Biopatents and the Problem/Promise of Genetic Leaks: Farming Canola in Canada

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> Unfortunately, isolation can be broken because pollen flow can cross barriers and surprisingly large distances. For example, Reiger et al. (2003) studied the movement of canola pollen and detected pollen-mediated gene flow nearly 3 kilometers from a source field.[1]

> It is only through the attempted expulsion of the improper, the disarranging, the unclean … that the representation of order can continue.[2]

Canola is an open-pollinated plant. This is actually something of an understatement. As Michelle Marvier and Rene van Acker point out in the first of the above quotations, canola plants can cross-pollinate over a 3-kilometer radius. This fact has, quite deservedly, earned canola a reputation as a "promiscuous plant."[3] The use of the term "promiscuity," however, implying as it does a habit for indiscriminate couplings, raises questions about how else a plant might reproduce. How can open-pollinated reproduction occur in any way other than promiscuously? The term seems to pop up, to become somehow appropriate, only in an environment in which plant reproduction is expected to take place otherwise than through the normal vectors of wind and insect. In short, the passing around of pollen and seeds only really becomes "promiscuous" when someone is trying to hold a crop variety apart, trying to keep something separate, to control reproductive couplings.

In the past, some plant breeding efforts have required a degree of holding apart. But in recent decades, the allocation of intellectual property (IP) rights in plant genetic resources has raised a new set of problems around agricultural gene flows. Biopatents on modified or isolated genetic material have only been available anywhere in the world since the landmark U.S. Supreme Court ruling in Diamond v. Chakrabarty (447 U.S. 303) in 1980. Since this ruling, patents on genetic material have become commonplace in most countries around the world.[4] In contrast to the free flow of genetic materials discussed above, these patents attempt to freeze or fix movements, particularly of their more tangible vectors like pollen and seeds, in order to isolate some genetic materials as discrete objects of private property with specific owners. But what happens when these kinds of restrictions on plant movements cannot be achieved?

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[1] Michelle Marvier and Rene C. van Acker, "Can Crop Transgenes Be Kept on a Leash?," *Frontiers in Ecology and the Environment*, Vol. 3, No. 2, 2005, p. 100.

[2] Elizabeth Grosz, *Volatile Bodies: Toward a Corporeal Feminism* (St. Leonards, NSW: Allen & Unwin, 1994), p. 201.

[3] Reg Sherren, "Could Transgenic Canola Troubles Be Repeated with Wheat?," Country Canada Report, *CBC*, March 22, 2002.

[4] John Barton, et al., "Integrating Intellectual Property Rights and Development Policy," Commission on Intellectual Property Rights, 2002; Bonwoo Koo, Carol Nottenburg, and Philip G. Pardey, "Plants and Intellectual Property: An International Appraisal," *Science*, Vol. 306, November 19, 2004.

The introduction of transgenic canola into Canada illustrates precisely this difficulty, and as such provides an ideal opportunity to assess some of the many problems that arise when patented genetic resources are introduced into real agricultural environments. Two cases recently before the Supreme Court of Canada, namely Harvard College v. Canada (2002 SCC 76) and Monsanto Canada, Inc. v. Schmeiser (2004 SCC 34), offer two distinct approaches to dealing with the uncontrollable movement of patented genetic material—the "leakiness" of genetic property. This leakiness was understood and handled quite differently by the majority ruling in each of the two cases, opening up at least two avenues for managing an object of property that is moving uncontrollably into the surrounding environment, which is often comprised of other people's property. The Supreme Court's position(s) ultimately fail to adequately address this leakiness, and in so doing raise substantial problems for farmers and other people interested in the equitable allocation of genetic property. There are, however, other property systems that may better allow for the kinds of gene flows that occur in agricultural environments and might, as such, offer important alternatives to biopatenting regimes.

Farming Canola in Canada

Each summer, the western prairie provinces of Canada are awash with fields of golden canola flowers, often as far as the eye can see. Canola has taken on a significance in these regions that is hard to fully imagine. It is one of the most important crops for local farmers, annually generating over $12 billion of economic activity in the region.[5] Today, almost all of this canola is one of three herbicide-tolerant (HT) varieties: Monsanto's "Roundup Ready," Bayer Crop Science's "Liberty Link," and BASF's "Clearfield." All of these varieties have been bred to be resistant to an herbicide that can then be sprayed on them post-germination to selectively kill weeds. HT varieties thus make possible a new kind of weed management, which, for many farmers, makes growing canola more profitable and/or manageable in the very short growing seasons that are characteristic of farming in this region. The first two of these canola varieties have been genetically modified (GM) to tolerate an herbicide manufactured by each of their parent companies—Monsanto's "Roundup" and Bayer's "Liberty," respectively. The tolerance in the third variety, "Clearfield," has been produced through a process of mutagenesis. While estimates vary slightly, these three HT varieties today represent approximately 96 percent of all canola produced in Canada, with Monsanto's Roundup Ready accounting for about 50 percent.[6]

One of the most interesting things about the cultivation of canola in Canada is the way in which it has settled, once and for all, the issue of uncontrollable gene movements in agricultural environments. While it was once argued by the biotechnology industry that transgene contamination from genetically modified crops would not represent a substantial issue, the movements of canola in Canada have very clearly shown this not to be the case. According to Michelle Marvier and Rene van Acker:

> One of the best documented examples of far-ranging gene spread involves canola (*Brassica napus* L) … With the unconfined commercial release of GM canola in Canada, transgene movement from canola crop to canola crop was predicted, but the speed and extent of movement surprised everyone. By 1998, after only two seasons of commercial cultivation of GM herbicide-tolerant canola types in western Canada, volunteer canola plants carrying GM resistance traits were found in many fields where farmers were not intentionally growing these GM varieties. More importantly, even though the original GM canola possessed either glyphosate [Roundup] tolerance or

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[5] Canola Council of Canada, "Canola in Canada," 2009, available from: http://www.canola-council.org/canadian_canola_industry.aspx, last accessed April 14, 2009.
[6] Ian J. Mauro and Stephane M. McLachlan, "Farmer Knowledge and Risk Analysis: Postrelease Evaluation of Herbicide-Tolerant Canola in Western Canada," *Risk Analysis*, Vol. 28, 2008, p. 465.

