries into protecting the intellectual property of their firms.⁹⁷ “By linking TRIPs to GATT, and so thereby bringing all signatory states under the auspices of the WTO”, according to Laurie,

⁹⁴ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003, p.19. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

⁹⁵ Ronald Hirshhorn and Jock Langford. *Intellectual Property Rights in Biotechnology: The Economic Argument*. Prepared for the Canadian Biotechnology Advisory committee Project Steering Committee on Intellectual property and the Patenting of Higher Life Forms, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00386e.html>

⁹⁶ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003, p.4. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

⁹⁷ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

“the relevant politicians and governments in control have been able to establish a system which is almost impossible to resist.”⁹⁸ However, according to Laurie,

The real stroke of economic genius has been to link non-compliance with TRIPS to the withdrawal of GATT privileges – in the event of an adverse ruling by the WTO – thereby potentially crippling a states entire economy for the sake of intellectual property rights.⁹⁹

Patents on Life and Pressures on Developing Countries

Until recently, patents on living organisms were not recognized under the WTO. However, with the inclusion of TRIPS, this has begun to change. On January 1, 1995 TRIPS entered into force and made it obligatory for all parties to make patents available for “any invention, whether product or process, in any field of technology without discrimination by the year 2000 for developing countries and 2006 for least-developed countries.”¹⁰⁰ The protection of plant varieties is dealt with specifically in Article 27(3), where protection of some form is required: “members shall provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof.”¹⁰¹ According to Ewens, those countries that do not currently allow the patenting of plants or agricultural products—India is an example—will be obliged to offer some sort of protection for plant varieties even if this contradicts national policies.¹⁰²

⁹⁸ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003, p.4. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

⁹⁹ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003, p.4. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf

¹⁰⁰ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.5. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹⁰¹ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm

¹⁰² Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: David Tilford. *Saving the Blueprints: The International Legal Regime for Plant Resources*, 30 Case W. Res. J. Int'l L. 373, 402 (1998), *supra* note 55, at 408-409. “From the United States’ point of view this means signatories may decide to offer separate and perhaps weaker plant variety protection rather than the full patent rights advocated by the U.S. In India, reaction to this provision was so vehement that in October 1993 half a million farmers rallied together to protest the patenting of agricultural products.” See Charles McManis. *The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, 76 Wash. U. L.Q. 255, 255–56 (1998), *supra* note 15, at 257, 267. The head of the association that organized the protest, M. D. Nanjundaswamy, said the farmers were demonstrating “for collective, not individual control over seeds and plants.”

According to Koyek, while TRIPS Article 27.3(b) allows WTO members to exclude plants and animals provided that they offer patents or establish “an effective *sui generis* system” of protection for plant varieties, what constitutes “an effective *sui generis* system” is not defined by WTO and this has generated considerable debate.¹⁰³

According to Koyek,

Numerous Asian countries have taken the *sui generis* option seriously and sought to guarantee their huge farming populations special features to buffer the impact of PVP. Others try to ensure that some of the royalties captured by industry will flow back into genetic conservation. Thailand, for instance, has created provisions for local communities to secure rights over local varieties, compulsory sharing of profits from PVP-protected seeds and links to biosafety law. Similar thinking has been guiding the drafting process in Bangladesh.¹⁰⁴

As UPOV’s former Vice Secretary-General recently put it, “Countries have a great deal of freedom in devising their own laws on genetic resources and farmers’ rights and so on, *as long as the new laws do not conflict with UPOV requirements.*”¹⁰⁵ However, Koyek notes, “the overriding trend is *not* toward a world of do-as-you-please *sui generis* systems. It is toward harmonization.”¹⁰⁶ He goes on to give specific examples:

India and the Philippines both started off with somewhat “progressive” PVP drafts, seeking to avoid the worst of UPOV in the implementation of TRIPS. As those drafts moved further through the

¹⁰³ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.5. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹⁰⁴ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.6. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹⁰⁵ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.8. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹⁰⁶ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.6. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

legislative pipeline, nearly all those special features were deleted or watered down considerably, to the extent that these countries are about to adopt unmistakably UPOV laws. When and where that process is too slow, direct pressure through bilateral trade negotiations is steering governments to the same end. The trade agreement signed between the US and Viet Nam last year provides that Hanoi will embrace UPOV as soon as possible. So does the Swiss-Vietnamese bilateral IPR agreement. As does the US-Cambodia trade agreement. Ditto for the latest EU-Bangladesh development cooperation package. Never mind that some of these countries may not have the means of enforcing these laws to begin with.¹⁰⁷

According to Koyek, industrialized countries are working hard to secure standard UPOV-type laws in all countries to “wrench the doors open to full-scale industrial patents on life” and “secure the conditions that will provide strategic advantages for their firms.”¹⁰⁸ According to Fulton et al, developing countries can be expected to fiercely resist and strengthening of the TRIPs. In fact, “[t]heoretical examinations of this issue to date indicate that the levels of retaliation currently allowed in the WTO will not be sufficient to induce countries to live up to their TRIPs commitments.”¹⁰⁹ On the contrary, Koyek notices that:

¹⁰⁷ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.7. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf. See also: *US-Vietnam Bilateral Trade Agreement*. Chapter II, Intellectual Property Rights, signed 13 July 2000. Available at: <http://usembassy.state.gov/vietnam/www/whitiss.html>; Swiss Federal Institute of Intellectual Property. *Ratification of Intellectual Property Agreement*. Berne, 19 May 2000. Available at: <http://www.ige.ch/e/news/2000/n107.htm>; *Agreement between United States of America and the Kingdom of Cambodia on Trade Relations and Intellectual Property Rights Protection*. Available at: <http://www.cptech.org/ip/health/c/agreements/cambodia-1994-ip.html>. “Cooperation Agreement between the European Community and the People’s Republic of Bangladesh in Partnership and Development”, *Official Journal of the European Communities*, Luxembourg, C143/9, 21 May 1999, approved by the European Parliament under Consultation Procedure on 17 January 2001. See UN Conference on Trade and Development, *The TRIPs Agreement and Developing Countries* (UNCTAD, Geneva, 1997, p. 25), for an estimate of the costs to Bangladesh.

¹⁰⁸ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.7. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹⁰⁹ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

While Asia weighs the pros and the cons of what to do in the complex IP arena, agribusiness multinationals and research labs in the North have already built up an extensive portfolio of patents for genetically engineered plants that are waiting to be transferred to or built upon here. Some of these “inventions” may already be setting foot in Asia as patents on transgenic microorganisms or breeding methods. . . A quick search through the online database of the Thai Patent Office reveals over 15 patents on transgenic “microorganisms”, most of them covering plants! This should not really come as a surprise, given the environment of IP law today, even if Thailand does not allow for patents on plants.¹¹⁰

Biopiracy

According to Ewens, the intellectual property regime enshrined in TRIPs, and to a lesser extent in the Biodiversity Treaty seem to be a continuation of United States intellectual property policy and raises serious questions of distributive justice.¹¹¹ James Boyle writes, “on the institutional level, the GATT has been used both to expound and to enforce the developed world’s view of intellectual property”¹¹² and have been utilized by the West as a “one way valve for property claims.”¹¹³ Ewens notes that:

the flow of germplasm and indigenous agricultural knowledge from the Third World to the First has largely been an uninterrupted and uncompensated

¹¹⁰ D. Koyek. Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia. Institute for Agriculture and Trade Policy (IATP), 2001, p.11. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹¹¹ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Vandana Shiva. *BioPiracy: The Plunder of Nature and Knowledge*, 1997.

¹¹² Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm.

¹¹³ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm.

exchange of valuable information and resources because what comes out of the Third World is not, in the legal context, deserving of protection.¹¹⁴

Multinational companies are now controlling seed banks and plant genetic resources. According to Bernardo Lopez, author in the Global News Wire, this has happened both in the Cordilleras by the International Rice Research Institute (IRRI) and in India, by Syngenta who "attempted to control the whole gene bank of Indira Gandhi Agricultural University, which held 24,000 rice samples in trust."¹¹⁵ The next step after gene-banking is patenting:

In other words, after "stealing" the species from Third World resources, it now claims "ownership" of modified versions for exclusive sale through patents. They do not pay royalty on the sources of their sequencing or share ownership or patents. They may own the technology, but not the inputs or the original genes.¹¹⁶

Likewise, according to Vandanna Shiva, "[a]t the heart of the GATT treaty and its patent laws is the treatment of biopiracy as a natural right of Western corporations, necessary for the 'development' of the Third World."¹¹⁷ According to Ewens, Third World germplasm has generally been thought of as a free good and has been "liberally appropriated by the developed countries with no direct remuneration to the Third World countries from which the germplasm is taken" and then it is returned back as a high-priced commodity with little concern for the "generational innovation" which forms the basis of all agricultural crops today.¹¹⁸ Ewens comments on the hypocrisy of such practices:

¹¹⁴ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: James Boyle, *Shamans, Software, and Spleens: Law and the Construction of the Information Society* xii (1996), *supra* note 43, at 141-142.

¹¹⁵ Bernardo Lopez. *Upshot*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; BusinessWorld (Philippines), August 4, 2004. Available through NEXUS – LEXUS.

¹¹⁶ Bernardo Lopez. *Upshot*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; BusinessWorld (Philippines), August 4, 2004. Available through NEXUS – LEXUS.

¹¹⁷ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Vandana Shiva. *BioPiracy: The Plunder of Nature and Knowledge*, 1997, *supra* note 136, at 5.

¹¹⁸ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Jack Ralph Kloppenburg, Jr. *First the Seed: The Political Economy of Plant Biotechnology*, 1492–2000, at 1 (1988), *supra* note 1, at 15;

Western countries have pushed for quick adoption of TRIPs to protect against Third World piracy of their products which accounts for millions of dollars in lost profits. But note, developed countries' claim to piracy is an assertion about a certain kind of ideological piracy: that of high-tech innovations in computer programs, CDs, and genetic technology, but not the equally acute piracy occurring in the opposite direction. The hypocrisy of western demand for intellectual property protections is twofold: not only do developing countries pay a high premium for the patented products that are reintroduced in their countries (yet made from local resources), but developing countries are unable to use the intellectual property framework to protect against the piracy of their own indigenous and local resources and knowledge.¹¹⁹

Intellectual Property Rights and Freedom to Operate

Biotech Industry Controlled by Multinational Companies

According to Fulton et al., in the past ten years the seed and pesticide industries have seen a substantial number of mergers and acquisitions,¹²⁰ an increase in vertical and horizontal integration, and an increase in the importance of multinationals, particularly in the seed industry.”¹²¹ According to Ewens, in mid-1998, the top ten largest seed companies controlled

Charles McManis. *The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, 76 Wash. U. L.Q. 255, 255–56 (1998), *supra* note 15, at 268.

¹¹⁹ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Keith Aoki. *Neocolonialism, Anticommons Property and Biopiracy in the (Not-So Brave) New World Order of International Intellectual Property Protection*. *Global Legal Studies*, 1998, 11, 34–35, *supra* note 45, at 47-50.

¹²⁰ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

¹²¹ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the

30% of the seed trade worldwide (\$7 billion US in trade in both biotech and non-biotech seeds),¹²² and the industry is quickly consolidating as companies compete to seize control of a lucrative global market.¹²³

In 1997 and 1998, Ewens notes, Monsanto spent \$6.7 billion US, positioning itself to become a top giant in what is now being called the “life sciences” industry.¹²⁴ According to Robert Lenzner et al., in an article published by Forbes, Monsanto’s chairman, Robert Shapiro is aggressively continuing this positioning. In 1996 alone he spent \$750 million buying ownership interests in a number of other biotech companies in order to get access to their technology, their distribution channels and their partnerships. They include Calgene (54%), DeKalb Genetics (40%), Ecogen (10%) and Agracetus (100%).¹²⁵

Multinationals like Monsanto have taken control of the seed market. In Canada, according to Fulton et al., there were approximately thirteen million acres of canola planted in 1999. About ten million of those acres were seeded to herbicide-tolerant varieties controlled by three companies — Monsanto, AgrEvo, and Cyanamid.¹²⁶ Likewise, these multinationals have also gained control of foreign and developing markets. According to Koyek:

Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

¹²² Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: RAFI Communique, *Seed Industry Consolidation: Who owns Whom?* July 1998, *supra* note 30. Available at: www.rafi.org/web/allpub-display.shtml?pfl=com-list-all.param. In specific seed markets corporate market share may be much higher. See RAFI Communique, *The Gene Giants: Update on Consolodation in the Life Industry*, March, 1999. Available at: www.rafi.org/web/allpub-display.shtml?pfl+com-list-all.param. “For example, in 1999, four companies controlled 69% of the North American seed corn market, and five vegetable seed companies controlled 75% of the global vegetable seed market.”

¹²³ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Scott Kilman and Susan Warren. *Dupont, Monsanto Going to Seed*. Wall Street Journal., May 28, 1998, at C7.

¹²⁴ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Scott Kilman and Susan Warren. *Dupont, Monsanto Going to Seed*. Wall Street Journal., May 28, 1998, at C7.

¹²⁵ Robert Lenzner and Bruce Upbin. *Monsanto v. Malthus*. Forbes, March 1997, Vol. 159 Issue 5, p58, 3p, 1 diagram, 2c.

¹²⁶ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

Technico, an Australian potato seed company, signed a \$60 million multi-year deal with global food giant Pepsi-Frito Lay for production of potato seed in Thailand and China. Technico plants have been established in China and India capable of producing 10 million and 18 million Technituber seeds per year respectively.¹²⁷

Economics of Consolidation and Multinationals

According to Fulton et al., these structural changes have occurred at the same time that transgenic technology has been used to develop new products and the legal framework of intellectual property rights (IPRs), a non-rival good, has been substantially strengthened, creating economies of scale and scope.¹²⁸ According to Fulton et al.:

. . . R&D expenditures and regulatory costs are both sunk costs and a source of economies of scale and scope. Since economies of scale or scope mean that larger and more diversified firms have lower average costs, there is clearly an incentive for firms to get large. As firms get larger, concentration in the industry rises.¹²⁹

In Canada, according to Andy Holloway, author in *Canadian Business*, testing can often cost more than a product's R&D costs. "One of the problems for a company like us is that we'll probably never be able to afford the tests on a product," says David Dennis, president and CEO of Performance Plants Inc., a Kingston, Ont.-based agri-biotech company that is inserting genes into traditional crops to improve yields. "We'll have to go with a big partner to take it through the

¹²⁷ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.16. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹²⁸ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

¹²⁹ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

regulatory process because it's so strict and so stringent."¹³⁰ As a result, biotechnology is often carried out by large, multinational corporations.

