1 Introduction

Are cod more like potatoes, or more like cattle? This koan summarizes the puzzle in determining what kind of intellectual property regime is best suited to promoting innovation in new breeds of animals. Continuing innovation in agriculture and aquaculture are essential to feeding the world population with a minimal ecological footprint. The challenge is particularly acute as climate change is altering the environment to which existing plant and animal varieties are adapted. One important aspect of such innovation is improvement in plant varieties and animal breeds in order to increase food production while minimizing land and resource utilization. This article discusses two questions touching on this issue: Is intellectual property (IP) protection necessary in order to encourage innovation in agriculturally and aquaculturally important plants and animals? If so, what kind of intellectual property system is best?

This article focuses in particular on the implications of the increased use of the genomics-enabled animal breeding and plant variety development technique called marker assisted selection. Historically new breeds and varieties were developed using traditional hybridizing through phenotypic selection of mature plants and animals. More recently, genetic modification has resulted in the introduction of wholly new traits, such as herbicide and cold resistance, into plants and animals. Both these techniques have limitations. Traditional hybridizing is slow, while genetic modification is controversial. Marker assisted selection applies genomics techniques to traditional hybridizing, to speed the process of developing new breeds and varieties, while avoiding the controversy surrounding the introduction of traits that are foreign to the species.

For concreteness this article focuses on three examples of commercially important crops and animals currently benefiting from the results of genomics, namely potatoes, cattle and cod. Potatoes are clonally propagated, and IP protection is available for new varieties that are developed through traditional hybridizing. The evidence to date suggests that IP rights have been important in the development of new varieties of potatoes. Cattle are sexually propagated,
and IP protection is not available for new varieties developed through traditional hybridizing. Despite the lack of IP protection, new breed development is quite active. Cod are sexually propagated and new varieties are being developed using marker assisted breeding. The question then is whether cod are more like potatoes, or more like cattle, from an IP perspective.

We begin with a review of the theory of intellectual property rights (IPRs) as applied to agricultural products, and then turn to a description of the existing intellectual property regime in Europe, the United States and Canada. All of these jurisdictions have two IP regimes applicable to higher life forms, namely patents and plant variety protection, but they differ in approach where these regimes intersect. In particular, patent protection is available to new plant varieties in the US, but not in Europe, while Canada has an incoherent approach. The article outlines the issues at stake in deciding whether patent protection should be extended to new plant varieties. We then turn to the issue of IP protection for animals. None of these jurisdictions provides specific protection for new breeds of animals, as contrasted with new varieties of plants.

2 Current IP Regimes for Higher Life Forms

As this overview of IP theory indicates, there can be no general answer to the question of whether IPRs are desirable. The answer depends on the circumstances, not the least of which is the particular form of IPRs which are under consideration. This section provides an overview of the current forms of IP protection available for higher life forms.

It is convenient to begin with a discussion of plants, as this has been the main historical battle ground. There are two main methods of protecting new types of plants in Canada and in most of our major trading partners, including the United States and the European Union, namely patents and plant variety rights.

The Canadian Patent Act (Government of Canada, 1985a) is intended to protect inventions of all types, regardless of the field of technology. To qualify for patent protection, an innovation must satisfy five requirements. It must be new, useful and non-obvious (or “inventive”). These requirements distinguish an innovation from a true invention. The innovation must also be patentable subject matter. Finally, the patent application must “disclose” or “enable” the invention. Part of the patent bargain between society and the inventor is that in return for a legally protected pseudo-monopoly on licensing the invention for the term of the patent, the invention must be made freely available for anyone to use at the end of the term. To enforce this bargain, the inventor is required to describe the invention in terms that will allow any person with the necessary technical skills to make the invention themselves. This is known as “enabling” disclosure. This may seem to be a somewhat technical requirement, but we will see that it was for a long time a key barrier in the way of obtaining patents for higher life forms generally.

In the early part of the twentieth century commercial development of new
plant varieties became increasingly commercially important and pressure grew to protect the fruits of such development (Heitz, 1990). There was doubt as to whether the patent system could be used to protect new plant varieties. There were two main concerns about the patent system. One was the thought that plants were not patentable subject matter. It was thought that since traditional hybridizing is an application of the laws of nature, the result of that hybridization might not be patentable. A second problem was that it was doubtful whether the disclosure requirement could be satisfied. Describing the plant itself would not enable someone else to make the plant, which is what patent law requires. Describing the breeding process would not help either. Because of the random nature of sexual reproduction, a person starting with exactly the same parent plants and following exactly the same steps as the original breeder, will normally end up with a different plant.