> glufosinate [Liberty] tolerance, individual plants of volunteer canola appeared that possessed both forms of resistance.[7]

In 2002, van Acker, along with Lyle Friesen and Alison Nelson (from the University of Manitoba) surveyed 27 certified canola seed lots[8] for glyphosate-resistance, indicating the presence of Monsanto's patented Roundup Ready trait.[9] They found that 14 had contamination levels above 0.25 percent and three in excess of 2.0 percent. As Devlin Kuyek has pointed out in relation to this study:

> If the certified seed lots are contaminated, it can safely be assumed that almost every canola field in Canada has some plants with the RR gene, whether the fields are planted with RR canola or not.[10]

Although this uncontrollable outcrossing of genetically modified varieties of canola has raised numerous environmental and human health concerns, my focus here is the movement of *patented* genetic materials, which in this case happen to have been genetically modified. The case studies cited deal primarily with Monsanto's Roundup Ready (RR) canola. In Canada the canola plants themselves are not patentable subject matter, and are as such protected by a patent over modified genes (and cells) within the plants that provide their resistance to Roundup. With this patent in hand, Monsanto is able to require farmers to pay a technology use fee in order to obtain a license to legally cultivate RR canola. As is clear from this example, it is impossible to *completely* separate the issues of genetic modification from those of patenting—often, but by no means always, it is precisely these *modified* genes within a plant that are either the subject or the basis of a patent claim. The focus of this paper, however, is the specific dimensions of the interface between patent law and agricultural plant genetic resources, whether or not the plants have been genetically modified. This interest picks up on legal and philosophical concerns, but is also responsive to farmers' concerns in Canada, which, as I discovered in interviews in June 2008, often center less on the potential dangers of genetically modified crops and more on the patents that accompany them. Areas of contention include farmers' autonomy and the right to save seed as well as, in some cases, concerns about plants with unlicensed, patented gene sequences growing anonymously in their fields.[11]

Leaks, Dirt and Other Undesirables

Following Mary Douglas,[12] and in particular Elizabeth Grosz's reading of Douglas in *Volatile Bodies: Toward a Corporeal Feminism*, we may think about these transgressive movements as "leaks" of plant genetic material. The notion of "leakiness" in Grosz's work links up closely with Douglas' notion of "dirt." In her examination of pollution and taboo, Douglas offers an account of "dirt" as that which threatens the stability of established order by failing, or refusing, to fit neatly into given social structures.

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[7] Marvier and van Acker, "Can Crop Transgenes Be Kept on a Leash?," p. 100.
[8] Seed lots are certified crops grown specifically to produce the seed that farmers and others use to plant their field crops.
[9] Lyle F. Friesen, Alison G. Nelson, and Rene C. van Acker, "Evidence of Contamination of Pedigree Canola (Brassica Napus) Seed lots in Western Canada with Genetically Engineered Herbicide Resistance Traits," *Agronomy Journal*, Vol. 95, 2003.
[10] Devlin Kuyek, "Stolen Seeds: The Privatization of Canada's Agricultural Biodiversity," research paper published by *The Ram's Horn*, on behalf of the Forum on the Patenting of Life, January 2004.
[11] See also Mauro and McLachlan, "Farmer Knowledge and Risk Analysis."
[12] Mary Douglas, *Purity and Danger: An Analysis of Concepts of Pollution and Taboo* (London and Henley: Routledge and Kegan Paul, 1969).

> As we know it, dirt is essentially disorder. There is no such thing as absolute dirt: it exists in the eye of the beholder… Dirt offends against order. Eliminating it is not a negative movement, but a positive effort to organize the environment.[13]

Grosz picks up this notion of "dirt," alongside Julia Kristeva's work, in her exploration of the body, and in particular the formation of "clean" or "proper" bodies within given social contexts. In part, here Grosz is interested in body fluids and the way in which they seep and leak, refusing any notion of absolute control. In both Douglas' and Grosz's work, it is clear that leaks are not politically neutral. How it is that a leak comes to be rhetorically structured as a leak is a vitally important issue. Ultimately, which flows are characterized as undesirable or problematic (and therefore classed as "leaks") is highly dependent on broader social structures and systems of meaning.

My use of the concept of leaks in this paper picks up on Grosz's general theme of substances out of place: movements of seed and pollen that cannot be controlled, that refuse to conform to established social—or in this case legal—systems and structures. Prior to the introduction of intellectual property (and genetic modifications) into Canada's canola fields, these uncontrollable movements of pollen and seed by wind, insects, and a variety of other vectors would not have raised any problems. In fact, such gene flows have introduced genetic variability and thus adaptability into crops for thousands of years. In the context of the dominant intellectual property system, which seeks to regulate gene movements in order to create the possibility of a new kind of property, gene flows that would otherwise pollinate and introduce diversity into crops (albeit unwanted diversity in some cases), have been re-characterized as transgressive and illegitimate movements, as leaks that are undesirable, uncontrollable, and ultimately illegal.

While seed and pollen are the vehicles for gene flow in an agricultural context, the foundation of intellectual property actually lies in its attempt to regulate flows of *intangible* informational resources. In the context of biopatents, this does not mean that genes do not have a physical component, but rather that it is their informational dimension that is technically owned within contemporary frameworks of use and property. As Sabrina Safrin has put it:

> While genes have a tangible component (i.e., a miniscule combination of chemicals), they share more in common with an intangible good like information than they do with a typical tangible resource like oil. What holds value and is really being sought is not so much a particular physical cell as the information, the blueprint, contained in that cell and, in fact, in millions of similar cells.[14]

In particular, when it is the informational components of genetic materials that are being valued, they share two key characteristics with other intangible goods that often makes their regulation so difficult—specifically, they are "non-rivalrous" and "non-excludable" in use.[15] Being non-rivalrous means that one person's use of the good does not interfere with another's ability to simultaneously make use of it, while being non-excludable means that it is impossible, or at least very difficult or costly, to allow some people to use a good while excluding others.[16] In the context of genetic materials, while one can quite easily exclude a person from the use of a specific tangible genetic sequence, for example by locking it away, and one person's use of that tangible genetic material is rivalrous with another's, when it is their *informational* components that are

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[13] Douglas, *Purity and Danger*, p. 2.
[14] Sabrina Safrin, "Hyperownership in a Time of Biotechnological Promise: The International Conflict to Control the Building Blocks of Life," *The American Journal of International Law*, Vol. 98, 2004, p. 664.
[15] Peter Drahos, "The Regulation of Public Goods," *Journal of International Economic Law*, Vol. 7, No. 2, 2004, p. 324.
[16] *Ibid.*; Keith E. Maskus, "The Globalization of Private Knowledge Goods and the Privatization of Global Public Goods," *Journal of International Economic Law*, Vol. 7, No. 2, 2004.