Biotech innovation in agriculture and the consolidation of the biotech market have brought intense competition to the seed industry. According to Ewens, these global corporations have positioned themselves in a biotech market that has immense potential. According to G. Steven Burrill, CEO of Burrill & Company, a San Francisco-based life sciences merchant bank, "the biotech industry has raised \$13 billion already in 2004 and close to \$29 billion since BIO 2003 convened in D.C. last year."¹³¹ According to Burrill, the biotech industry is up "nearly \$75 billion more than this time last year."¹³² In fact, Merrill Lynch estimates the global market for genetically engineered seeds will continue to grow from \$450 million US in 1995 to \$6.6 billion in 2005.¹³³ Likewise, a 1994 report by management consultants Ernst & Young predicts the world agricultural and food biotechnology market has the potential to grow to US\$46 billion by the year 2000, expanding in North America by 55% annually for the next decade.¹³⁴

Economically speaking, Fulton et al. note, large concentrated biotechnology industry is a good thing. They go on to explain that:

the benefits captured by the innovator are a significant part of the benefits received by the home country. When market power is zero, the home country receives only 22% of the total benefits, whereas when market power is high the home

¹³⁰ Andy Holloway. *Welcome to the bioeconomy: advances in biology are changing the way the world does business, and Canada could rise to the top of the food chain in the new biotech economy. The missing link is money.* Canadian Business, Toronto, Sep 2, 2002, Vol. 75, Iss. 16; pg. 28.

¹³¹ Anonymous. *20,000 Biotech Executives Gather at BIO in San Francisco: Biotech on Track for Success.* PR Newswire Association, Inc., June 10, 2004. Available through NEXUS – LEXUS. See also: Anonymous. *Biotechnology Industry Convention (BIO) 2003 Annual Convention.* Available at: <http://www.bio.org/events/2003/intl/profile2.asp?id=104>

¹³² Anonymous. *20,000 Biotech Executives Gather at BIO in San Francisco: Biotech on Track for Success.* PR Newswire Association, Inc., June 10, 2004. Available through NEXUS – LEXUS.

¹³³ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds.* Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Cath Blackledge. *Life Sciences Firms Will Make Money By Controlling the Whole Food Chain*, European, May 18, 1998, *supra* note 30, at 20. "The Rural Advancement Foundation International (RAFI) cites an equally large estimate from the International Seed Federation that the world market for genetically engineered seeds is expected to reach \$2 billion by the year 2000 and \$20 billion by 2010." See RAFI Communique, *Seed Industry Consolidation: Who owns Whom?* July 1998, *supra* note 30. Available at: www.rafi.org/web/allpub-display.shtml?pfl=com-list-all.param. An article in the New York Times describes some analysts' prediction that "[C]ontrol of genetic resources, the raw material for biotechnology, will be to the next century what oil and metal were to this one." See Michael Pollack. *U.S. Sidetracks Pact to Control Gene Splicing*, N.Y. Times, Feb. 25, 1999, at A1.

¹³⁴ Shafer Parker Jr. *Superspud flexes its muscles.* Alberta Report / Newsmagazine, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

country receives 58% of the benefits (assuming the innovation is adopted around the world). Thus, the encouragement of a highly concentrated innovating sector within its borders could become part of a strategic trade policy for a country wishing to maximize the benefits it receives from biotechnology.¹³⁵

Freedom to operate

According to Ewens, the increasing privatization of plant genetic research may suggest a growing imbalance between public and private access to plant genetic resources. “The de facto solution has been in favor of private, corporate interests and indicates a growing tendency in intellectual property protection towards the support of stronger private property rights over the recognition of the need for equitable global management of *finite resources*.”¹³⁶ According to Koyek, IPRs are simply a means for controlling the seed market. “The transnational seed companies are building vast industrial breeding networks in all major crops and, with their economies of scale . . . they will shut local private and public breeders out of the commercial market.”¹³⁷ In fact, the Washington, DC-based Foundation on Economic Trends, led by activist Jeremy Rifkin, and the National Family Farm Coalition announced a plan to file lawsuits in 30 countries accusing the major GM seed companies of having too much control over world seed supplies.¹³⁸ According to Laurie, “[t]he European Parliament issued a Resolution in October 2001 calling on the EPO to reconsider the grant of patents to Myriad Genetics over the genes for breast cancer. The concern is summed up by the Nuffield Council on Bioethics in its discussion paper on the ethics of patenting DNA:

The opposition is aimed at curtailing any possible deleterious consequences which might stem from sanctioning the monopoly conferred on Myriad

¹³⁵ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

¹³⁶ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm

¹³⁷ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.23. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹³⁸ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America*. Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

Genetics, including the possible threat to the development of research and the identification of new tests and diagnostic methods. It has also been argued that the patent will have a serious impact on equitable access to testing. It is suggested that the monopoly is antithetical to an approach to public health that is based on a commitment to the comprehensive care of patients at high-risk.¹³⁹

According to Ewens, patents exert a negative cost on society since, the more costly and restricted the access to information protected by patents, the more inefficient the market. She goes on to explain that:

Conceptually, the idea of patents is antithetical to the concept of a liberal democracy founded on the ideal of public discourse and free access to, and transmission of, information. . . . Because we think of creativity as flowing from a universe of infinite possibilities, there is a tendency to systematically increase intellectual property protection. But, as Keith Aoki notes, the expansion of intellectual property protections “make[s] us ignore the common-sense knowledge that new intellectual creations are formed from pre-existing thoughts and ideas in a long chain stretching back into antiquity. In other words, patent everything and there is no longer any common material from which to create.”¹⁴⁰

Clearly dominant patents have prevented small and medium enterprises from gaining access to patented tools of biotechnology and restricted the ability of many public and private sector stakeholders to commercialize the results of their research.¹⁴¹ According to Philip G.

¹³⁹ Graham Laurie. *Intellectual Property Protection of Biotechnological Inventions and Related Materials*. Innogen Working Paper 4, 2003. Available at: http://www.innogen.ac.uk/ownPubs/G_Laurie_2003.pdf. See also: Nuffield Council. *The Ethics of Patenting DNA*, 2002, para. 4.6.

¹⁴⁰ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Keith Aoki. *Neocolonialism, Anticommons Property and Biopiracy in the (Not-So Brave) New World Order of International Intellectual Property Protection*. *Global Legal Studies*, 1998, 11, 34–35.

¹⁴¹ FAAR Biotechnology Group Inc. & Auditor Bioconsulting. *Canadian Biotechnology Strategy: Opportunities and Challenges for Application of Biotechnology in the Canadian Agri-food Sector*. Summary Document and Recommendations, April 28, 1998. Available at: http://www.carccrac.ca/english/cdn_biotech_strategy/cbs.htm

Pardey, author of *Are Intellectual Property Rights Stifling Agricultural Biotechnology In Developing Countries?*, owners of a technology may be unwilling to share or license it or willing only after costly negotiations, thus making it difficult for others to obtain essential tools for advancing their own research. Moreover, owners of technology may litigate against alleged infringers, so in practice, those who hope to use a protected technology must weigh the risk of litigation against the costs of obtaining licenses.¹⁴²

To further complicate matters, explains Pardey:

the modern methods used to develop new crop varieties depend on a wide range of component innovations, the rights to which might be held by many competing parties — be they patent rights or assigned use rights via commercial contracts or licenses. And the number of separate rights needed to produce a new innovation will only escalate as biotechnology patents become more prevalent. If ownership of these rights is diffuse and uncertain, it can be difficult or impossible for potential users to successfully negotiate with all of the relevant parties.¹⁴³

In fact, Shapiro has been fighting rivals in court over its gene patents. Last October Mycogen sued Monsanto, along with DeKalb Genetics and Delta & Pine Land Co., claiming ownership of the process for producing insect-resistant seeds. "We have multiple patents and other patent applications, some of which are in interference with other parties," says Shapiro. "But at the end of the day, we believe we'll be practicing the technology."¹⁴⁴ Economically, when too many owners hold the right of exclusion—through patents or other means—then underuse and underutilization of the resource occurs.¹⁴⁵ If this phenomenon were to occur in the global food market, the dangers are clear: over-protection of high-yield seeds could severely

¹⁴² Philip G. Pardey, Brian D. Wright and Carol Nottenburg. *Are Intellectual Property Rights Stifling Agricultural Biotechnology In Developing Countries?* IFPRI Annual Report, 2000-2001. Available at: http://www.ifpri.org/pubs/books/ar2000/ar2000_essay02.htm

¹⁴³ Philip G. Pardey, Brian D. Wright and Carol Nottenburg. *Are Intellectual Property Rights Stifling Agricultural Biotechnology In Developing Countries?* IFPRI Annual Report, 2000-2001. Available at: http://www.ifpri.org/pubs/books/ar2000/ar2000_essay02.htm

¹⁴⁴ Robert Lenzner and Bruce Upbin. *Monsanto v. Malthus*. Forbes, March 1997, Vol. 159 Issue 5, p58, 3p, 1 diagram, 2c.

¹⁴⁵ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Keith Aoki. *Neocolonialism, Anticommons Property and Biopiracy in the (Not-So Brave) New World Order of International Intellectual Property Protection*. Global Legal Studies, 1998, 11, 34–35.

limit farmers' ability to plant the most desirable crops as well as farmers' and seed companies' ability to breed future generations of seeds. The result would be the underutilization of genetic resources that have been in the cultural commons for over 10,000 years.¹⁴⁶

According to Ewens:

one way to address and limit the dominance of the western seed corporations is to reduce the length of time patents extend protection to plant varieties. This has the advantage of releasing bio-engineered seeds and hybrids to farmers far earlier than under the normal patent structure, making plant genetic information more readily available to the public and to other plant breeders, and perhaps beneficially influencing genetic diversity. However, maintaining some patent protection, perhaps as much as ten years, also has the advantage of allowing corporations to recoup their research costs and make profits by selling licenses and charging a premium for patented goods.¹⁴⁷

Autonomy of farmers

According to Koyek, "PVP and patents are purely intended to protect a small number of formal sector breeders, particularly the handful of transnational corporations that dominate the commercial market. They are disastrous for farmers."¹⁴⁸ He goes on to explain that:

In a narrow sense they restrict the right of farmers to share, use and save seed from their harvests by extending the breeder's monopoly to the harvest of the farmer's crop. Under UPOV, the breeder has the "power not only over the right to produce or sell, but also . . . the power to specify how this production or sale should occur." But, more broadly, PVP and patents violate the spirit of

¹⁴⁶ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm

¹⁴⁷ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm

¹⁴⁸ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.19. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

farmers' rights and set a precedent for their elimination. Farmer's rights embody the rights of farmers and farming communities to conserve, develop, use, control, and benefit from not only local biodiversity but also rural peoples' knowledge systems and technologies. These rights, which cannot be protected by IPRs, form the basis of sustainable agriculture and recognize the importance of farmer innovation to global food security and well being.¹⁴⁹

According to Koyek, PVP was constructed as an alternative to patenting that would supposedly be attuned to the rights of farmers and the needs of agriculture. PVP left loopholes open for farmers and other breeders. However, since then, both those loopholes have been tightened. It appears that "there is always pressure under IPR regimes to scale back the rights of farmers in favor of the rights of industry."¹⁵⁰ For industry, however, PVP has some limitations when compared to patenting. However, according to Koyek, where PVP is ineffective, the private sector already has ways to enforce its own IP protection systems without the IPR laws. For example, Material Transfer Agreements (MTAs) are used. An MTA, according to Koyek, is a "contract between two or more parties specifying the conditions under which materials – say, a seed sample – are exchanged."¹⁵¹

Another way for the private sector to enforce its own IP protection is by using, what Koyek refers to as "Biological Protection."¹⁵² Biological IP protection is the development of seeds in which the intellectual property claimed by the breeder collapses or cannot be transmitted through natural reproduction. According to Koyek,

the most widespread example of biological protection is hybridization. The yield factor of F1

¹⁴⁹ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.19. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf. See also: David Godden. *Growing Plants, Evolving Rights: Plant Variety Rights in Australia*. Australian Agribusiness Review, Vol. 6, 1998, Paper 3. Available at: <http://www.agribusiness.asn.au/agribusinessreview/1998V6/GrowingPlantsRightsIssues.htm>.

¹⁵⁰ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.20. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹⁵¹ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.9. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹⁵² D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.10. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

hybrids deteriorates in subsequent generations, forcing farmers to buy fresh seed from the company every year or two . . . Another development in biological protection is Genetic Use Restriction Technology (GURT), more popularly known as “terminator” and “traitor” technologies. GURTs prevent farmers from saving seeds since the genetically engineered plants will not germinate in subsequent generations or will not express a particular trait (such as herbicide resistance) unless sprayed with specific chemicals that activate the right gene.¹⁵³

Monsanto first disclosed in 1998 that it would use genetic engineering to cause sterility in seeds after one planting in an attempt to force farmers back to Monsanto every year for new seeds.¹⁵⁴ However, according to Brian Halweil, author in *World Watch*, Monsanto has decided not to commercialize its terminator technology because of concerns about the impact of the terminator technology on farmers in Africa, Asia and Latin America.¹⁵⁵

A third mechanism employed by industry is purchase agreements. According to Koyek, contractual agreements between seed companies and farmers are now standard practice in Canada and the United States. Monsanto’s Roundup Ready Technology Agreement is the most widely known and enforced example.¹⁵⁶ According to the Agreement;

The farmer cannot save seed or any other part of the crop grown from the Monsanto seed for replanting. The farmer is prohibited from supplying seed to any other person. The farmer must pay 120 times the technology fee plus the legal fees if s/he is caught violating the agreement. The farmer must cooperate

¹⁵³ D. Koyek. Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia. Institute for Agriculture and Trade Policy (IATP), 2001, p.10. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹⁵⁴ Cynthia Reynolds. *Frankenstein’s harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America.* Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

¹⁵⁵ Brian Halweil. *Monsanto drops the terminator.* World Watch, February 2000, Vol. 13 Issue 1, p8, 2p.

¹⁵⁶ D. Koyek. Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia. Institute for Agriculture and Trade Policy (IATP), 2001, p.11. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

fully with Monsanto's inspections of his/her fields.¹⁵⁷

According to Koyek, "Monsanto's contract for 2001 carries added obligations that place the burden of liability on the farmer and impose binding arbitration as the sole method of settling any disputes, with the arbitration handled by a private company selected by Monsanto."¹⁵⁸ According to Cynthia Reynolds, author in *Canadian Business*, while Monsanto explicitly retains the right to say whatever it wants about the settlement, the farmer signs away his right to speak publicly. However, lawsuits are not Monsanto's preferred course of action against patent infringers or TUA violators. Instead, it usually meets with a grower and sends a letter for the farmer to sign in which he agrees to hand over the \$15-per-acre fee and all the profits from his crop.¹⁵⁹ On the Contrary, according to Koyek, Monsanto seems to take these agreements quite seriously. In fact, the company "has used private security agents and toll-free "snitch" lines to enforce the agreements and "[b]y February 1999, Monsanto had launched an unbelievable 525 cases against farmers."¹⁶⁰

Farmers, according to Reynolds, are severely constrained by the TUA. For example, in what was thought to be the first ruling of its kind anywhere in the world, the Supreme Court of Canada ruled 5-4 that since Monsanto holds a patent on a gene in its Roundup Ready canola plants, it can control the use of the plant.¹⁶¹ Now farmers can't just buy Roundup Ready seeds, according to Reynolds, but they have to sign Monsanto's "unique -- and controversial -- technology use agreement (TUA)."¹⁶² This agreement grants Monsanto the right to conduct

¹⁵⁷ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.11. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf. See also: Michael Stumo. *Down on the Farm Farmers Get the Biotech Blues*. *Multinational Monitor*, Vol. 21, Nos. 1&2, January/February 2000.

¹⁵⁸ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.11. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf. See also: Eva Ann Dorris. *To sign or not to sign*. *Farm Progress*, December 1, 2000.

¹⁵⁹ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America*. *Canadian Business*, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

¹⁶⁰ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.12. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf. See also: Rick Weiss. *Monsanto's Gene Police Raise Alarm On Farmers' Rights, Rural Tradition*. *Washington Post*, February 3, 1999.

¹⁶¹ *Monsanto Canada Inc. v. Schmeiser*. Available at: <http://www.lexum.umontreal.ca/csc-scc/en/rec/html/2004scc034.wpd.html>

¹⁶² Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America*. *Canadian Business*, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

surprise inspections and take samples from any part of their fields for three years, even if they stop buying Roundup Ready seed.¹⁶³ According to canola farmer, Percy Schmeiser, Monsanto's dominant market position and the appeal of the product mean that a great many farmers who signed the TUA did so because they felt they had little choice. "Farmers are desperate," he says. "The price of canola had dropped to its lowest level in more than a decade. They'll try anything. They may be signing it, but that doesn't mean they like it."¹⁶⁴

Autonomy of Developing Countries

Despite the potential benefits of agricultural biotechnology for LDCs, concerns remain regarding the accessibility of new technologies. According to Pardey et al, many are concerned that corporations' efforts to protect their profits will isolate developing countries from the benefits of important innovations.¹⁶⁵ Even if the institutional structure was sufficient for multinational companies to choose to make their intellectual property available in LDCs, Fulton et al asks, "could small-hold farmers afford the new production technologies? Many observers believe that the current GM products, which are typically labour saving, would not be in high demand because labour on small farms is plentiful and hard currency is scarce."¹⁶⁶

According to Ewens, while the Biodiversity Treaty may call for the transfer of technology, the United States has been reluctant to sign the treaty because of concerns from the biotech industry that the technology transfer may call for transfer that does not require full payment by the transferee for use of the technology.¹⁶⁷ As David Tilford writes of this conflict: "The South wants the technology and the North wants the South to have it. But while the South sees itself as a potential partner, the North looks south and sees only paying customers."¹⁶⁸

¹⁶³ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America.* Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

¹⁶⁴ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America.* Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

¹⁶⁵ Philip G. Pardey, Brian D. Wright and Carol Nottenburg. *Are Intellectual Property Rights Stifling Agricultural Biotechnology In Developing Countries?* IFPRI Annual Report, 2000-2001. Available at: http://www.ifpri.org/pubs/books/ar2000/ar2000_essay02.htm

¹⁶⁶ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops.* Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

¹⁶⁷ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds.* Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm

¹⁶⁸ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds.* Boston College Law School Student Publications. Available at:

According to a study conducted by the Indian Council of Medical Research (ICMR), because biotechnology is being developed by private sector multinational companies and is subject to intellectual property protection, it will lead to “reduced competition, monopoly of profits and exploitation of small farmers.”¹⁶⁹ More importantly, because large farmers capture most of the benefits, agriculture biotechnology could lead to increased inequality of income and wealth.¹⁷⁰

There is little doubt, however, that biotechnology could have huge benefits for developing countries and many authors believe that providing these countries with better access to biotechnology should be given higher priority. For example, up to 80% of the yield of sweet potato, the major root crop in East Africa, can be destroyed by crop diseases such as the sweet potato feathery mottle virus (SPFMV). A sweet potato that is resistant to SPFMV is being developed through the combined efforts of non-governmental agencies, biotechnology groups, and agricultural entities. Even small improvements in crop yield, owing to this new technology, will feed countless people in Africa.¹⁷¹ While East Africa has refused genetically modified food aid, West Africa’s government leaders, under the assumption that biotechnology could help feed the hungry, welcomed more research by the U.S. into genetically modified foods.¹⁷²

Likewise, B. t. potato technology, if properly managed, offers substantial benefits for developing countries.¹⁷³ Nevertheless, very little has been done to develop this technology in the tropics where it is most needed.¹⁷⁴ According to a report by the FAO, while biotechnology could certainly help feed the hungry, more research is need on “orphan crops.”¹⁷⁵ Nevertheless,

http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: David Tilford. *Saving the Blueprints: The International Legal Regime for Plant Resources*, 30 Case W. Res. J. Int’l L. 373, 402 (1998), *supra* note 55, at 418–20.

¹⁶⁹ Anonymous. *ICMR Wants Overhaul of Foods Regulation*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; The Indian Express Online Media Ltd., Financial Express, July 25, 2004. Available through NEXUS – LEXUS.

¹⁷⁰ Anonymous. *ICMR Wants Overhaul of Foods Regulation*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; The Indian Express Online Media Ltd., Financial Express, July 25, 2004. Available through NEXUS – LEXUS.

¹⁷¹ Anonymous. *Development and transfer of genetically modified virus-resistant sweet potato for subsistence farmers in Kenya Wambugu FM*. Nutrition Reviews, June 2003, 61 (6): S110-S113 Part 2.

¹⁷² Anonymous. *West African Leaders Embrace U.S. Biotechnology*. The New Farm, The Rodale Institute, 2004. Available at: http://www.newfarm.org/international/news/060104/061404/af_bio.shtml

¹⁷³ Marc Ghislain, Aziz Lagnaoui, and Thomas Walker. *Fulfilling the promise of B.t. potato in developing countries*. Journal of New seeds, 2003; 5(2-3): 93-113.

¹⁷⁴ Hari C. Sharma, Kiran K. Sharma, Nadoor Seetharama, and Rodomiro Ortiz. *Prospects for using transgenic resistance to insects in crop improvement*. Electronic Journal of Biotechnology, 2000. Available at: <http://www.ejb.org/content/vol3/issue2/full/3/index.html>. See also: Hari Sharma, Kiran Sharma, Nador Seetharama, and Jonathan Crouch. *The utility and management of transgenic plants with Bacillus thuringiensis genes for protection from pests*. Journal of New seeds, 2003; 5(1): 53-76.

¹⁷⁵ Anonymous. *Fight Hunger with Science*. The State Journal-Register, Springfield, IL, July 12, 2004. Available through NEXUS – LEXUS. See also: Anonymous. *The truth about biocrops*. The State Journal-Register

[n]either the private nor the public sector has invested significantly in new genetic technologies for the so-called 'orphan crops' such as cowpea, millet and sorghum that are critical for the food supply and livelihoods of the world's poorest people . . . In fact, the report states that nearly all of the \$3 billion spent each year on research in biotechnology goes toward just four crops: soybeans, corn, cotton and canola.¹⁷⁶

According to Martin Qaim, author of *Potential Benefits of Agricultural Biotechnology: An example form the Mexican Potato Sector*, transgenic disease resistance technology for potatoes in Mexico is a promising technology for developing countries and could benefit all groups of potato growers and could even improve income distribution. However, providing these countries with better access to biotechnology should be given higher political priority.¹⁷⁷ In fact, the UN food agency stated on May 17, 2004 that while GM crops are helping poor farmers and have posed no adverse health or environmental effects so far, the biggest problem is that it has not spread fast enough to small farmers and has focused on crops mostly of use to big commercial interests.¹⁷⁸ According to Pardey, many indigenous food-crops that feed a large percentage of the African population (such as yams, millet, sorghum and cassava), represent little commercial interest to the multinational companies that invest in R&D.¹⁷⁹ Nevertheless, concerns that patents and other forms of intellectual property are severely constraining the

(Springfield, IL), May 24, 2004. Available through NEXUS – LEXUS; Andrew Pollack. *UN joins crop debate*. The New York Times; The International Herald Tribune, May 19, 2004. Available through NEXUS – LEXUS; Maggie Farley. *The World; Altered Crops Backed by U.N.; Genetically modified foods are safe, but staples should be stressed, agency says*. The Times Mirror Company; Los Angeles Times, May 18, 2004. Available through NEXUS – LEXUS: The UN Food and Agriculture Organization (FAO) released a report in May 2004 called "Agricultural Biotechnology: Meeting the Needs of the Poor?" It was the strongest endorsement yet of genetically modified foods, and has become the talk of everyone involved in agricultural biotechnology, stating that enhanced crops were helping poor farmers and had so far been found to be safe. But most developing countries are missing out on the benefits because private research is concentrated on four lucrative cash crops, and not on the staple "orphan" crops needed to feed the world's hungry.

¹⁷⁶ Anonymous. *Fight Hunger with Science*. The State Journal-Register, Springfield, IL, July 12, 2004. Available through NEXUS – LEXUS.

¹⁷⁷ Martin Qaim. *Potential Benefits of Agricultural Biotechnology: An example form the Mexican Potato Sector*. Review of Agricultural Economics, fall-Winter 1999, v. 21, iss. 2, pp. 390-408.

¹⁷⁸ Anonymous. *U.N. Food And Agriculture Organization: U.N. food agency still supports genetically modified crops*. Lab Business Week via IncRx.com, June 13, 2004. Available through NEXUS – LEXUS.

¹⁷⁹ World Intellectual Property Organization (WIPO) and the International Union for the Protection of New Varieties of Plants (UPOV). *Dissemination of Plant Biotechnology – An African Perspective: WIPO-UPOV Symposium on Intellectual Property Rights in Plant Biotechnology*. Geneva, October 24, 2003. Available at: http://www.upov.int/en/documents/Symposium2003/wipo_upov_sym_05.pdf

freedom to operate in developing countries is largely misplaced and is diverting attention from more crucial issues.¹⁸⁰ The real problem, according to Pardey, is that developing countries rely on crops that are outside the scope of private investors.¹⁸¹ According to P.G. Pardey et al, in an article entitled *Intellectual Property and Developing Countries: Freedom to Operate in Agricultural Biotechnology. Does IPR regulation restrict research and development into new food crops?*, “[t]his concern about current developing-country access to essential intellectual property is exaggerated and largely misdirected.”¹⁸² “International and National agricultural research centers currently have far greater freedom to operate (the ability to use innovation) in agricultural research on crops for the developing world than is commonly perceived.”¹⁸³ As Kim Gloria points out in an article for Canadian Business, the Canadian International Development Agency has given \$280,000 to a project in China to grow Monsanto's genetically modified cotton and corn--and plans to pony up \$70,000 more in coming months.¹⁸⁴

In fact, Koyek gives a remarkable example of how researchers’ fears of barriers created by intellectual property may be unjustifiable:

In January 2000, after ten years of research and millions of dollars in public funding, European scientists Ingo Potrykus and Peter Beyer announced that they had successfully developed a transgenic beta-carotene enhanced rice. This so-called “golden rice” was immediately hailed as proof that biotech will help the poor. But such lofty ambitions were quickly thrown into doubt when the International

¹⁸⁰ Philip G. Pardey, Brian D. Wright and Carol Nottenburg. *Are Intellectual Property Rights Stifling Agricultural Biotechnology In Developing Countries?* IFPRI Annual Report, 2000-2001. Available at: http://www.ifpri.org/pubs/books/ar2000/ar2000_essay02.htm

¹⁸¹ Philip G. Pardey, Brian D. Wright and Carol Nottenburg. *Are Intellectual Property Rights Stifling Agricultural Biotechnology In Developing Countries?* IFPRI Annual Report, 2000-2001. Available at: http://www.ifpri.org/pubs/books/ar2000/ar2000_essay02.htm. See also: World Intellectual Property Organization (WIPO) and the International Union for the Protection of New Varieties of Plants (UPOV). *Dissemination of Plant Biotechnology – An African Perspective: WIPO-UPOV Symposium on Intellectual Property Rights in Plant Biotechnology*. Geneva, October 24, 2003. Available at: http://www.upov.int/en/documents/Symposium2003/wipo_upov_sym_05.pdf

¹⁸² P.G. Pardey, B.D. Wright, C. Nottenburg, E. Binenbaum, and P. Zambrano. *Intellectual Property and Developing Countries: Does IPR regulation restrict research and development into new food crops?* International Food Policy Research Institute (IFPRI), 2003. Available at: <http://www.eldis.org/static/DOC11378.htm>

¹⁸³ P.G. Pardey, B.D. Wright, C. Nottenburg, E. Binenbaum, and P. Zambrano. *Intellectual Property and Developing Countries: Does IPR regulation restrict research and development into new food crops?* International Food Policy Research Institute (IFPRI), 2003. Available at: <http://www.eldis.org/static/DOC11378.htm>

¹⁸⁴ Kim Gloria. *Chew on this! Ottawa is still pumping tax dollars into GM foods*. Canadian Business, Toronto, Oct 1, 2001, Vol. 74, Iss. 18; pg. 14.