valued, genetic resources become fundamentally non-excludable and non-rival in use, since the information is amenable to mass copying, replication, and widespread transmission and dissemination.[17]

The enrollment of genes into IP regimes, however, provides a means of exclusion through the granting of a limited monopoly. The introduction of precisely these restrictions on whom can and cannot use these resources transforms them into objects of private property. In the absence of IP, when farmers purchase a seed, they are automatically entitled to make use of its genetic material for as many generations of planting as they like. Simplistically, intellectual property might be understood as a way to legally separate the seed/plant from its genetic components, thus making it possible to allocate property in the latter to another individual. Within the context of IP law, these genetic components are understood as an informational or intangible resource and are not limited to any specific tangible manifestation. As such, once issued a patent, the patent holder is not just entitled to a claim over the actual physical sequence/s that the patent holder has worked with. The patent grants a property right over every instantiation of that genetic information which exists in a whole host of organisms with which the patent holder has never come into contact.[18] But how can property be allocated in this way if the movement and consequently the use of these resources cannot be controlled?

Drawing on Douglas and Grosz, it is useful to consider how these substances out of place challenge the stability of the systems and structures that fail to contain them. What do leaks reveal about the plant bodies and the legal categories out of and into which they are flowing? In this context, what might the distinction between the material and the immaterial or "informational" aspects of plants *and* the leakiness of plants and their seed systems show us about the feasibility of IP regimes in securing discrete objects of private property? The various leaks that occur both in the human management of seed and through the cross-pollination of plants reveal a set of deep problems in the application of IP—and in particular the patent system—to agricultural genetic resources.

Of Mice and Plants: Biopatents in Canada

In one of the very few rulings of its type in a senior court in an industrialized country, the Supreme Court of Canada captured a part of this "leaky" problem in its 2002 ruling in Harvard College v. Canada (2002 SCC 76). Although this case was not explicitly concerned with canola or even plants, it set the background against which the patenting of organisms and their genetic materials in Canada must be understood, while also raising and addressing some of the central problems associated with these patents. This important ruling established that OncoMouse—and ultimately all higher life forms, including plants—are *not* patentable subject matter in Canada.[19] The reasoning of the 5-4 majority in this case centered on the view that in the Patent Act, Parliament had provided an exhaustive definition of patentable subject matter, and in so doing had limited the kinds of inventions that might be patented to the following: arts, processes, machines, manufactures, and compositions of matter. Higher life forms, the Court reasoned, are not conventionally considered to fit within any of these categories. While there is the possibility that they might be thought of as either "manufactures" or "compositions of matter"—as they

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[17] Carolina Roa-Rodríguez and Thom van Dooren, "The Shifting Common Spaces of Plant Genetic Resources in the International Regulation of Property," *The Journal of World Intellectual Property*, Vol. 11, No. 3, 2008.
[18] Safrin, "Hyperownership in a Time of Biotechnological Promise," p. 664.
[19] How to define "higher life forms" and distinguish between them and "lower life forms" is just one of the many problems that this ruling raises.

have been in the U.S. and elsewhere—the Court ruled that both of these terms imply a far higher level of human involvement and control than is present in the growth of even genetically modified plants and animals. The Court did, however, accept that lower life forms, isolated parts of higher life forms, and even life forms at earlier stages of development (e.g., a one-cell mouse egg), were most likely patentable.

A central part of the majority's reasoning in this case was that Parliament had not intended the Patent Act to cover plants and animals at the time of its drafting. The Court acknowledged that due to the very nature of innovation, the Act must be able to be utilized to cover inventions not foreseen by Parliament. Nonetheless, the majority argued that the unique issues raised by the patenting of higher life forms and the failure of the Act to adequately speak to these issues meant that higher life forms should not be patentable until more detailed and specific direction had been provided by Parliament. Interestingly, in pointing to the unique issues raised by the patenting of higher life forms, the primary examples offered by the Court centered on agricultural plants. Drawing on Marceau J.A.'s observation in *Pioneer Hi-Bred* (F.C.A.) that more specialized legislation is required for plants than the Patent Act provides, the majority argued that:

> The patenting of higher life forms raises special concerns that do not arise in respect of non-living inventions. Unlike other inventions, biologically based inventions are living and self-replicating (§167).

The majority drew on the Canadian Biotechnology Advisory Committee's (CBAC) 2002 report, "Patenting of Higher Life Forms and Related Issues: Report to the Government of Canada Biotechnology Ministerial Coordinating Committee."[20] According to the CBAC, patents on plants and animals—which would automatically cover the organism's progeny—are problematic because these "inventions" are capable of reproducing on their own. The majority of the Supreme Court agreed with this view, adding that it must be recognized that plants and animals will not always reproduce under the control or even with the knowledge of those people who raise them.[21] They went on to point out that:

> Patent law does not currently require a patent holder to prove that an alleged infringer knew or ought to have known about the reproduction of a patented invention. An "innocent bystander" may therefore be faced with high costs to defend a patent infringement suit and an award of damages for infringement without a countervailing remedy against the patent holder (§172).

This concern with the self-replicating nature of living, breathing, reproducing "inventions" recognizes their "leakiness."

This Supreme Court ruling is, however, something of an exception among industrialized nations which have, by and large, allowed for the patenting of all biological organisms except human beings.[22] In addition to this domestic legal context, at an international level the harmonization of intellectual property through the World Trade Organization (WTO), and in particular its Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), has greatly diminished the power of individual nations to make these kinds of exclusions from the

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[20] CBAC, "Patenting of Higher Life Forms and Related Issues—Report to the Government of Canada Biotechnology Ministerial Coordinating Committee," Canadian Biotechnology Advisory Committee, 2002.
[21] There is no reasoning in the Supreme Court's ruling to explain why these problems would be limited to higher organisms. In fact, patents on genes and cells (both considered to be "lower life forms") have raised precisely these issues for farmers.
[22] Koo, Nottenburg, and Pardey, "Plants and Intellectual Property." Human genetic sequences and other "parts" are patentable subject matter in most industrialized countries, including Canada.

sphere of patentability.[23] However, even in a Canadian context, this ruling is somewhat unique. The exclusion from patentability for higher organisms that it "created," very quickly became an exclusion in name only, particularly after the Court issued its ruling in another case, Monsanto Canada, Inc. v. Schmeiser (2004 SCC 34).