Service for the Acquisition of Agri-biotech Applications (ISAAA), which conducted a study for the Rockefeller Foundation and IRRI, revealed that there were some 70 patents potentially tying up the technology. Fearing the complexity and expense of patent negotiations, the researchers quickly signed the publicly-funded technology away to AstraZeneca (now Syngenta), one of the world's largest agrochemical and biotech corporations. RAFI pointed out that the researchers' fears were not justifiable. Of the 60 countries with Vitamin A deficiency – which golden rice is supposed to address – only 25 could possibly honor any of the patents involved. And in these countries, only 11 of the patents could constrain the project locally. Seven of those are held by four transnational corporations (Syngenta, Aventis, Monsanto, and DuPont), two of which have expressed their interest to make the technology freely available to the poor. The other patents are held by public institutions. Furthermore, ISAAA's study looked at patent *applications* filed through the World Intellectual Property Office, without confirming whether the patents were actually granted or not in the different countries . . . Rather than fight a winnable battle against the corporations, Potrykus and Beyer “cried wolf” and allowed the IP hegemony of the rich to trample over the so-called interests of the poor to access technology. Now the IPR hurdles have simply been passed down the line.¹⁸⁵

Still, freedom to operate in developing countries remains a concern. According to Ewens, with the advent of sterile “terminator” seed, corporations are able to combat the weak patent protection offered in many developing countries and enforce biologically what has been impossible to fully enforce contractually or through property rights.¹⁸⁶ As one critic of the sterile

¹⁸⁵ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.12. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf. See also: RAFI, *Golden Rice and Trojan Trade Reps: A Case Study in the Public Sector's Mismanagement of Intellectual Property*. RAFI Communique, Number 65, September/October 2000. Available at: <http://www.rafi.org>

¹⁸⁶ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Jeffrey Kluger et al. *The*

seeds has said, “From a marketing perspective, the technology is brilliant. From a social perspective, it’s pathological. This is a question of who controls the seeds of life.”¹⁸⁷ While several major companies, according to Koyek, have insisted in public that they will not pursue the technology, “a recent report by coalition of groups in Europe identified 60 patents on GURTs – 25 of them held by a single seed company, Syngenta.”¹⁸⁸

Moreover, according to Koyek, market segmentation has made it difficult to negotiate:

Several years ago, the International Potato Center (CIP), a CGIAR institute in Peru began negotiations with Plant Genetic Systems (PGS) of Belgium to license its proprietary Bt technology for use in transgenic potatoes. Under the initial agreement, CIP could transfer the technology to any developing country, as long as the Bt potatoes were not sold to developed countries. In the second round of negotiations, PGS insisted on market segmentation, but this time they were unwilling to give CIP freedom-to-operate in important commercial markets in the South, most notably India. Before negotiations could advance, PGS was purchased by AgrEvo. CIP returned to the table to try and negotiate then with AgrEvo, but once again the talks were interrupted when AgrEvo merged with Rhone-Poulenc to form Aventis.¹⁸⁹

Koyek spoke directly with CIP’s Director-General, Wanda Collins, who is frustrated by the process: “Each time we are close to negotiating an agreement the company has merged or

Suicide Seeds Terminator genes could mean big biotech bucks—but big trouble too, as a grass-roots protest breaks out on the Net. Time, Feb. 1, 1999.

¹⁸⁷ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds.* Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bciclr/23_2/05_FMS.htm. See also: Jeffrey Kluger et al., *The Suicide Seeds Terminator genes could mean big biotech bucks—but big trouble too, as a grass-roots protest breaks out on the Net.* Time, Feb. 1, 1999.

¹⁸⁸ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia.* Institute for Agriculture and Trade Policy (IATP), 2001, p.11. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf. See also: *Syngenta: Switching off farmers rights?* ActionAid, GeneWatch UK, Berne Declaration and the Swedish Society for Nature Conservation, October 2000. Available at: <http://www.actionaid.org>

¹⁸⁹ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia.* Institute for Agriculture and Trade Policy (IATP), 2001, p.16. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

been taken over.”¹⁹⁰ According to Koyek, the private sector is preoccupied with turning a profit and when it comes to potatoes, market segmentation will not provide much freedom-to-operate in Asia.¹⁹¹

¹⁹⁰ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.16. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

¹⁹¹ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.16. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

Benefits for Farmers

According to S.D. Atkins et al, authors in Applied & Environmental Microbiology, “Potato Cyst Nematodes (PCN) are serious pests in commercial potato production, causing yield losses valued at approximately \$300 million in the European Community.” However, a biological control agent against PCN, according to Atkins et al, reduced field populations by up to 60% in trials.¹⁹² Adopting GM technology, therefore, could have economic benefits for potato farmers. This technology is responsible for controlling the length of the dormancy period of tubers and reducing the amount of crops lost to disease.¹⁹³ Moreover, according to Dr. C. S. Prakash, along with increasing crop yields, GM technology means a reduction in herbicide application and this reduction “saved North American farmers U.S. \$30 per hectare.”¹⁹⁴

However, according to Steve Abel, author in The New Zealand Herald,

[c]ontrary to the claims of Monsanto and apologists such as Francis Wevers, articles in the New Scientist and independent analysis of United States Department of Agriculture figures confirm that GM soy is actually yielding less than conventional soy, and has led to significant increases in herbicide use in the US and Argentina.¹⁹⁵

According to Fulton et al, “Canadian farmers have generally adopted new technology when it has become available.” However, the benefits of adopting the new technology are often “passed on to processors and consumers and, now with biotechnology, input suppliers.”¹⁹⁶

¹⁹² S.D. Atkins, I.M. Clark, D. Sosnowska, P.R. Hirsch, and B.R. Kerry. *Detection and Quantification of Plectosphaerella cucumerina, a Potential Biological Control Agent of Potato Cyst Nematodes, by Using Conventional PCR, Real-Time PCR, Selective Media, and Baiting.* Applied & Environmental Microbiology; August 2003, Vol. 69 Issue 8, p4788, 6p, 5 charts, 2 graphs.

¹⁹³ Marc Ghislain, Aziz Lagnaoui, and Thomas Walker. *Fulfilling the promise of B.t. potato in developing countries.* Journal of New seeds, 2003; 5(2-3): 93-113. See also: Uwe Sonnewald. *Control of potato tuber sprouting.* Trends in Plant Science, 2001; 6(8): 333-335; A.A. Araji and S.L. Hafez. *The economic and environmental impacts of nematode biocontrol methods: An ex-ante approach.* Nematopica, 2001; 31(2): 181-193.

¹⁹⁴ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops.* Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: C.S. Prakash. *Why Do We Need Genetically Modified Crops?* October 5, 1999. Testimony submitted to the U.S. House of Representatives Subcommittee on Basic Research hearing on Plant Genome Research: From the Lab to the Field to the Market, part II. Serial No. 106-60. Washington, DC: Government Printing Office. Available at: www.house.gov/science/106_hearing.htm#Basic_Research

¹⁹⁵ Steve Abel. *Non-consenting subjects of a global experiment.* The New Zealand Herald, May 24, 2004. Available through NEXUS – LEXUS.

¹⁹⁶ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified*

While it is generally believed that farmers will be worse off economically if they do not adopt the technology, “there is no general agreement as to the truth of this statement.” Fulton et al explains:

If farmers had not adopted Marquis wheat, they would certainly be worse off today. On the other hand, their refusal to adopt rBST in the Canadian dairy industry does not appear to have hurt either dairy farmers or consumers.¹⁹⁷

According to Fulton et al, GM canola is expected to save farmers \$5 to \$8 per acre and the “rapid adoption of HT canola varieties in western Canada would indicate that producers have benefited from adopting the new technology.”¹⁹⁸ In fact, according to Clive James, ISAAA chairman and founder, farmers “continue to rapidly adopt biotech crops because of significant agronomic, economic, environmental and social advantages.”¹⁹⁹ According to the International Service for the Acquisition of Agri-biotech Applications (ISAAA) in 2003, the global area of biotech crops grew a remarkable 15 percent, an even greater expansion than the year before. Moreover, the “167 million acres was grown by 7 million farmers in 18 countries, an increase from 6 million farmers in 16 countries in 2002,” and in the last eight years, the number of biotech crop acres worldwide increased by a staggering fortyfold.²⁰⁰ If Fulton is right, this would suggest that farmers have benefited a lot from adopting biotechnology.

In the United States, however, according to Dr. Dr. Charles M. Benbrook of Benbrook Consulting Services, between 1996-2001, “American farmers paid at least \$659 million in price premiums to plant Bt corn, while boosting their harvest by only 276 million bushels – worth some \$567 million in economic gain” and this represents “a net loss of \$92 million – about \$1.31 per acre” for

Crops. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-ccb.nsf/en/ah00388e.html>

¹⁹⁷ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-ccb.nsf/en/ah00388e.html>

¹⁹⁸ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-ccb.nsf/en/ah00388e.html>

¹⁹⁹ Michael Fumento. *Seeds of fear*. News World Communications, Inc.; The Washington Times, May 16, 2004. Available through NEXUS – LEXUS.

²⁰⁰ Michael Fumento. *Seeds of fear*. News World Communications, Inc.; The Washington Times, May 16, 2004. Available through NEXUS – LEXUS.

farmers.²⁰¹ While there have been studies done in the United States, according to Fulton et al., estimates of economic benefits in Canada “remain forecasts until a survey of actual farm experience has been completed.”²⁰² Nevertheless, according to Kim Gloria, author in Canadian Business, Canada should not be investing in agricultural biotechnology developed by Monsanto, because according to the analysis by the Canadian Wheat Board, Canadian farmers could conceivably lose hundreds of millions of dollars.²⁰³ In fact, according to a 2003 press release from the Institute for Agriculture and Trade Policy, 82% of North Dakota grain elevator operators said they were very concerned about the proposed introduction of Monsanto’s genetically engineered Roundup Ready wheat. According to Dennis Olson, Senior Associate at the Institute: “This survey reflects serious concern among North Dakota wheat elevator operators about the potential adverse economic impacts of GE wheat.”²⁰⁴

While Shafer Parker, author of *Superspud flexes its muscles*, argues that third-world farmers could benefit from larger harvests with the NewLeaf potato, developed by Monsanto because it resists the potato beetle without added pesticides and, therefore, costs less to grow,²⁰⁵ like Canada and the United States, developing countries seem to be lacking any concrete data on the benefits of GM technology for farmers. According to a study conducted by The Indian Council of Medical Research (ICMR) “although the cultivation of GM crops have been claimed to be profitable to farmers, the impact varies by year, location, crop etc.”²⁰⁶ In Uganda, for instance “conventional breeding (of sweet potatoes) has produced a high-yielding variety more quickly and more cheaply”²⁰⁷ than GM varieties and while Monsanto has been financing a

²⁰¹ Dr. Charles M. Benbrook. *When Does it Pay to Plant Bt Corn? Farm-Level Economic Impacts of Bt Corn, 1996-2001*. Benbrook Consulting Services, 2001. Available at: <http://www.gefoodalert.org/library/admin/uploadedfiles/WhenDoes It Pay to Plant Bt Corn Farm-Level Ec.pdf>

²⁰² Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also G.M. Carlson and B. Hubbell. *Transgenic Technology for Crop Protection*. Choices (Third Quarter), 1997, 31-36; H. Mayer and W. H. Furtan. *Economics of Transgenic Herbicide-Tolerant Canola: The Case of Western Canada*. Food Policy, 1999, 24: 431-442.

²⁰³ Kim Gloria. *Chew on this! Ottawa is still pumping tax dollars into GM foods*. Canadian Business, Toronto, Oct 1, 2001, Vol. 74, Iss. 18; pg. 14.

²⁰⁴ Dennis Olson and Ben Lilliston. *New Survey Indicates Strong Grain Elevator Concern Over GE Wheat*. Press Release from the Institute for Agriculture and Trade Policy, April 8, 2003. Available at: http://www.agobservatory.org/library/uploadedfiles/New_Survey_Indicates_Strong_Grain_Elevator_Con.pdf

²⁰⁵ Shafer Parker Jr. *Superspud flexes its muscles*. Alberta Report / Newsmagazine, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

²⁰⁶ Anonymous. *ICMR Wants Overhaul of Foods Regulation*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; The Indian Express Online Media Ltd., Financial Express, July 25, 2004. Available through NEXUS – LEXUS.

²⁰⁷ Bernardo Lopez. *Upshot*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; BusinessWorld (Philippines), August 4, 2004. Available through NEXUS – LEXUS.

project in Kenya modifying sweet potatoes to resist a virus, according to the World Bank and the US government, they “were no less vulnerable than ordinary varieties.”²⁰⁸ Nevertheless, project leader Dr. Florence Wambugu branded it a “resounding scientific success” and an “agricultural revolution in Africa” in spite of its failure to resist the virus.²⁰⁹ Likewise, the U.N. in a recent report called “Agricultural Biotechnology: Meeting the Needs of the Poor?” stated that some GM crops, especially insect-resistant cotton, “are yielding significant economic gains to small farmers” and while private companies have been largely responsible for selling transgenic seeds, “it is the producers and consumers who are reaping the largest share of the economic benefits of transgenic crops,” adding: “This suggests that the monopoly position engendered by intellectual property protection does not automatically lead to excessive industry profits.”²¹⁰

However, in India and Asia for instance, Syngenta's GMO rice is being blamed “for destroying the livelihoods of the peasants” and “destroying sustainable agricultural systems.”²¹¹ According to Bernardo Lopez, author of *Upshot*, GMO causes food insecurity by derailing “appropriate technologies such as organic farming called System of Rice Intensification (SRI) and other ecological methods, that have been proven highly productive without using ... hybrids, or GE seeds, chemical fertilizers and pesticides.”²¹² Nevertheless, multinational corporations have set up extensive public relations programs such as “pseudo-farmer associations to articulate and justify their campaigns” which have created a false picture of consensus, despite the fact that this technology might not be suitable for developing countries.²¹³

²⁰⁸ Bernardo Lopez. *Upshot*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; BusinessWorld (Philippines), August 4, 2004. Available through NEXUS – LEXUS.

²⁰⁹ Bernardo Lopez. *Upshot*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; BusinessWorld (Philippines), August 4, 2004. Available through NEXUS – LEXUS.

²¹⁰ Michael McCarthy. *UN backs GM crops despite concerns that benefits do not reach the world's poor*. Financial Times Information; Global News Wire - Europe Intelligence Wire; The Independent Newspapers (UK), May 19, 2004. Available through NEXUS – LEXUS.

²¹¹ Bernardo Lopez. *Upshot*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; BusinessWorld (Philippines), August 4, 2004. Available through NEXUS – LEXUS. See also: New Scientist, Vol. 181, No. 2433, 7 February 2004.

²¹² Bernardo Lopez. *Upshot*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; BusinessWorld (Philippines), August 4, 2004. Available through NEXUS – LEXUS. See also: New Scientist, Vol. 181, No. 2433, 7 February 2004.

²¹³ Bernardo Lopez. *Upshot*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; BusinessWorld (Philippines), August 4, 2004. Available through NEXUS – LEXUS.

Environmental Concerns

Biodiversity

According to Ewens, the Biodiversity Treaty and the TRIPs Agreement “offer two conflicting visions of future global trade in genetic resources: one dedicated to strengthening international biodiversity protection, the other establishing strong intellectual property protections in order to promote world trade, including trade in biodiversity.”²¹⁴ According to Ewens:

Both treaties use intellectual property rights as the foundation for achieving these goals. The use of intellectual property rights to accomplish arguably different international goals (biodiversity protection versus free market international trade in biological resources) highlights the preeminent place intellectual property plays, and will play, in international attempts to control and regulate plant genetic resources and biodiversity.²¹⁵

According to Jeroen van Wijk, “IPRs over the seed supply reduces information flows, germplasm flows, and, ultimately, competition.”²¹⁶ These findings echo earlier studies

²¹⁴ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: Charles McManis. *The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, 76 Wash. U. L.Q. 255, 255–56 (1998), *supra* note 15, at 255; UNCTAD-ICTSD International Centre for Trade and Sustainable Development. *Food, agriculture and biodiversity*. Project on IPRs and Sustainable Development, Chapter 7. Available at: http://www.ictsd.org/pubs/ictsd_series/iprs/PP/PP_3CH_07.pdf

²¹⁵ Lara E. Ewens. *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*. Boston College Law School Student Publications. Available at: http://infoeagle.bc.edu/bc_org/avp/law/lwsch/journals/bcicl/23_2/05_FMS.htm. See also: Darrell A. Posey. *International Agreements and Intellectual Property Right Protection for Indigenous Peoples*, in *Intellectual Property Rights for Indigenous Peoples: A Source Book* 225, 226 (Tom Greaves ed., 1994). As Darrell Posey writes:

[D]oes anyone have a better mechanism than IPR [intellectual property rights] to provoke a new, more socially just and economically sound paradigm of “wealth,” to strengthen positions of local communities, or to recognize the intellectual contribution of indigenous peoples to human patrimony? Alternative strategies are welcome and needed. But the deadly serious race to conserve biological and cultural diversity of the Planet is on: IPR seems to be one of the most interesting intellectual, legal, economic and political tools available to us at the present.

²¹⁶ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.9. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf. See also: Jeroen van Wijk and Walter Jaffé. *Intellectual Property Rights and Agriculture in Developing Countries*. University of Amsterdam, January 1996; Jeroen van Wijk and Walter Jaffé. *The Impact of Plant Breeders' Rights in Developing Countries: Debate and experience in Argentina, Chile, Colombia, Mexico, and Uruguay*, October 1995.

conducted in the US²¹⁷ and although PVP is new to Asia, the Chinese government has already reported “serious impacts on the free flow of germplasm” from the introduction of PVP such as: breeders not sharing parental lines, reduced use of exotic germplasm in breeding, and lack of attention to *in situ* conservation and farmers’ knowledge.²¹⁸ Wijk surveyed the impact of PVP systems in Latin America:

PVP may help the domestic seed industry in least-developed countries to restrict the trade in seed saved from their varieties and to increase their income. There is little evidence, however, that this additional income leads to the availability of more and better varieties for farmers.”²¹⁹

Herbicide-resistant Crops

According to Fulton et al, the scientific evidence that is available so far suggests that the impact of genetically engineered herbicide-resistant crops on the environment has been positive and the advantages clearly outweigh the disadvantages.²²⁰ Nevertheless, public fear persists as to the potential dangers to the environment, while the benefits of the technology are ignored. Herbicide-resistant crops, according to Fulton et al, have resulted in an overall reduction in herbicide application and a reduction in tillage and soil erosion. Moreover, any problems that have arisen, such as herbicide-resistant volunteer canola, have been manageable using standard farm management practices.²²¹

²¹⁷ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.9. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf. See also: L.J. Butler and B.W. Marion. *The Impacts of Patent Protection on the US Seed Industry and Public Plant Breeding*. Food Systems Research Group Monograph 16, University of Wisconsin-Madison, 1985; B.W. Marion. Plant Breeders' Rights in the US: Update of a 1983 Study, in *Intellectual Property Rights and Agriculture in Developing Countries*, Jeroen Van Wijk and Walter Jaffé (eds), University of Amsterdam, 1996, pp 17-33; and Jack R. Kloppenburg Jr. *First The Seed: The Political Economy of Plant Biotechnology 1492-2000*, Cambridge University Press, 1988, pp. 140-151.

²¹⁸ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.9. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

²¹⁹ D. Koyek. *Intellectual property rights: ultimate control of agricultural R&D in Asia: IR and PVP - undermining farmers' rights in Asia*. Institute for Agriculture and Trade Policy (IATP), 2001, p.9. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Intellectual_Property_Rights_Ultimate_Control_.pdf

²²⁰ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

²²¹ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified*

Because herbicide-resistant crops are designed to tolerate a broad-spectrum of herbicides, it is reasonable for the public to believe that the amount of herbicide applied to agricultural crops will increase. Monsanto claims that farmers can douse the whole field with Monsanto's Roundup herbicide and kill only the weeds. But, according to Abel, this practice makes weeds herbicide-resistant as well. "While results in early seasons may look good, farmers soon use more chemical to get the "kill" they want and eventually resort to older, more toxic chemicals to combat the superweeds that result from GM farming."²²²

However, according to Fulton et al, this has not been the result:

For example, while there was a rise in the amount of Roundup used on United States soybean crops as the adoption of transgenic crops increased, the use of other synthetic herbicides decreased by a greater amount, so there was a significant decrease in overall herbicide application.²²³

According to Fulton et al, an independent Monsanto study indicated that "Roundup Ready crops required 10%- 40% less herbicide in total."²²⁴ Moreover, herbicide-resistant crops "allow the application of a single, broad-spectrum herbicide to an established crop rather than the traditional pre-emergence and post-emergence cocktail of up to fifteen conventional herbicides that provides only partial weed control."²²⁵ It is important to note these synthetic herbicides are

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²²² Steve Abel. *Non-consenting subjects of a global experiment*. The New Zealand Herald, May 24, 2004. Available through NEXUS – LEXUS.

²²³ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: Economic Research Service (ERS). *Impacts of Adopting Genetically Engineered Crops in the U.S: Preliminary Results*. U.S. Department of Agriculture, July 20, 1999.

²²⁴ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: Monsanto Inc. *Residues in Roundup Ready Soya Lower Than Conventional Soya*, June 22, 1999. Available at: www.monsanto.co.uk/news/news.html

²²⁵ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: A. McHughen. *Pandora's Picnic Basket: The Potential and Hazards of Genetically Modified Foods*. New York: Oxford University, 2000.

at least three times as toxic and persist in the environment nearly twice as long.²²⁶ However, according to Abel, figures from the US “show a 23 million kilogram increase in herbicide use since GM crops were introduced.”²²⁷ Abel calls this a “chemical nightmare” and it is unfolding in Argentina as well, “where GM soy covers half the arable land and millions of litres of herbicide is sprayed over whole fields.”²²⁸

Critics also claim that the introduction of herbicide-resistant crops will upset delicate ecosystems. The argument is that scientists are “letting the genie out of the bottle” and as a result, herbicide-resistant crops will “reproduce unrestrictedly and be impossible to eradicate.”²²⁹ However, as Fulton et al explains, this argument is “based on the misconception that genetically engineered plants will behave like non-indigenous plant pests.”²³⁰ According to Fulton et al, “the comparison of GM crop plants to non-indigenous plants is inaccurate at best.”²³¹ While there have been a number of weeds that have been impossible to eradicate, “these species became pests because they were introduced into an environment to which they are suited and in

²²⁶ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: Ralph Heimlich, Jorge Fernandez-Cornejo, William McBride, Cassandra Klotz-Ingram, Sharon Jans, and Nora Brooks. *Adoption of Genetically Engineered Seed in U.S. Agriculture*. Presented at the Sixth International Symposium on the Biosafety of Genetically Modified Organisms, Saskatoon SK, July 2000.

²²⁷ Steve Abel. *Non-consenting subjects of a global experiment*. The New Zealand Herald, May 24, 2004. Available through NEXUS – LEXUS.

²²⁸ Steve Abel. *Non-consenting subjects of a global experiment*. The New Zealand Herald, May 24, 2004. Available through NEXUS – LEXUS.

²²⁹ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>.

²³⁰ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

²³¹ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

which they have no natural enemies.”²³² Crop plants that have been genetically engineered, however, are merely “reintroduced into the same or a similar environment from which they were taken, so they are not analogous to the introduction of nonnative species.”²³³ According to Anthony Trewavas, to expect a crop to survive in the wild is analogous to expecting that “a Chihuahua would survive in a pack of wolves.”²³⁴

On the Contrary, according to Abel, “weed problems are beginning to emerge for those farmers in the south of Brazil who have been illegally growing the GM seed” and “with new weed problems and the widespread and unwanted contamination of conventional and organic crops, GM soy is proving to be an environmental nightmare.”²³⁵ In fact,

it is becoming more difficult to source soy that doesn't have some presence of GM varieties. But the illegal contamination that robs us of the GM-free choice is exactly what was predicted of GM crops - that they would spread and uncontrollably contaminate conventional crops.²³⁶

There are also concerns that these plants will cross-breed with nearby weeds, creating “superweeds.”²³⁷ However, according to Fulton et al, many conditions must be present in order for cross-breeding or cross-hybridization to occur:

²³² Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

²³³ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: National Academy of Sciences. *Introduction of Recombinant DNA-Engineered Organisms into the Environment: Key Issues*. Washington DC: National Academy Press, 1987, p.14.

²³⁴ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: Anthony Trewavas. *GM is the Best Option We Have*. AgBioview, June 5, 2000, p. 4. Available at: www.agbioworld.org

²³⁵ Steve Abel. *Non-consenting subjects of a global experiment*. The New Zealand Herald, May 24, 2004. Available through NEXUS – LEXUS.

²³⁶ Steve Abel. *Non-consenting subjects of a global experiment*. The New Zealand Herald, May 24, 2004. Available through NEXUS – LEXUS.

²³⁷ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified*

There must be a wild relative with which the crop plant can breed. Most of the novel plants so far approved for release in Canada — including potatoes, tomatoes, corn, soybean, and flax — do not have wild relatives.”²³⁸

Furthermore, according to the National Academy of Science, there is no evidence that any crop plant has ever become a weed. In fact, the academy describes the chances of this happening as “negligible.”²³⁹ According to Fulton et al, gene-splicing herbicide resistant traits into a plant will not increase a plant’s propensity toward weediness, as it is merely one alteration to one of many genes that the plant already possesses.²⁴⁰ Fulton et al go on to explain that because the genetic variation is “performed on a plant whose traits are already well known, there is a broad base upon which to predict future behaviour” and “potential risk can be estimated a priori using knowledge of the systematics of crop/wild/weed complexes.”²⁴¹ According to Fulton et al, risk is “assessed on a case-by-case basis for each crop, each country/ecological

Crops. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

²³⁸ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: Canadian Food Inspection Agency (CFIA). *Outcrossing*, May 1998a. Available at: <http://www.inspection.gc.ca/english/toce.shtml>

²³⁹ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: National Academy of Sciences. *Introduction of Recombinant DNA-Engineered Organisms into the Environment: Key Issues*. Washington DC: National Academy Press, 1987.

²⁴⁰ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

²⁴¹ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: S.I. Warwick, H.J. Beckie and E. Small. *Transgenic crops: new weed problems for Canada?* *Phytoprotection*, August 1999, 80 (2): 71-84.

region, and for each trait” and “The Canadian Food Inspection Agency (CFIA) has the authority to discontinue field trials and suspend further development of the plant if it feels so justified.”²⁴²

Insect-resistant Crops

According to Fulton et al, the most commonly used gene to instill insect resistance is the naturally occurring *Bacillus thuringiensis* or Bt.²⁴³ According to John Dickey, Monsanto’s director of corporate affairs, “the addition of Bt-derived protein enables the NewLeaf potato to produce a naturally-occurring substance that is indigestible to the potato beetle. The beetle simply stops eating and dies.”²⁴⁴ However, according to Fulton et al, the impact of pest-resistant transgenic plants is controversial and there are ongoing studies to determine if these plants accelerate the inevitable development of pesticide-resistant insects:

Although the agricultural community has always embraced Bt, the fact that it has now been inserted directly into the plant through the process of genetic engineering has raised special concerns — particularly that, because transgenic Bt crops express Bt toxins in their tissue at all times (as opposed to spraying, which is periodic), the development of pesticide-resistant insects will accelerate. Parallel to the term “superweeds,” such insects have been named “superpests.”²⁴⁵

²⁴² Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

²⁴³ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

²⁴⁴ Shafer Parker Jr. *Superspud flexes its muscles*. Alberta Report / Newsmagazine, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

²⁴⁵ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

As Dr. Cook notes, while this is a legitimate concern for farmers and governments, “[t]his issue is not new to agriculture.”²⁴⁶ Likewise, Fulton et al note that Bt resistance is to be expected, whether or not Bt crops are used. Therefore, it is not a “GM issue *per se*; rather, it is a management problem that applies equally to traditional as well as organic agriculture” and “to date, the reliable, constant, and predictable dosages offered by GM crops seem preferable to the often unreliable, inconsistent, and unpredictable consequences of spraying.”²⁴⁷ For example, as Dr. Milton Gordon, a biochemist from the University of Washington, points out, it is preferable to develop resistance to only one gene rather than to a cocktail of many and sprayed Bt, like sprayed herbicides, is a cocktail of different Bt compounds.²⁴⁸ Moreover, as Fulton et al explain, “Bt is a natural pesticide that has been widely used since the 1950s in insecticidal powders. It is certified organic” and exhibits “low toxicity to humans and other animals.”²⁴⁹

While there is some concern that inserting insect-resistant genes into plants will have a detrimental effect on the environment or the plant itself, R.M. Babu et al, authors of *Advances in genetically engineered (transgenic) plants in pest management*, suggest otherwise. In the majority of the cases, the genes showing expression in transgenic plants are stably inherited into the progeny without detrimental effects on the recipient plant.²⁵⁰ Moreover, according to the U.S. Environmental Protection Agency's (EPA) regulation of pesticides produced in plants:

²⁴⁶ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: James R. Cook. *Testimony before the U.S. House of Representatives Subcommittee on Basic Research hearing on “Plant Genome Research: From the Lab to the Field to the Market, Part II.”* Serial No. 106-60. Washington, DC: Government Printing House, October 5, 1999, p.42. Available at: www.house.gov/science/106_hearing.htm#Basic_Research

²⁴⁷ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

²⁴⁸ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: M. Gordon. *Letter to Subcommittee Chairman Nick Smith, U.S. House of Representatives Subcommittee on Basic Research hearing on “Plant Genome Research: From the Lab to the Field to the Market, Part II.”* Washington, DC: Government Printing Office, 1999.