In this case, the Supreme Court of Canada established a precedent under which patents on parts of higher organisms (like genes and cells) are interpreted in such a way that they effectively grant patent protection over the whole organisms that contain them.[24] The background to this case is that Canadian farmer Percy Schmeiser was sued by Monsanto for patent infringement after canola plants containing Monsanto's patented Roundup Ready (RR) genes were found growing in his fields. Many of the details of this case are unclear or highly contested. Schmeiser, inter alia, claimed not to have planted the RR variety and that the presence of RR genes in his canola fields was either the result of cross-pollination from a neighbor's field or RR canola seed blew onto his land from an uncovered truck passing on the nearby road. The possibility that seed might have blown onto Schmeiser's land represents an example of the leakiness of agricultural *seed systems*. In addition to wind-borne pollination, these kinds of "human induced" comminglings of genetic material—which often occur in the processing, storage, and transportation of seed—offer another route in which genes move in agricultural environments. Stephen Brush writes eloquently about the importance of these kinds of flows—both intentional and unintentional—for the sharing of diversity and the sustainability of farming systems, in particular in (semi)subsistence farming communities.[25] But in an industrial agricultural context, these flows demonstrate the uncontrollably leaky nature of genetic property.

In the Schmeiser case, the Justices of the Supreme Court seem not to have been convinced of Schmeiser's "innocence" in all of these interactions, viewing him as more of an opportunist who may have used the Roundup herbicide in a small number of his canola fields in order to isolate RR plants from which to save seed for future sowing (§62-3).[26] Further, the majority opinion cited the trial judge's finding that "none of the suggested sources [proposed by Schmeiser] could reasonably explain the concentration or extent of Roundup Ready canola of a commercial quantity" found in his fields (§6). This is perhaps an issue that will remain unresolved, with each party giving a different account of events. Schmeiser's lawyer, Terry Zakreski, pointed out to me in an interview that the allegation that Schmeiser intentionally cultivated the RR variety made no sense, because he did not spray Roundup herbicide on his fields and thus received no advantage whatsoever from this highly risky planting strategy.[27] This position is at least partially supported by the majority ruling of the Supreme Court of Canada which notes that despite the presence of the RR plants, no finding has been made that Schmeiser actually used Roundup on his fields to reduce weeds (§104).

Ultimately, both the Federal and the Supreme Courts of Canada deemed it to be unimportant how the canola found its way into Schmeiser's fields. According to Justice McKay of the Federal Court, the fact that Schmeiser saved and replanted seed that he "knew or ought to have known" was Roundup resistant was the only relevant fact. How the plants that he saved the

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[23] Roa-Rodríguez and van Dooren, "The Shifting Common Spaces of Plant Genetic Resources in the International Regulation of Property."
[24] Jeremy DeBeer, "Reconciling Property Rights in Plants," *The Journal of World Intellectual Property*, Vol. 8, No. 1, 2005, pp. 10-11.
[25] Stephen B. Brush, "Farmers' Rights and the Protection of Traditional Agricultural Knowledge," CGIAR Systemwide Program on Collective Action and Property Rights, Working Paper No. 36, 2005, pp. 5-6.
[26] In contrast to this finding, Schmeiser himself claims that he had over many years developed his own locally appropriate variety of canola and that contamination by Monsanto's Roundup Ready plants destroyed this variety.
[27] Author interview with Zakreski, June 3, 2008.

seed from came to be Roundup resistant in the first instance was "really not significant for the resolution of the issue of infringement" (2001 FCT 256, §119-120). In its finding, the Supreme Court gave no in-depth consideration and passed no real judgment on how the plants in Schmeiser's fields came to be Roundup Ready, or even whether he knew or ought to have known about them. They started from the simple fact that Schmeiser cultivated and sold plants that were tested and found to contain Monsanto's patented gene and cell. In the words of the Majority: "we are not concerned here with the innocent discovery by farmers of 'blow-by' patented plants on their land … Our sole concern is with the application of established principles of patent law to the essentially undisputed facts of this case." (§2-3.)

This lack of concern for the origin of the patented genetic material is perhaps an example of precisely the problem that the Court articulated two years earlier in Harvard College v. Canada. There, as noted above, the Court pointed out that inventions that replicate and spread beyond the control of their owners might cause an "innocent bystander" to be caught up in a patent infringement suit, especially since patent law does not require that an alleged infringer deliberately or even knowingly infringe. It therefore makes no difference to the issue of infringement whether Schmeiser actively cultivated the plants or they spread into his fields through wind, a passing truck, or a mix-up or contamination of the seed he planted.

Research that highlights the widespread contamination of both farmers' fields and certified seed lots by transgenic (and, more importantly for our purposes, *patented*) canola was already going on at the time of Schmeiser's trial. Despite this fact, Terry Zakreski, Schmeiser's lawyer, recalls that it was very difficult to convince the Court that these crops might be spreading around in an uncontrolled manner.[28] Only a couple of years later in another case involving RR canola was this kind of contamination readily accepted as inevitable by all parties. In this case, Hoffman v. Monsanto Canada, Inc. (2005 SKQB 225), Zakreski represented the Saskatchewan Organic Directorate (SOD) in a class action lawsuit on behalf of all organic canola farmers in the Canadian province of Saskatchewan against Monsanto and Bayer Crop Sciences. SOD alleged that GM contamination had made it impossible to produce certified organic (GM-free) canola in the province and that the respondents should be accountable for undermining the business opportunities of local organic farmers.

In the Hoffman case, contra Schmeiser, Monsanto's own position was that GM contamination—or "adventitious presence"—was "not only foreseeable but inevitable, given the open-pollinating nature of canola." (§ 63.) In this case, however, the Court found that Monsanto and Bayer could not be held accountable for any damage to organic farmers, in part because the unconfined commercial release of the crops had government approval. This ruling has given rise to a substantial body of legal commentary that argues, in light of the combined implications of Schmeiser and Hoffman, that biotechnology companies now possess all of the *rights* of a property holder in relation to genetic materials, but none of the *responsibilities*.[29]

The fact that Monsanto's and other biotech companies' genetic property is leaking into farmers' fields and broader agricultural seed systems creates a situation that raises clear problems for the rest of Canada's—and indeed the worlds'—farmers, especially those who farm open-

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[28] *Ibid.*

[29] Jeremy DeBeer, "The Rights and Responsibilities of Biotech Patent Owners," *UBC Law Review*, Vol. 40, No. 1, 2007; Jane Matthews Glenn, "Footloose: Civil Responsibility for GMO Gene Wandering in Canada," *Washburn Law Journal*, Vol. 43, 2004; Martin Phillipson, "Giving Away the Farm? The Rights and Obligations of Biotechnology Multinationals: Canadian Developments," *King's Law Journal*, Vol. 16, No. 2, 2005.

pollinated crops like canola. What might we learn about the patent system by thinking about these leaks with Douglas and Grosz?