²⁴⁹ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: Alan McHughen. *Pandora’s Picnic Basket: The Potential and Hazards of Genetically Modified Foods*. New York: Oxford University Press, 2000.

²⁵⁰ R.M. Babu, A. Sajeena, K. Seetharaman, and M.S. Reddy. *Advances in genetically engineered (transgenic) plants in pest management - an overview*. *Crop Protection*, November 2003, 22 (9): 1071-1086.

The first three Experimental Use Permits (EUPs) granted by EPA for field testing of plant-pesticides were for delta endotoxins from *Bacillus thuringiensis* expressed in cotton (*Gossypium hirsutum* L.), potato (*Solanum tuberosum* L.) and maize (*Zea mays* L.). In each instance, an environmental-fate assessment by the Agency found no significant risk of gene expression beyond the spatial and temporal limits of the proposed field tests.²⁵¹

In fact, according to Marc Ghislain et al, authors of *Fulfilling the promise of B.t. potato in developing countries*, B.t. has the potential to save on pesticides and be beneficial for the environment²⁵² Likewise, according to A.A. Araji and S.L. Hafez, authors of *The economic and environmental impacts of nematode biocontrol methods: An ex-ante approach*, insect-resistant crops have proved to be beneficial for the environment. They find that while Nematodes in sugar beets and potatoes in the Pacific Northwest are presently managed with expensive and toxic soil fumigants, “[i]nvestment in the development of the nematode biocontrol methods will eliminate an estimated 6.17 million kilograms (13.6 lb million) of active toxic material from the environment in Idaho and reduce nematode numbers by more than 90 percent.”²⁵³

According to Fulton et al, it has also been suggested that the process of genetic modification could have a “detrimental impact on the existence of beneficial, non-target insects such as the Monarch butterfly.”²⁵⁴ This concern arose from a preliminary laboratory study done by John Losey and published in a letter to *Nature* in May, 1999. The study, the result of a single laboratory assay, reported the death of 44% of Monarch larvae that were fed genetically modified Bt maize pollen.²⁵⁵ According to Fulton et al, the report was interpreted to mean that

²⁵¹ L.R. Lasota. *Evaluation by the United States Environmental Protection Agency of pesticidal substances produced in plants*. Field Crops Research, 1996; 45(1-3): 181-186.

²⁵² Marc Ghislain, Aziz Lagnaoui, and Thomas Walker. *Fulfilling the promise of B.t. potato in developing countries*. Journal of New seeds, 2003; 5(2-3): 93-113.

²⁵³ A.A. Araji and S.L. Hafez. *The economic and environmental impacts of nematode biocontrol methods: An ex-ante approach*. Nematropica, 2001; 31(2): 181-193. See also: Larry D. Makus, Joseph F. Guenther, and Biing-Hwan Lin. *Factors Influencing Producer Support for a State Mandatory seed Law: An Empirical Analysis*. Journal of Agricultural and Resource Economics, December 1992, v.17, iss. 2, pp. 286-93.

²⁵⁴ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

²⁵⁵ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified*

genetic engineering caused the death of Monarch butterflies. Every entomologist recognizes that the death of *Lepidopteran* insects, including Monarch butterflies was the result of an application of Bt. The Monarch butterfly, already an unofficial symbol of conservation, thus became the “Bambi” of the GM debate.²⁵⁶

According to Fulton et al, while “the concern that Bt will affect insects other than those that are harmful to crops is undoubtedly valid, it is immaterial whether the Bt is delivered through a transgenic plant or through a traditional spray used by an organic farmer.”²⁵⁷ According to Mr. Dickey, “Bt proteins form the basis for pesticides that have been used safely by organic farmers and home gardeners for 30 years” and it does not harm beneficial insects that help control other potato pests.²⁵⁸ However, according to the International Council for Science, the use of “more effective pesticides (including herbicides) over the past 20 years has been a major cause of the decline in farmland birds, arable wild plants, and insects in several European countries.”²⁵⁹ While this is more of a concern Europe, “the more widespread use of broad-spectrum herbicides may accelerate this trend.”²⁶⁰ In fact, the result of the world’s largest ever trial of GM crops show that they can be worse for the environment. The results of the 6 million trials in Britain show that two out of three GM crops had a “worse impact on farmland wildlife than conventional crops.”²⁶¹

Crops. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: J. E. Losey, L. S. Rayor, and M. E. Carter. *Transgenic pollen harms monarch larvae*. *Nature*, 1999, 399: 214.

²⁵⁶ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

²⁵⁷ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

²⁵⁸ Shafer Parker Jr. *Superspud flexes its muscles*. *Alberta Report / Newsmagazine*, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

²⁵⁹ International Council for Science (ICSU). *Agricultural Biotechnology, Biodiversity and the Environment*. Companion Publication: *Biotechnology and Sustainable Development*, Chapter 4. Available at: http://www.icsu.org/1_icsuinscience/GMO/html/WSSD%20chapter_4.htm

²⁶⁰ International Council for Science (ICSU). *Agricultural Biotechnology, Biodiversity and the Environment*. Companion Publication: *Biotechnology and Sustainable Development*, Chapter 4. Available at: http://www.icsu.org/1_icsuinscience/GMO/html/WSSD%20chapter_4.htm

²⁶¹ Anonymous. *GM crops can be worse for environment*. *GM Food Special Report*, *New Scientist*, October 2003. Available at: <http://www.newscientist.com/hottopics/gm/gm.jsp?id=ns99994283>

Nevertheless, according to M.G. Paoletti and D. Pimentel in *The environmental and economic costs of herbicide resistance and host-plant resistance to plant-pathogens and insects*, extensive research on risk assessment is either limited or nonexistent on nontarget organisms in agroecosystems in which genetically modified organisms are expected to be released.²⁶² According to Alex Avery, research associate at the Virginia-based Center for Global Food Issues: "We really have two choices,"

either mankind can view biotechnology as a way of eliminating pesticides and preventing further wildlife habitat destruction, or it can oppose all change and insist that a growing number of people adopt agrarian lifestyles to feed the world's expanding population by inefficient methods.²⁶³

"That," insists Mr. Avery, "would be the real environmental disaster."²⁶⁴

²⁶² M.G. Paoletti and D. Pimentel. *The environmental and economic costs of herbicide resistance and host-plant resistance to plant-pathogens and insects*. Technological Forecasting and Social Change, September 1995, 50 (1): 9-23.

²⁶³ Shafer Parker Jr. *Superspud flexes its muscles*. Alberta Report / Newsmagazine, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

²⁶⁴ Shafer Parker Jr. *Superspud flexes its muscles*. Alberta Report / Newsmagazine, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

GM Safety and Regulation

GM technology has now made it possible to make traditional foods better by adding vaccines and nutrients. For example, a project at Loma Linda University School of Medicine in California has added a gene to potatoes that enables them to make a nontoxic component of the cholera toxin and could lead to protection against a scourge that afflicts 5 million people annually²⁶⁵ and the International Science and Technology Center (ISTC) is supporting research that is working on incorporating an HIV antigen in tomatoes.²⁶⁶ The Indian government has given approval for the commercial growing of Protato, a genetically modified potato with more protein.²⁶⁷

According to Avery, genetic engineering allows scientists to change a single gene while leaving the other untouched. "If a corn variety is drought resistant," says Mr. Avery, "the genetic engineer can change a gene that will improve yield while avoiding the loss of drought resistance. And even though the new gene may be from bacteria, it is only a single gene added to 100,000 others. The corn is still corn."²⁶⁸ On the contrary, according to Michael Meacher, author in the Guardian, a London Newspaper,

GM introduces genes from other species, even distant ones, which nature would never do. It also breaks up nature's all-important sequencing of the genes. Making a GM plant thus involves breaking and joining the DNA at random locations. This leads to substantial scrambling of both foreign and host DNA, which can produce abnormalities in animals and unexpected toxins and allergens in food crops.²⁶⁹

In fact, according to Richard Caplan, author of *Antibiotic Resistance and Genetically Modified Plants*,

²⁶⁵ J. Raloff. *Taters for tots provide an edible vaccine*. Science News, March 1998, Vol. 153 Issue 10, p149, 1/2p, 1c.

²⁶⁶ Anonymous. *Tomatoes may offer edible AIDS vaccine*. AIDS Weekly & Law via LawRx.com, August 12, 2004. Available through NEXUS – LEXUS. See also: A.S. Rishi, N.D. Nelson, and A. Goyal. *Molecular farming in plants: A current perspective*. Journal of Plant Biochemistry and Biotechnology, January 2001, 10 (1): 1-12.

²⁶⁷ Anonymous. *India to Approve GM Potato*. Asia Pacific Biotech News, July 2003, Vol. 7 Issue 15, p910, 1/3p.

²⁶⁸ Shafer Parker Jr. *Superspod flexes its muscles*. Alberta Report / Newsmagazine, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

²⁶⁹ Michael Meacher. *Comment & Analysis: GM food is heading for your fridge. It may well be dangerous - and it is about to enter our food chain*. Guardian Newspapers Limited, London, June 25, 2004. Available through NEXUS – LEXUS.

[m]any genetically engineered crops on the market currently contain antibiotic resistance marker genes because of the imprecision of the gene insertion process. Scientists use these genes to determine whether a gene has inserted itself into a target organism. As a result of incorporating these antibiotic resistance genes, these crops threaten the already growing problem of antibiotic resistance, which the world medical community acknowledges as a serious public health concern. Infectious diseases are responsible for one-quarter of all the deaths in the world, second only to cardiovascular diseases. As new strains of bacteria and viruses emerge that are resistant to drugs and antibiotics, infections become more difficult to treat.²⁷⁰

Meacher points out the abundance of worrying conclusions that have been drawn from recent studies on GM foods:

A study in August 1998 by Dr Arpad Pusztai in Aberdeen found that young rats fed GM potatoes for just 10 days developed growth-like thickening of the stomach and intestinal lining . . . In a study at Newcastle University in 2002, volunteers were fed a single meal of GM soya. The GM DNA was found not to have been digested, as scientists had claimed it would be, but to have survived and transferred to the gut bacteria, which could compromise antibiotic resistance. In the US in 2000 many food products were accidentally contaminated with GM StarLink maize, and it caused allergic reactions in 50 Americans, some life-threatening. Recently in Germany 12 cows died after eating Syngenta's GM Bt 176 maize, and the company paid the farmer compensation.²⁷¹

The Indian Council of Medical Research (ICMR) has also recently raised concerns over the safety of genetically modified (GM) food. An ICMR study entitled 'Regulatory Regime for

²⁷⁰ Richard Caplan. *Antibiotic Resistance and Genetically Modified Plants*. June 2002. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Antibiotic_Resistance_and_Genetically_Engineer.pdf

²⁷¹ Michael Meacher. *Comment & Analysis: GM food is heading for your fridge. It may well be dangerous - and it is about to enter our food chain*. Guardian Newspapers Limited, London, June 25, 2004. Available through NEXUS – LEXUS.

Genetically Modified Foods: The Way Ahead', said "the case of GM potatoes experiencing Galanthus nivalis lectin gene for insecticidal properties is an example of the potential of GM foods to cause toxicity. In a group of rats fed with GM potato damage to immune system and stunted growth was observed and the experiment had generated considerable controversy."²⁷² The study also expressed several other health concerns, but noted with significance "that there has been no report of any adverse health effect of GM foods and there are no peer reviewed publications on the health effects of GM foods in humans."²⁷³ Likewise, a recent U.N. report stated that "[i]n those countries where transgenic crops have been grown, there have been no verifiable reports of them causing any significant health or environmental harm."²⁷⁴ However, it appears that the reports that do exist on the risks of GM foods are criticized and the scientists discredited. According to Holloway, "there is a lot of misinformation out there."²⁷⁵ Holloway draws our attention to a particular, potentially damaging study regarding the safety of GM foods:

At a Scottish research institute in Aberdeen, for instance, experimental raw potatoes, engineered to be resistant to insects, were fed to rats. The researcher came to the conclusion that potatoes impaired the rats' immune systems and their growth. He made his conclusion public without any peer review. The experiment could not be repeated, but the press and environmental activists jumped on the story, declaring that genetically engineered crops were unsafe for human consumption even though the findings were invalid.²⁷⁶

However, what Holloway calls misinformation, according to Alison Pierce, author of *Bioscience Warfare*, represents one of the "most dramatic and high-profile allegations about retaliation against researchers." The researcher's name is Arpad Pusztai, a native of Hungary

²⁷² Anonymous. *ICMR Wants Overhaul of Foods Regulation*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; The Indian Express Online Media Ltd., Financial Express, July 25, 2004. Available through NEXUS – LEXUS.

²⁷³ Anonymous. *ICMR Wants Overhaul of Foods Regulation*. Financial Times Information; Global News Wire - Asia Africa Intelligence Wire; The Indian Express Online Media Ltd., Financial Express, July 25, 2004. Available through NEXUS – LEXUS.

²⁷⁴ Anonymous. *The truth about biocrops*. The State Journal-Register (Springfield, IL), May 24, 2004. Available through NEXUS – LEXUS.

²⁷⁵ Andy Holloway. *Welcome to the bioeconomy: advances in biology are changing the way the world does business, and Canada could rise to the top of the food chain in the new biotech economy. The missing link is money*. Canadian Business, Toronto, Sep 2, 2002, Vol. 75, Iss. 16; pg. 28.