The Embodiment of Intellectual Properties

For both of these theorists, leaks of this kind expose important realities about the categories and systems out of which they trickle (or in this case flood). Douglas claims, for example, that:

> ideas about separating, purifying, demarcating and punishing transgressions have as their main function to impose system on an inherently untidy experience. It is only by exaggerating the difference between within and without, above and below, male and female, with and against, that a semblance of order is created.[30]

In the context of genetic resources, what are the insides and the outsides? What is leaking, and where is it going?

As noted above, IP in plant varieties and genetic material is fundamentally grounded in a claim over an intangible or intellectual resource. The holder of an IP right is then entitled to a claim over the physical instantiations of this object—in this case, usually genes and cells.[31] While this situation may make sense in other areas (although it arguably still produces deeply inequitable outcomes), in the case of IP protection over living organisms which are necessarily involved in exchanges of precisely these now proprietary "resources" for their survival, important problems arise. As the Supreme Court of Canada pointed out in relation to higher life forms, some of these problems center on uncontrolled self-replication and spreading. What the Court failed to acknowledge or address, however, was the fact that these problems are not limited to patents on higher life forms—a situation that their own ruling in Schmeiser makes all too clear. Here, despite the fact that the plant itself was not (technically) patented, the spread of patented cells and genes had precisely the same effect. In simple terms, living, breathing, reproducing "inventions" of all sizes are very often not controllable to the same extent that other objects of IP are—especially when they are sold and used commercially by farmers. While a book or DVD that is the subject of a copyright will not copy itself or produce an adaptation of itself in company with some other book or DVD (thus mixing up IPs), this is precisely what organisms do for their survival—especially "highly promiscuous" open-pollinated plants.

This leakiness, which has allowed Monsanto's RR genes to move between different farmers' fields, must remind us of the necessarily embodied, material nature of this kind of supposedly intangible property. Grosz offers us an interesting way of thinking about these movements when she writes (in a very different context):

> Body fluids flow, they seep, they infiltrate; their control is a matter of vigilance, never guaranteed. In this sense, they betray a certain irreducible materiality; they assert the priority of the body over subjectivity; they demonstrate the limits of subjectivity in the body, the irreducible specificity of particular bodies. They force megalomaniacal aspirations to earth…[32]

Grosz is focused here on undermining conventional Western notions of subjectivity that center on a disembodied (or even brain-centered) notion of mind or consciousness. In contrast to these

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[30] Douglas, *Purity and Danger*, p. 4.
[31] Rebecca Eisenberg, Andrew Marks, and George Annas, "Molecules vs. Information: Should Patents Protect Both? (Symposium on Bioinformatics and Intellectual Property Law)," *Boston University Journal of Science & Technology Law*, Vol. 8, 2002.
[32] Grosz, *Volatile Bodies*, p. 194.

positions (and here drawing explicitly on Douglas), she argues that the uncontrollable leakiness of the body, its unwillingness to do as it is told, does not display the absolute separation of self from body, but must rather humble subjectivity and force an acknowledgement of our necessary and often uncontrollable corporeal being. Who we are as individuals and how our subjectivity is formed and shaped is in no small way informed by these fleshy bodies that are by no means within our control.

As with Grosz's leaky bodies, an acknowledgement of the way in which genetic resources leak into each other in uncontrollable ways reminds us of the necessary materiality (or "embodiment") of the supposedly intangible objects of genetic property that are being divided up for ownership all over the world.[33] It reminds us, as Cressida Limon has put it, that "patent law needs a body: an invention to be an invention must be embodied in some material form."[34] This is a fundamental requirement of patent law. In Drahos' terms:

> The corporeality of intellectual property is, legally speaking, never very far away and manifests itself in various requirements which impose a condition of materiality on the abstract object … At some point before property rights attach to the abstract object, the various different regimes of intellectual property law require some kind of "corporealization" of the abstract object.[35]

And yet, surprisingly little consideration has been given to the specificity of these patented bodies, to what N. Katherine Hayles has called the "materiality of informatics." With the term "informatics" Hayles means to mark the "material, technological, economic, and social structures" within which information is produced, translated, transformed, and transported in the "information age."[36]

Thinking with Hayles requires us to reflect in more corporeal terms on all of the diverse "informational" goods with which we interact today. In this case, this kind of thinking requires that we acknowledge the very real material differences between the way in which a mousetrap (which embodies its design or invention) operates in the world and the way in which a mouse, a plant, or even a gene or a cell *lives*, *reproduces*, *and dies.* These differences *make a difference*. While genes can often be made to look like distinct objects of property on paper (at least for the courts and patent offices), the kinds of leaks going on in fields and seed systems all over the world undermine this simplistic logic. These objects of property are necessarily vested in material bodies that will not be purified and separated from each other for the sake of convenient—and profitable—human property regimes. In short, as Douglas argues, these kinds of leaks expose the contingent and "impure" nature of the categories around which various social systems are structured.

How to Hold on to Leaky Property

In addition to challenging the distinction between intangible property and the actual organisms, genes, and cells that provide its body, these genetic leaks also speak to the impossibility of isolating genetic information as a discrete object of *private property*. These leaks create a situation in which private property is "going public," mixing itself indiscriminately with

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[33] Bronwyn Parry, *Trading the Genome: Investigating the Commodification of Bio-Information* (New York: Columbia University Press, 2004), p. 84.
[34] Cressida Limon and Thom van Dooren, "Biopatents: New Properties of Parts and Wholes," paper presented at Bio[X]: New Iterations of Lively Bodies, University of California at Santa Cruz, February 23, 2007.
[35] Peter Drahos, *A Philosophy of Intellectual Property* (Aldershot, England: Dartmouth, 1996), pp. 21, 153.
[36] N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago & London: The University of Chicago Press, 1999), p. 313.

genetic resources that are either owned by another individual or constitute part of a broader public domain.[37] The lines between the public domain and various spheres of private property are at stake here. If IP is created through the regulation of information flows, what does it mean for those flows to be uncontrollably leaky, and thus, ultimately, unable to be regulated? Interestingly, the Supreme Court of Canada offers us not one, but two, very distinct and even conflicting answers to this question in the form of the majority rulings in Harvard College v. Canada and Monsanto Canada, Inc. v. Schmeiser.