²⁷⁶ Andy Holloway. *Welcome to the bioeconomy: advances in biology are changing the way the world does business, and Canada could rise to the top of the food chain in the new biotech economy. The missing link is money*. Canadian Business, Toronto, Sep 2, 2002, Vol. 75, Iss. 16; pg. 28.

who was, until August 1998, the senior scientist at the Rowett Research Institute in Aberdeen, Scotland. The study, according to Pierce, which was one of the few studies ever done to assess the risks of such food on humans and animals,

was published in the leading United Kingdom medical journal, *The Lancet*. Shortly thereafter, Pusztai's home was burglarized, his files detailing the research were stolen, and he was fired from his job of 30 years at Rowett. Pusztai says he has undergone a slanderous international campaign to discredit him. He now spends much of his time traveling to interested universities and groups telling his story.²⁷⁷

According to Steve Dube, author in *Global News Wire*, Pusztai said Prime Minister, Tony Blair was “personally responsible for the corruption of GM science.”²⁷⁸ According to Pusztai, Blair and his government promoted and “actually encouraged scientific fraud on a substantial scale” in pursuit of a “pro-GM agenda”²⁷⁹ and Pusztai is not the only researcher who has been silenced because the results of their experiments do not support a pro-GM agenda. Meacher gives an example, pointing to the fact that the study of “GM Chardon LL maize, fed to cows at Reading University two years ago, has never been published, probably because the results were so unpalatable to the biotech industry.”²⁸⁰ This is what happened when Tyrone B. Hayes, professor at UC Berkeley, found that applying atrazine to frog specimens creates frightening malformations in the frogs including the sex organs.²⁸¹ Hayes noted that the amount applied to the frogs was well below the amount allowed in our drinking water. Fearing that “the most widely used large-scale weed killer in the world” could be dangerous to humans, Hayes

²⁷⁷ Alison Pierce. *Bioscience Warfare: UC professor Tyrone Hayes found that a highly profitable weed killer causes sexual abnormalities in frogs. Then he found out how nasty a biotech multinational can be.* *SF Weekly, LP* (California), June 2, 2004. Available through NEXUS – LEXUS.

²⁷⁸ Steve Dube. *Blair accused on GM Agenda.* *Financial Times Information; Global News Wire – Europe Intelligence Wire; The Western Mail*, May 11, 2004. Available through NEXUS – LEXUS.

²⁷⁹ Steve Dube. *Blair accused on GM Agenda.* *Financial Times Information; Global News Wire – Europe Intelligence Wire; The Western Mail*, May 11, 2004. Available through NEXUS – LEXUS.

²⁸⁰ Michael Meacher. *Comment & Analysis: GM food is heading for your fridge. It may well be dangerous - and it is about to enter our food chain.* *Guardian Newspapers Limited*, London, June 25, 2004. Available through NEXUS – LEXUS.

²⁸¹ Alison Pierce. *Bioscience Warfare: UC professor Tyrone Hayes found that a highly profitable weed killer causes sexual abnormalities in frogs. Then he found out how nasty a biotech multinational can be.* *SF Weekly, LP* (California), June 2, 2004. Available through NEXUS – LEXUS.

sought to continue experimentation.²⁸² However, Hayes received his funding from Syngenta, a “biotechnology giant.” Not only did Syngenta refuse to fund more studies, but they refused to let him publish those findings and offered to “pay him to keep the results secret.”²⁸³ When Hayes notified the EPA about the possible risks associated with the chemical, there was a mandatory environment and human health risk review. Nevertheless, atrazine was reapproved, critics say because of pressures from Syngenta.²⁸⁴

A similar story comes from Losey, the scientist who found that genetically modified BT corn kills monarch butterflies. According to Pierce,

after Losey published his study, he says, he was attacked by the Biotechnology Industry Organization [BIO], the world's largest international biotech group, with a membership that includes the multinational giants Syngenta, Monsanto, Genentech, Bayer CropScience, and DuPont . . . BIO supplied misinformation to the popular media, Losey says, and the resulting maelstrom of press reports on his study was like nothing he had ever seen.²⁸⁵

"It was overwhelming, and certainly there were industry folks trying to denigrate what we found,"²⁸⁶ says Losey. According to Skryabin, “there is no proof that genetically modified food products may be bad for health.”²⁸⁷ In fact, Konstantin Skryabin, head of bioengineering center, Russian academy of sciences; “offered a reward of \$10,000 to anyone who would find an article in a scientific journal proving that potatoes resistant to the Colorado beetle could harm the

²⁸² Alison Pierce. *Bioscience Warfare: UC professor Tyrone Hayes found that a highly profitable weed killer causes sexual abnormalities in frogs. Then he found out how nasty a biotech multinational can be.* SF Weekly, LP (California), June 2, 2004. Available through NEXUS – LEXUS.

²⁸³ Alison Pierce. *Bioscience Warfare: UC professor Tyrone Hayes found that a highly profitable weed killer causes sexual abnormalities in frogs. Then he found out how nasty a biotech multinational can be.* SF Weekly, LP (California), June 2, 2004. Available through NEXUS – LEXUS.

²⁸⁴ Alison Pierce. *Bioscience Warfare: UC professor Tyrone Hayes found that a highly profitable weed killer causes sexual abnormalities in frogs. Then he found out how nasty a biotech multinational can be.* SF Weekly, LP (California), June 2, 2004. Available through NEXUS – LEXUS.

²⁸⁵ Alison Pierce. *Bioscience Warfare: UC professor Tyrone Hayes found that a highly profitable weed killer causes sexual abnormalities in frogs. Then he found out how nasty a biotech multinational can be.* SF Weekly, LP (California), June 2, 2004. Available through NEXUS – LEXUS.

²⁸⁶ Alison Pierce. *Bioscience Warfare: UC professor Tyrone Hayes found that a highly profitable weed killer causes sexual abnormalities in frogs. Then he found out how nasty a biotech multinational can be.* SF Weekly, LP (California), June 2, 2004. Available through NEXUS – LEXUS.

²⁸⁷ Anonymous. *The case for/against GM foods.* Moscow News (Russia): Ecology; No. 16, April 28, 2004. Available through NEXUS – LEXUS.

health of a human being. No one claimed the reward.”²⁸⁸ Those who support biotechnology, use the lack of research as leverage to support the claim that the technology is safe. However, according to Chuck Benbrook, a food policy expert and former executive director of the Board on Agriculture of the National Academy of Sciences, big biotech has “silenced the vast majority of scientists who are interested in doing research on risks.”²⁸⁹ According to Benbrook, they have “been going after scientists in a systematic, organized way that I haven't seen in my memory.”²⁹⁰

This does not mean that GM foods are necessarily dangerous. After all, three years after the monarch butterfly cover-up, “scientific studies show that the risks to monarchs from genetically modified corn are actually quite low.”²⁹¹ However, what these stories do suggest is that while there is a distinct possibility that GM foods could be dangerous, the potential risks are not being explored. Instead, they are being covered-up and suppressed, resulting in a complete disregard of potential risks by the biotech industry.²⁹² In fact, according to Dube, “all grant aid to research on the health effects of GM crops has now been cut and the only serious research in the field is taking place in Norway.”²⁹³

However, the argument is made that GM foods are tested greatly. In an article by Shafer Parker entitled *Superspud flexes its muscles*, published in *News magazine*, Mr. Mayers explains the five subject areas to be assessed in order for the genetically modified food to be approved by Health Canada:

The company altering the food must report on the modified organism, giving the molecular history of the recombinant gene along with a description of its characteristics. Second, the company must compare the novel food product to the traditional food it is designed to replace. "This is where a novel food has to demonstrate a substantial equivalent," Mr.

²⁸⁸ Anonymous. *The case for/against GM foods*. Moscow News (Russia): Ecology; No. 16, April 28, 2004. Available through NEXUS – LEXUS.

²⁸⁹ Alison Pierce. *Bioscience Warfare: UC professor Tyrone Hayes found that a highly profitable weed killer causes sexual abnormalities in frogs. Then he found out how nasty a biotech multinational can be*. SF Weekly, LP (California), June 2, 2004. Available through NEXUS – LEXUS.

²⁹⁰ Alison Pierce. *Bioscience Warfare: UC professor Tyrone Hayes found that a highly profitable weed killer causes sexual abnormalities in frogs. Then he found out how nasty a biotech multinational can be*. SF Weekly, LP (California), June 2, 2004. Available through NEXUS – LEXUS.

²⁹¹ Anonymous. *Three Years Later: Genetically Engineered Corn and the Monarch Butterfly Controversy*. Pew Initiative on Food and Biotechnology. Available at: <http://pewagbiotech.org/resources/issuebriefs/monarch.pdf>

²⁹² Michael Meacher. *Comment & Analysis: GM food is heading for your fridge. It may well be dangerous - and it is about to enter our food chain*. Guardian Newspapers Limited, London, June 25, 2004. Available through NEXUS – LEXUS.

²⁹³ Steve Dube. *Blair accused on GM Agenda*. Financial Times Information; Global News Wire – Europe Intelligence Wire; The Western Mail, May 11, 2004. Available through NEXUS – LEXUS.

Mayers states. "We insist that its makeup be the same as the traditional food with the exception of the altered gene's intended effect." Third, Health Canada requires that the company describe the novel food's impact on consumers, insisting that taste, rate of spoilage, and overall quality at least the existing product. Fourth, the novel food must demonstrate nutritional equivalency to the traditional food. Finally, tests must show that the novel food has no toxic effects.²⁹⁴

In fact, according to David Dennis, president and CEO of Performance Plants Inc., a Kingston, Ontario based agri-biotech company that is inserting genes into traditional crops to improve yields, genetically modified products are the most tested food products ever.²⁹⁵ At least in some cases, this claim seems to be true. For example, according to Mr. Mayers, animal studies are not required when substantial equivalency is demonstrated in the first four steps, unless a brand new protein is being introduced. Since Bt proteins have been used as pesticides for decades, for instance, animal studies for the NewLeaf potato aren't required. "But Monsanto did them anyway," he reports. "They went to the point of overkill on the safety side to reassure a concerned public."²⁹⁶ However, Meacher raises the question of whether the tests conducted are the right ones.

Against this background it is almost incredible, but true, that there have been no peer-reviewed clinical studies on the human health effects of GM food. Instead, when the biotech companies manufacture a new GM product, they compare it with its non-GM counterpart in terms of nutrients, toxins and allergens, and if they allege it to be "substantially equivalent", they deem it to be safe. Such an assumption would never be allowed in the regulation of pesticides or drugs. It is simply a device to circumvent direct trials of the effects of GM foods

²⁹⁴ Shafer Parker Jr. *Superspud flexes its muscles*. Alberta Report / Newsmagazine, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

²⁹⁵ Andy Holloway. *Welcome to the bioeconomy: advances in biology are changing the way the world does business, and Canada could rise to the top of the food chain in the new biotech economy. The missing link is money*. Canadian Business, Toronto, Sep 2, 2002, Vol. 75, Iss. 16; pg. 28.

²⁹⁶ Shafer Parker Jr. *Superspud flexes its muscles*. Alberta Report / Newsmagazine, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

on human health, and ensures that GM crops can be patented without even animal testing.²⁹⁷

In the EU, this kind of regulation has the population worried about the safety of GM foods. According to Meacher, GM products are being approved despite the fact that they didn't get the majority of votes by the EU's scientific regulatory committee because of "ministerial deadlock."²⁹⁸ This leads one to question the safety of GM products. According to Meacher:

. . . one is not encouraged when the guardian of our food safety, the Food Standards Agency, and particularly its chairman, John Krebs, is so strongly pro-GM. They naively rely on company data to prove the safety of GMOs, despite numerous reports which have revealed the dubious credibility of company studies. The FSA has also focused mainly on the safety of inserted GM material, and neglected the inherent risks of the gene insertion process itself, such as the production of new toxins and allergens.²⁹⁹

Likewise, public confidence in GM testing and food-regulation in the United States and Canada has been dwindling. According to Philip Regal, an ecology professor at the University of Minnesota, when it came to testing GM foods, the government "just gave up."³⁰⁰ In fact, according to Caplan,

No federal laws have ever been passed to govern the regulation of genetically engineered foods and crops. The regulations in place, cobbled together under existing statutes, require no mandatory pre-market or post-market health testing. When the regulations

²⁹⁷ Michael Meacher. *Comment & Analysis: GM food is heading for your fridge. It may well be dangerous - and it is about to enter our food chain.* Guardian Newspapers Limited, London, June 25, 2004. Available through NEXUS – LEXUS.

²⁹⁸ Michael Meacher. *Comment & Analysis: GM food is heading for your fridge. It may well be dangerous - and it is about to enter our food chain.* Guardian Newspapers Limited, London, June 25, 2004. Available through NEXUS – LEXUS.

²⁹⁹ Michael Meacher. *Comment & Analysis: GM food is heading for your fridge. It may well be dangerous - and it is about to enter our food chain.* Guardian Newspapers Limited, London, June 25, 2004. Available through NEXUS – LEXUS.

³⁰⁰ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America.* Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

were legally challenged in the 1980s, the court found they were flawed but did not set them aside, reasoning that they were only a beginning effort to set policy. Instead, the regulations remain largely in place, although weakened over time. One result of this lax oversight is that potentially unsafe practices, such as the inclusion of antibiotic resistance marker genes, have gone forward with far too little scientific and public debate and scrutiny.³⁰¹

According to Reynolds, the FDA is now being sued by the Washington, DC-based Center for Food Safety because recent leaked documents show that while the FDA held that its decision to classify GM food as substantially equivalent to non-GM food was grounded in science, some FDA scientists had concerns about approving GM food.³⁰² According to Regal, the problem was that testing all of the GMOs would be too difficult and the cost would be astronomical. The general idea was, "We'll just have to risk it. If the people want progress they're going to have to be guinea pigs."³⁰³

In Canada, like the U.S., testing is usually carried out by the biotechnology companies themselves. This method, however, has generated a great deal of controversy. According to an article published in the Economist entitled *Politics and current affairs: Food fight*, by an anonymous author, these companies are only required to show that their products are "substantially equivalent" to conventionally bred crops, "a test that many scientists consider insufficient."³⁰⁴ Critics say that the existing system is aimed more at easing new products into the market than ensuring safe food. For instance, Health Canada has quietly announced that since May of 1994 it had approved seven genetically engineered foods for human consumption, Monsanto Canada's NewLeaf potato among them.³⁰⁵ According to Mark Winfield of the Toronto-based Canadian Environmental Law Association: "They're approving these things before they've completed the regulatory framework for evaluation," he said. "That's crazy."³⁰⁶

³⁰¹ Richard Caplan. *Antibiotic Resistance and Genetically Modified Plants*. June 2002. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Antibiotic_Resistance_and_Genetically_Engineer.pdf

³⁰² Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America*. Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

³⁰³ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America*. Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

³⁰⁴ Anonymous. *Politics and current affairs: Food fight*. The Economist, London, Dec 31, 1999, Vol. 353, Iss. 8151; pg. S22, 1 pgs.

³⁰⁵ Emily S. Plishner. *A new leaf*. FW, September 1995, Vol. 164 Issue 20, p16, 2/3p, 1 cartoon.