As previously mentioned, in the Harvard case the majority ruled that OncoMouse was not patentable subject matter. In making this ruling, the court argued that Parliament had not intended the Patent Act to cover higher life forms, including plants. Part of this ruling was based on the view that the definition of a patentable invention in the Act (principally "manufactures" and "compositions of matter") could not be interpreted to cover these organisms. However, the majority also argued that if the Act had been intended to cover these life forms, it would have been better provisioned to do so. Again quoting Marceau J.A.'s observations in Pioneer Hi-Bred (F.C.A.), the majority pointed out that more specific forms of IP—like Plant Variety Protection (PVP)—offer a better way of addressing some of the unique characteristics of higher life forms (principally their self-replication). Plant Variety Protection systems are an alternative form of intellectual property that was initially developed in the 1960s and early 70s specifically for cultivated plants. These systems are more appropriate than patents in an agricultural context, because they have traditionally included a farmers'/gardeners' exemption, which allows farmers to save seed from protected plants for their own use as long as they do not sell it commercially as seed. As the majority noted in this case, this exemption would overcome many of the "innocent bystander" issues that arise from biopatents. In this regard the majority referred to the CBAC's recommendation that a "farmers' privilege" provision might be included in the Patent Act in order to better balance the needs of commercial breeders and biotech companies with those of farmers. (§171.)

The majority opinion of the Court in Monsanto Canada, Inc. v. Schmeiser, however, presented a somewhat different position. Although the origin of the Roundup Ready plants in Schmeiser's fields is contentious, it is clear that: a) genes from patented genetically modified canola and other plants are leaking onto farms in Canada and elsewhere, and b) how these genes get onto a farmer's land is immaterial for the resolution of a patent infringement claim. What is perhaps most interesting about this specific case, however, is the way in which the Court dealt with this leakiness. Here, leaks did not dissipate Monsanto's property, but rather, allowed it to expand to take in what had previously been other peoples' property. Schmeiser's argument before the Court attempted to make this disparity clear. He argued that according to the law of "admixture," he should not be held accountable for the "adventitious spread of Monsanto's gene."[38] The law of admixture recognizes that—quoting from the judgment of an 1811 Canadian court case—"if a man puts corn in my bag, in which before there is some corn, the whole is mine because it is impossible to distinguish what was mine from what was his."[39] Clearly, in this case, the Supreme Court did not follow this logic. As legal theorist Jeremy DeBeer has argued so forcefully, this is very often the case today. Intellectual property claims are now trumping all

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[37] In the case of genetic resources, it is far from clear that there is a meaningful "public domain" or pool of common resources left after the various regulatory incursions into this space that have taken place over the past several decades. There is, however, a "less-proprietary" space that after the 1992 Convention on Biological Diversity is dominated by the sovereignty claims of nation states. I have explored this situation in far greater detail elsewhere. See Roa-Rodríguez and van Dooren, "The Shifting Common Spaces of Plant Genetic Resources in the International Regulation of Property."

[38] DeBeer, "Reconciling Property Rights in Plants," p. 11.

[39] *Ibid.*

manner of public usage rights and other classical property rights (like Schmeiser's property in his tangible plants and seeds). Mixture now constitutes patent infringement, and these other rights are simply being lost or ignored as viral patented genes leak freely into other spaces—both public and private.[40] There is a strong similarity with some projects of colonization in this dynamic in which every movement is a movement into *empty* land.

In these two cases the highest court in Canada seemingly offered two very different resolutions to the leakiness of genetic property. In noting the lack of provision for innocent bystanders and farmers' rights in the Patent Act, and pointing to the fact that PVP systems are better equipped to manage intellectual property rights in plants than the patent system, the majority in Harvard College v. Canada offered one way of addressing the leakiness of agricultural genetic property. In short, a different form of IP or changes to the patent system might create a situation in which farmers (and others) are not unfairly disadvantaged by the leakiness of other peoples' genetic property. This is a suggestion that merits further consideration as it offers the possibility of a more equitable balance between the rights of inventors on the one hand and farmers, consumers and "the public" on the other.

Unfortunately, however, the Court's ruling in Monsanto Canada, Inc. v. Schmeiser represents a far more common response to the adventitious spread of patented genetic material. Here, leakiness is ignored; a patent system that was developed for cogs and machinery is clumsily applied in a way that fails to acknowledge the real world embodiments and entanglements of genes, cells, plants, and people. Grosz, drawing on Douglas, argues that it is by precisely this kind of ignoring—or the attempt to prevent and ultimately *punish* the leakiness that gives rise to substances out of place ("dirt")—that social systems, structures, and bodies present themselves as coherent, proper, bordered, and controlled.[41] In addition to exposing the contingency of social systems, therefore, it is important to also note that leaks provide an opportunity for these systems to *reassert themselves through the punishment of transgression*.[42]

In the Schmeiser case, while genetic leakiness has highlighted the incoherence of the patent system as it applies to genetic resources, Schmeiser's punishment has also forcefully reasserted the strength and authority of IP in these agricultural domains. Thus, this lawsuit and others like it now play a significant role in the way in which some farmers are approaching seed purchasing and saving. In a situation in which genes are clearly leaking and farmers that have them on their land (even unknowingly) are being successfully sued for patent infringement, the only realistic recourse for farmers is to either give up farming altogether,[43] or stop saving their own seed and instead purchase it anew each season.[44] North Dakota soybean farmer Rodney Nelson, for example, has argued that biotech companies are deliberately creating a situation in which farmers are too scared to save their own seed:

> We feel that we were profiled by Monsanto because of the size of our farm and that they wanted to try to make an example of us to scare other farmers into never saving their own seed—to be too scared to save their own seed—and that's happening.[45]

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[40] *Ibid.*
[41] Grosz, *Volatile Bodies*, p. 201.
[42] Douglas, *Purity and Danger*, p. 4; Grosz, *Volatile Bodies*, p. 201.
[43] Keith Aoki, "Weeds, Seeds and Deeds: Recent Skirmishes in the Seed Wars," *Cardozo Journal of International and Comparative Law*, Vol. 11, 2003, p. 297.
[44] DeBeer, "Reconciling Property Rights in Plants," p. 13.
[45] Deborah Koons Garcia, *The Future of Food*, Lily Films, U.S.A., 2004.