³⁰⁶ Shafer Parker Jr. *Superspid flexes its muscles*. Alberta Report / Newsmagazine, January 1996, Vol. 23 Issue 3, p18, 4p, 1 chart, 1 cartoon, 3bw.

While the federal government of Canada said it would set up a committee of experts to review its system for approving GM foods in 1999 and it has since negotiated a Food Safety and Inspection Bill, according to officials, the bill makes no changes in standards and simply modernises existing regulations.³⁰⁷ According to the anonymous author, the Canadian Food Inspection Agency, which is supposed to enforce food-safety regulations, reports to the minister of agriculture and also promotes farm production and trade.³⁰⁸ Gloria notes that the government “acts as a promoter for the agri-biotech industry, but also purports to be its regulator.”³⁰⁹ According to Gloria,

It's nothing short of deplorable that there are so many incestuous ties between the food giants and the government . . . Ottawa spent \$2.8 million last spring on a door-to-door brochure extolling the virtues of GM foods. And Industry Canada, that repeated bestower of corporate welfare, is a member of BioteCanada, a lobby group for the biotech industry. Then there's the Consumers' Association of Canada (CAC), a group that opposes mandatory labeling of genetically modified foods while claiming independence from the industry.³¹⁰

According to Gloria, Bradford Duplisea of the Canadian Health Coalition, an Ontario-based watchdog, obtained documents this summer that reveal that the CAC receives an unknown amount of funding from Monsanto and tens of thousands of dollars from CFIA to generate pro-biotech, anti-mandatory labeling propaganda.³¹¹ Moreover, according to Duplisea,

the government has spent more than \$1 billion in agricultural biotech, much of that going to controversial projects such as Monsanto's. Between 1997 and 1998 alone, the biotech industry claimed \$314 million of

³⁰⁷ Anonymous. *Politics and current affairs: Food fight*. The Economist, London, Dec 31, 1999, Vol. 353, Iss. 8151; pg. S22, 1 pgs.

³⁰⁸ Anonymous. *Politics and current affairs: Food fight*. The Economist, London, Dec 31, 1999, Vol. 353, Iss. 8151; pg. S22, 1 pgs.

³⁰⁹ Kim Gloria. *Chew on this! Ottawa is still pumping tax dollars into GM foods*. Canadian Business, Toronto, Oct 1, 2001, Vol. 74, Iss. 18; pg. 14.

³¹⁰ Kim Gloria. *Chew on this! Ottawa is still pumping tax dollars into GM foods*. Canadian Business, Toronto, Oct 1, 2001, Vol. 74, Iss. 18; pg. 14.

³¹¹ Kim Gloria. *Chew on this! Ottawa is still pumping tax dollars into GM foods*. Canadian Business, Toronto, Oct 1, 2001, Vol. 74, Iss. 18; pg. 14.

your tax dollars on such projects as Monsanto's Roundup Ready canola (which has been found to have an unapproved extra gene) and Monsanto's transgenic potatoes (which have found their way to Ukraine and Georgia in unauthorized field tests).³¹²

This conflict of interest, unreformed by the bill, according to the anonymous author, poses "an imminent threat to the future health of Canadians", according to a memo to the health minister signed by 200 government food-safety experts and published in September. They want enforcement of food safety returned to the health ministry, which had it until two years ago.³¹³

³¹² Kim Gloria. *Chew on this! Ottawa is still pumping tax dollars into GM foods.* Canadian Business, Toronto, Oct 1, 2001, Vol. 74, Iss. 18; pg. 14.

³¹³ Anonymous. *Politics and current affairs: Food fight.* The Economist, London, Dec 31, 1999, Vol. 353, Iss. 8151; pg. S22, 1 pgs.

Backlash: Taking Arms Against GM Crops

Public Perception of GM Foods

Many activist groups, Reynolds notes, have recently launched domestic anti-GM campaigns:

In early September, Greenpeace, the Sierra Club and about 20 other Canadian groups met in Ottawa to map out a common strategy. This fall, consumers can expect a barrage of anti-GM advertising, supermarkets will be pressured to drop GM foods and food manufacturers will be challenged to use non-GM ingredients.³¹⁴

Public opinion surveys indicate that people are not very accepting of the process or the products of genetic modification and biotechnology. Even products such as the Potato, which could have huge benefits for developing countries, is under attack with opponents claiming that it will result in the neglect of traditional sources of protein and thus exacerbate protein deficiency.³¹⁵ According to Paul Thompson, author of *Food and Agricultural Biotechnology: Incorporating Ethical Considerations*, prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, four broad groups of concerns about biotechnology are apparent from the public: specific food safety and quality concerns, fear of the unknown, ethical objections, and environmental concerns.³¹⁶ According to Fulton et al, in the 1996 and 1999 Eurobarometer surveys, attitudes toward four applications of biotechnology were compared: the production of food, the development of insect resistance in plants, the development of medicines or vaccines, and the use of genetic testing to detect hereditary diseases.³¹⁷ The results indicate that:

³¹⁴ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America.* Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

³¹⁵ Mudur Ganapati. *Controversy grows over India's genetically modified potato.* British Medical Journal, June 2003, Vol. 326 Issue 7403, p1351, 1/6p.

³¹⁶ Paul Thompson. *Food and Agricultural Biotechnology: Incorporating Ethical Considerations.* Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, October 2000. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00447e.html>

³¹⁷ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops.* Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: European Commission. *The Europeans and Biotechnology. Eurobarometer 52.1. Directorate-General for Education and Culture.* European Commission, March 15, 2000. Available at: <http://europa.eu.int/comm/dg10/epo/eb.html>

public perception about biotechnology has become less optimistic over the years. Over the three-year period, public opinion became less optimistic about the potential usefulness of these applications, although there was little change in attitudes toward the perceived riskiness of the applications. Fewer respondents felt the applications to be morally acceptable, and fewer (12%-16%) thought these applications should be encouraged, relative to the 1996 survey results.³¹⁸

In fact, according to Thompson, ethical objections are common, although they are normally based on an argument that the technology or the process is unnatural and such arguments are difficult to sustain:

Straughan (1995) and Comstock (1998) review a series of ways to extend the claim that gene technology is unnatural into a more substantive ethical argument for regulating or restricting crop biotechnology. The general problem is that while, in one sense, all forms of modern technology are unnatural, no one has succeeded in articulating a principled way of stating why the unnaturalness associated with the manipulation of DNA is unethical, while ordinary plant and animal breeding, computers and modern transport are not. More persuasive extensions of the claim that gene technology is unnatural cite environmental risks, but with this argument there is no need to attribute special *ethical* significance to the fact that DNA has been manipulated. Any technology can be evaluated ethically with respect to its environmental risks. Manipulation of DNA may or may not create unique

³¹⁸ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

opportunities for environmental impacts, but that is an empirical, not an ethical, question³¹⁹

However, public perception of the issue in Canada may have shifted “from a science and technology issue to one of food safety and public health — a shift that has not occurred to date in the United States.”³²⁰ Nevertheless, according to the Angus Reid group, acceptance in Canada may be on the decline.³²¹ This finding is confirmed by E. Einsiedel, author of *Biotechnology and the Canadian Public: 1997 and 2000*. Einsiedel found that although Canadians remained “cautiously supportive” of biotechnology, their optimism had declined since 1997. She also found that consumers were relatively more positive when the term “biotechnology” was used than when the term “genetic engineering” was used.³²² According to Fulton et al., “this illustrates how the use of different terminology in a survey can elicit a different response.”³²³

In 2001, an Ipsos-Reid/Globe and Mail/CTV poll found that 63% of respondents would be less likely to buy a product if it contained GM ingredients.³²⁴ This negative response, however, may be due to a lack of knowledge about the effects of biotechnology and genetic

³¹⁹ Paul Thompson. *Food and Agricultural Biotechnology: Incorporating Ethical Considerations*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, October 2000. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00447e.html>

³²⁰ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

³²¹ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: Angus Reid Group. *New Thoughts in Food: Exploring Consumer Reaction to Biotechnology in Foods*. Angus Reid Group Study Prospectus, 1999.

³²² Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>. See also: E. Einsiedel. *Biotechnology and the Canadian Public: 1997 and 2000*. Unpublished report, University of Calgary, 2000.

³²³ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

³²⁴ Kim Gloria. *Chew on this! Ottawa is still pumping tax dollars into GM foods*. Canadian Business, Toronto, Oct 1, 2001, Vol. 74, Iss. 18; pg. 14.

engineering. While, the Eurobarometer surveys found that the public's general knowledge of biotechnology and genetics improved slightly between 1993, 1996, and 1999, according to Fulton et al, two notable exceptions emerged:

First, there was a marked improvement in the understanding of what is meant by "cloning." There was more uncertainty, however, about the potential outcomes of biotechnology. For example, more people were unsure whether a person's genes could be modified by eating a genetically modified fruit in 1999 (34%) than had been the case in 1996 (29%).³²⁵

Government and Market Response

The backlash, according to Reynolds, has been most intense in the UK where "several top grocery chains are phasing out all GM products and giant food processors Nestle Unilever and Cadbury Schweppes have pledged to go GM-free."³²⁶ According to Reynolds, "[e]ven McDonald's has banned GM soy from its food there."³²⁷ Moreover, on the government side, "the European Union (EU) voted earlier this summer not to approve any new GM seeds for two years" and "the fall of the EU market is causing other countries to rethink and reshape their policies toward GM seeds." In fact, "Australia, New Zealand, Japan, Brazil, Mexico and South Korea -- have begun to follow suit"³²⁸ and it is causing huge problems for trade:

Australia and New Zealand, in a joint agreement, announced in August that they would require GM products to be labeled. Japan, an essential export market for Canadian farmers, announced its similar

³²⁵ Murray Fulton, Hartley Furtan, Dustin Gosnell, Richard Gray, Jill Hobbs, Jeff Holzman, Bill Kerr, Jodi McNaughten, Jan Stevens, Derek Stovin. *Transforming Agriculture: the Costs and Benefits of Genetically Modified Crops*. Prepared for the Canadian Biotechnology Advisory Committee Project Steering Committee on the Regulation of Genetically Modified Foods, March 2001. Available at: <http://strategis.ic.gc.ca/epic/internet/incbac-cccb.nsf/en/ah00388e.html>

³²⁶ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America*. Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

³²⁷ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America*. Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

³²⁸ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America*. Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

intention in July, while two of that country's major breweries, Kirin and Sapporo, announced a plan to start phasing out GM ingredients. Mexico is also starting to buckle, even though it was one market that this year bought up some of the canola that Canada couldn't sell to the EU (which amounted to about \$90 million); Grupo Maseca, Mexico's No. 1 producer of corn flour, is now trying to go GM-free. In June, Brazil, a top soybean producer, banned the planting of GM soybean seeds pending an environmental review.³²⁹

Moreover, "that war is starting to come home."³³⁰ According to Reynolds, the controversy over GM foods has started to move to the North America. In fact, several big US companies have already fallen in line:

in July, Gerber Products Co. and HJ Heinz Co. announced they will begin phasing out GM products from their baby food lines, while pet-food giant Iams Co. has said it will stop using GM ingredients not approved by the EU.³³¹

Moreover, according to Marcella Athayde, author in World Watch, Monsanto is withdrawing the genetically modified Newleaf potato from the United States and Canadian market.³³² According to Scott Kilman, author in Wall Street Journal, McDonald's Corp. told their french-fry supplier to stop buying potatoes from Monsanto because of safety concerns regarding crop biotechnology distributed by Monsanto and McCain Foods, a New Brunswick firm and one of the world's largest suppliers of frozen chipped potatoes. According to Kilman, McCain Foods revealed that after January 1 it would no longer buy any genetically modified

³²⁹ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America.* Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

³³⁰ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America.* Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

³³¹ Cynthia Reynolds. *Frankenstein's harvest: in country after country, consumers are turning against genetically modified foods. Now the battle for public opinion has broken out in North America.* Canadian Business, Toronto, Oct 8, 1999, Vol. 72, Iss. 16; pg. 64.

³³² Marcella Athayde. *Monsanto drops its biotech potato.* World Watch, December 2001, Vol. 14 Issue 6, p5.

spuds.³³³ Moreover, according to a recent report by Kraft Foods Inc. entitled *Risky Business: Financial Risks that Genetically Engineered Foods Pose to Kraft Foods, Inc. and Shareholders*,

Kraft's use of genetically engineered ingredients poses risk of product recalls and liability lawsuits . . . loss of competitive advantage, consumer rejection of Kraft's products, and damage to reputation resulting from increased controversy surrounding these foods.³³⁴

According to the report, Kraft should discontinue use of GM ingredients since these are all unnecessary risks. In fact, even big companies like Monsanto are starting to respond to consumer backlash. According to an article by New Scientist, Monsanto's plans to sell genetically modified wheat in the U.S. have been put on hold because of "overwhelming consumer opposition in Europe and Japan."³³⁵ However, while some governments have been rethinking their acceptance of GM products, after a three-year "farm-scale evaluation" Britain has approved GM maize, the first GM crop approved for commercial growing.³³⁶

³³³ Scott Kilman. *Monsanto's Biotech Spud Is Being Pulled From the Fryer at Fast-Food Chains*. Wall Street Journal – Eastern Edition, April 2000, Vol. 235 Issue 85, pB4. See also: Anonymous. *Politics and current affairs: Food fight*. The Economist, London, Dec 31, 1999, Vol. 353, Iss. 8151; pg. S22, 1 pgs.

³³⁴ Kate Madigan. *Risky Business: Financial Risks that Genetically Engineered Foods Pose to Kraft Foods Inc. and Shareholders*. National Association of State PIRGs, As You Sow Foundation, April 2003. Available at: http://www.gefoodalert.org/library/admin/uploadedfiles/Risky_Business_Financial_Risks_that_Geneticall.pdf

³³⁵ Anonymous. *GM wheat put on hold*. GM Food Special Report, New Scientist, May 2004. Available at: <http://www.newscientist.com/hottopics/gm/gm.jsp?id=ns99994977>

³³⁶ Anonymous. *Britain gives go-ahead for first GM crop*. GM Food Special Report, New Scientist, March 2004. Available at: <http://www.newscientist.com/hottopics/gm/gm.jsp?id=ns99994754>

Useful Sites for Latest News on Agricultural Biotechnology and GM Foods:

Pew Initiative on Food and Biotechnology

<http://pewagbiotech.org/>

Krafted. Anti-GM Campaign.

<http://krafty.org/>

New Scientist

<http://www.newscientist.com/hottopics/gm/gm.jsp>

International Food Policy Research Institute

<http://www.ifpri.cgiar.org>