Although there are no figures available on changes to farmers' seed-saving practices in light of these legal developments, it is clearly possible that the leakiness of Monsanto's property may ultimately become a dominant factor in forcing farmers to abandon the development of their own plant varieties.[46]

While interviewing farmers in Canada, I heard a third-hand story about another farmer who had previously cultivated Monsanto's RR canola but later decided to grow a conventional variety instead. According to the story, this farmer was approached by a Monsanto agent and asked why he had not paid his technology use fee to the company. When he explained that he had planted a conventional variety this year, the agent reminded him that there were bound to be RR "volunteers" in his field from previous years, and that he should pay the fee soon to avoid testing and possible prosecution.[47] I heard this story third-hand, so there is no way to guarantee its accuracy. Nevertheless, the legal and agronomic environment that has developed in Canada makes these kinds of threats and actual litigation a plausible concern for farmers.

But genetic leaks also present *promises* for those interested in the fair allocation of property and farmers' rights to save, and perhaps even share, seed. Although these leaks have been profitably used by Monsanto to reinforce the role of the patent system in agricultural genetic resources, they could be used to challenge this system. Drawing popular attention to these leaks and Monsanto's profiting from them might, for example, expose both the failures and the inequities that biopatenting regimes systematically produce. In addition, by accentuating and perhaps even actively cultivating legal spaces within which these leaks can occur, we might help to undo some of the imbalances currently produced by biopatenting regimes.

Promises: Exploiting "Authorized Leaks"

Farmers' and breeders' exemptions in various Plant Variety Protection (PVP) systems and the notion of Farmers' Rights that has been outlined in some United Nations agreements and elsewhere have the potential to create a space in which "other people's" genetic property is made available for (limited) general use. Here, private property leaks over into the public domain—in the form of usage rights—in a manner that is authorized by international and some national legal structures. These kinds of leaks challenge the simplistic conceptual divide between the "public" and the "private." They represent a "murky" space in which objects of property are neither fully in nor out of the public domain.[48]

The concept of Farmers' Rights was first outlined by the Food and Agriculture Organization of the United Nations in 1989 in Resolution 5/89 of the International Undertaking on Plant Genetic Resources. According to this Resolution, Farmers' Rights are:

> … rights arising from the past, present and future contributions of farmers in conserving, improving, and making available plant genetic resources, particularly those in the centers of origin/diversity.

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[46] In the specific case of canola in Canada, however, the very rapid adoption of GM varieties along with the fact that many farmers have not traditionally saved canola seed (because it takes so little of it to seed an acre) has perhaps meant that this legal situation has not raised as much of an issue as it might otherwise have.

[47] For a discussion of the high levels of volunteers in farmers' fields several years after planting, see Mauro and McLachlan, "Farmer Knowledge and Risk Analysis."

[48] Pamela Samuelson, "Mapping the Digital Public Domain: Threats and Opportunities," *Law and Contemporary Problems*, Vol. 66, Winter/Spring, 2003.

These systems are an attempt to balance some of the excesses of IP so that farmers might continue as stewards and providers of genetic resources. Farmers' Rights could allow them to save, multiply, share, and perhaps even sell seed from their crops.[49] Unlike the rights granted to IP holders, however, these Farmers' Rights systems do not imply any form of exclusivity that would allow rights holders to prevent others from making use of these genetic resources. While Farmers' Rights systems do not fundamentally challenge many of the problems inherent in the allocation of patents in genetic resources, they could redress some of the imbalances.[50]

The second "authorized leak" from the private to the public domain that might be further exploited is provided for in the farmers'/gardeners' and breeders' exemptions in some Plant Variety Protection (PVP) systems. The major international agreement on PVP is the 1961 International Convention for the Protection of New Varieties of Plants (UPOV). While these exemptions have been greatly undermined in subsequent revisions of the convention and are under increasing attack,[51] where they are still operative, they allow farmers and breeders the freedom to save, reuse, and breed from seed that is protected under a PVP regime. In general, however, these exemptions do not allow farmers to exchange seed of a protected variety with another farmer. UPOV Article 14.1(a) expressly limits rights to the "selling or other marketing" of a protected variety to the PVP holder and may well prevent any significant exchange of protected varieties between farmers.[52]

Farmers Rights and the exemptions in PVP regimes may offer some limited additional options for farmers. The precise form they are able to take now and into the future is, however, far from clear. While the kinds of exemptions created by these "authorized leaks" are in some ways modest, they must be understood within the broader economic context in which biopatents operate today. As of 2005, ten companies own approximately 50 percent of the global commercial seed market, with Monsanto occupying the number one position.[53] Many of these same companies also completely dominate the agro-chemical and biotech seed industries.[54] This consolidation within and across various sectors of the agricultural inputs market has been very good for business. In addition to reducing competition, this kind of integration has enabled companies to create "synergies" between their various products and subsidiaries, effectively tying the use of one product to that of another.[55] The patent system—as applied to genetic resources, but also to chemicals and processes—has been instrumental in these changes. However, this consolidation—alongside increased cooperation between agricultural inputs companies and food processors—has reduced both farmers' choices and their profits.[56]

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[49] Carlos M. Correa, "Options for the Implementation of Farmers' Rights at the National Level," T.R.A.D.E. Working Papers (South Centre), Vol. 8, 2000, p. 9.
[50] This situation is discussed above. Also see Thom van Dooren, "Inventing Seed: The Nature/s of Intellectual Property in Plants," *Environment and Planning D: Society and Space*, Vol. 26, No. 4, 2008.
[51] Rene Salazar, Niels Louwaars, and Bert Visser, "On Protecting Farmers' New Varieties: New Approaches to Rights on Collective Innovations in Plant Genetic Resources," CGIAR Systemwide Program on Collective Action and Property Rights (CAPRi), Working Paper #45, 2006.
[52] Barton, et al., "Integrating Intellectual Property Rights and Development Policy," p. 63; Salazar, Louwaars, and Visser, "On Protecting Farmers' New Varieties," p. 15.
[53] ETC Group, "Global Seed Industry Concentration," *Communiqué*, Vol. 90, 2005, p. 2.
[54] John L. King and David Schimmelpfennig, "Mergers, Acquisitions, and Stocks of Agricultural Biotechnology Intellectual Property," *AgBioForum*, Vol. 8, No. 2&3, 2005; Irene Musselli Moretti, "Tracking the Trend Towards Market Concentration: The Case of the Agricultural Input Industry," United Nations Conference on Trade and Development, 2006, p. 3.
[55] Musselli Moretti, "Tracking the Trend Towards Market Concentration," p. 5.
[56] Fred Magdoff, John Bellamy Foster, and Frederick H. Buttel (eds.), *Hungry for Profit: The Agribusiness Threat to Farmers, Food, and the Environment* (New York: Monthly Review Press, 2000).

Despite this fact, many farmers continue to support these "developments." Almost all of the Canadian canola farmers with whom I spoke in mid 2008 supported many aspects of the current restrictive IP environment, seeing them as an essential accompaniment to the development of new plant varieties—which, in turn, they see as essential to keeping Canadian farming competitive. While I do not necessarily agree with either this evaluation of the situation or their response to it, it is the means by which many farmers see themselves staying afloat in a difficult economic environment. While many farmers in Canada and elsewhere continue to rely on this agricultural research and development, in the current situation the best that can be hoped for is an IP system that delivers a *fair* compromise between their needs and those of the agricultural biotech corporations doing the R&D. It is worth noting that while the Canadian canola farmers often said they supported IP regimes, this support was in all cases highly qualified. In particular, many were concerned that the "balance" between the biotech companies' needs/profits and their own was not quite right. While the odds are clearly stacked against farmers—especially in this climate of consolidation—the cultivation of authorized leaks might allow more of a "fair balance" to be achieved; at the very least, it would significantly address the issue of "innocent bystanders" raised by biopatent regimes.

Not Quite Property

Both Farmers' Rights and the exemptions within PVP systems problematize any notion of an "absolute" or completely discrete *object of genetic property*. They both allocate to farmers (and in some cases breeders) the "right" to make use of what has been deemed to be another person's property. In so doing, they overcome some of the disparities inherent in the attempt to enforce the ownership of "leaky property"—in particular the problem of innocent bystanders.

Neither Farmers' Rights nor the exemptions in PVP systems are property rights as such. Rather, they are exemptions created within the dominant IP system. Like the benefit sharing agreements that Cori Hayden has discussed, these provisions exist in "the space between (not-) rights and 'what is right.'"[57] In other words, they are largely constructed and issued not as real entitlements to which farmers have a strong "right" (like a property right), but rather as something more akin to charity, as "the right thing to do"—admittedly, a very weak position in the current context in which only strongly individualized liberal right-holding subjects are really taken seriously.[58]

The notion of an "authorized leak"—with its simultaneously legitimate and transgressive flavor—captures the ambivalence of this position well, marking both a curiosity and a suspicion about this kind of "entitlement" that is not a "right" per se. This is a suspicion we are entitled to entertain, especially in the current context in which the exemptions within PVP regimes have been systematically undermined in recent versions of UPOV, and may be further undermined in the near future.[59] Additionally, almost two decades after the notion of Farmers' Rights was first introduced in an *international* context, it is still largely a rhetorical concept[60]—much like the "benefit sharing" systems of the 1990s.[61] Meanwhile, the private property regimes that were

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[57] Cori Hayden, "Taking as Giving: Bioscience, Exchange, and the Politics of Benefit-Sharing," *Social Studies of Science*, Vol. 37, No. 5, 2007, p. 747.
[58] Rosemary J. Coombe and Andrew Herman, "Rhetorical Virtues: Property, Speech, and the Commons on the World-Wide Web," *Anthropological Quarterly*, Vol. 77, No. 3, 2004.
[59] Salazar, Louwaars, and Visser, "On Protecting Farmers' New Varieties," p. 15.
[60] Brush, "Farmers' Rights and the Protection of Traditional Agricultural Knowledge," p. 32.
[61] Santiago Carrizosa, et al. (eds.), *Accessing Biodiversity and Sharing the Benefits: Lessons from Implementing the Convention on Biological Diversity* (Gland, Switzerland: International Union for the Conservation of Nature, 2004).

established alongside these "not-rights" have continued to be broadened and strengthened in both global and national contexts.[62]

Nevertheless, the exemptions under PVP and Farmers' Rights systems may be the best alternative currently on offer to restrictive biopatenting regimes. As such, working to expand these "authorized leaks" is an important project. Working within the PVP framework is likely to be largely defensive and might include protecting existing exemptions as well as the role of PVP systems more generally, which some scholars argue are now becoming outdated and perhaps even obsolete in the face of expanding biopatent regimes.[63]

Moving in this direction towards property regimes that make allowances for the inevitable movements of genes makes good sense not just for farmers, but arguably also for the future of agricultural biotechnology. As it stands, biotechnology has become far too tightly coupled to the patent system. This configuration undermines the potential benefits that biotechnological developments might one day produce for farmers and the environment (through the financial and other barriers that patents introduce into research and development), as well as providing an additional site of activist opposition to these technologies through critiques of the "patenting of life." Personally, I don't think that the "developments" thus far commercialized by agro-biotech firms come even close to justifying the additional risks that they introduce. The primary return each product seems to make is to shareholders. Nonetheless, I do believe that this technology deserves consideration as a possibility that might, or at least could, exist outside of its current highly commercialized context in which patent monopolies stifle many developments and adequate testing is arguably not carried out in the race to get new products to market. As Donna Haraway has succinctly put it, "[g]enes for profit are not equal to science itself."[64] I am not at all sure what this alternative configuration might look like. But I am sure that cases like Schmeiser have not only done very little to help produce the kind of open dialogue that we need, they have also greatly polarized the debate and shut many people out of that dialogue—through fear or anger. It is, therefore, *also* for these reasons that the cultivation of alternatives to biopatents is a vitally important project that needs and deserves the support of farmers, plant breeders, biotechnologists, and anyone else who desires a more equitable and sustainable agriculture.

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[62] Sisule F. Musungu and Graham Dutfield, *Multilateral Agreements and a Trips-Plus World: The World Intellectual Property Organization (WIPO)* (Geneva & Ottawa: Quaker United Nations Office [QUNO] & Quaker International Affairs Programme [QIAP], 2003).

[63] Laurence R. Helfer, "The Demise and Rebirth of Plant Variety Protection: A Comment on *Obsolescence in Intellectual Property Regimes*," Vanderbilt University Law School, Public Law & Legal Theory Working Paper, 06-28, Law & Economics Working Paper, 06-31, 2007; Mark D. Janis and Stephen Smith, "Obsolescence in Intellectual Property Regimes," University of Iowa Legal Studies Research Paper, 05-48, 2006.

[64] Donna Haraway, *Modest_Witness@Second_Millenium.Femaleman©_Meets_Oncomouse™: Feminism and Technoscience* (New York and London: Routledge, 1997), p. 62.