The need to protect plant breeders combined with uncertainty about the adequacy of patent protection led a number of countries to respond with intellectual property legislation aimed specifically at plants. These efforts were harmonized and internationalized with the International Convention for the Protection of New Varieties of Plants of 1961. The Convention, initially signed by several European countries, created a Union for the Protection of New Varieties of Plants, generally known under its French abbreviation “UPOV”—L’Union Internationale pour la Protection des Obtentions Végétales (International Union for the Protection of New Varieties of Plants (UPOV), 2010). The 1961 UPOV Convention was amended in 1972, with major revisions in 1978 and 1991. Fifty-six states, including Canada and all of our major trading partners, are now signatory, although a state is only party to the version which was in effect when it joined unless it subsequently adopted a revised version. Canada is currently party to the 1978 Convention and the enabling legislation is the Plant Breeders’ Rights Act (Government of Canada, 1990). Canada has signed the 1991 Convention, however, and consultations on amendments to the Plant Breeders’ Right Act which would permit ratification of the 1991 Convention are currently under way.

In the U.S. the enabling legislation is the Plant Patent Act (United States, 1930), specifically §§161–164 (c. 15) for most asexually reproduced plants, excluding potatoes, and the Plant Variety Protection Act (United States, 1970), specifically §2321 et seq. (c. 57) for all other plants, including potatoes. The U.S. is also party to the 1991 Convention. In Europe the enabling legislation at the Community level is the Council Regulation on Community Plant Variety Rights (European Commission, 1994), as well as national legislation such as the U.K. Plant Varieties Act (United Kingdom, 1997). While the Council Regulation implements the 1991 Convention, some individual European countries are party to an earlier Convention.

Plant variety protection under UPOV of course avoided the subject matter concern about patentability of plants. It overcame the requirement of “enabling” disclosure which had also impeded patent protection for plants by simply abolishing it. The variety must be described morphologically or physiologically or so that a person can know whether a particular plant is protected, but the de-
scription need not enable a subsequent breeder to independently recreate the protected variety. The rationale is that enabling disclosure would inevitably occur when the plant propagating material was sold.

While plant variety protection temporarily relieved pressure for patent protection for plant innovations, the issue was raised with renewed pressure with the advent of genetic engineering. Because it was aimed at protecting the outcome of traditional hybridizing, the UPOV Convention provides that new varieties may—and must—be described at the whole plant level. It protects individual plant varieties, not whole categories of plants (International Union for the Protection of New Varieties of Plants (UPOV 1991), 1991, Art. 1(vi)). In consequence plant variety protection is not adequate to protect the product of genetic engineering. While a genetically engineered variant of an established variety would itself be eligible for protection as a new variety, it would not be practical for an inventor to seek protection for a modification such as herbicide resistance by seeking protection for each variety which might be transformed. Even if the inventor made dozens of individual applications for plant variety protection, the inventor would always be vulnerable to a competitor who chose to implement the modification in yet a different variety.

The concerns about patentability of plants that led to the UPOV Convention were not based upon direct case-law or legislation, but rather on the interpretation put on the Patent Act by various parties. It is only relatively recently, with the advent of genetic engineering, that these concerns have been tested in litigation.

The earliest decisions came in the U.S., and in particular the famous case of Diamond v. Chakrabarty, decided in 1980 (Diamond, Commissioner of Patents and Trademarks v. Chakrabarty, 1980). The particular invention in question was for a genetically engineered bacterium. But in holding that the patent was valid, the U.S. Supreme Court adopted a very broad approach to patentable subject matter, citing the legislature’s admonition that patentable subject matter includes “anything under the sun that is made by man” (Diamond, Commissioner of Patents and Trademarks v. Chakrabarty, 1980). It is now clear in U.S. law that plants, and higher life forms generally, are indeed patentable subject matter. Further, the requirement of enabling disclosure can be satisfied by depositing a viable sample of the propagating material of the plant with an approved depository. The result is that in the United States there is no subject matter exclusion under the Patent Act. In the U.S. a new variety of potato can be protected under the Plant Variety Protection Act, but it can also be protected under the Patent Act, so long as it meets the requirements of novelty, utility and non-obviousness (J. E. M. Ag Supply, Inc v. Pioneer Hi-Bred International, Inc, 2001). The products of genetic engineering can also be protected by patent, either by claiming the cells with the chimeric gene, or by claiming the plant itself.

The approach in Europe is quite different. It is now clear in European law that plants are patentable (European Commission, 1998), but granting protection to the same innovation under both patent law and plant variety protection law is considered to be objectionable “double patenting” (European Commis-
sion 1998, Art. 4(1)(a) and European Patent Office (EPO) 1973, Art 53(b)). The result, in contrast to the U.S. position, is that plant varieties which are protected by plant variety protection cannot also be patented. But when a new characteristic is introduced by genetic engineering, in a process which could be replicated in any number of existing varieties in order to produce new, genetically engineered varieties, the invention is considered to be aimed at the modification itself and not at the new varieties (European Patent Office (EPO), 2000). The net result is that the products of traditional breeding are protected only by plant variety protection, while the products of genetic engineering are protected by patent.

The situation in Canada is more complex and less coherent. In the famous Harvard Mouse case, the invention in question was a mouse which had been genetically engineered to be susceptible to cancer (the “oncomouse” is used in cancer research) (Harvard College v. Canada (Commissioner of Patents), 2002). The Supreme Court of Canada held that the claim for “A transgenic non-human mammal” with specified genetic characteristics, was invalid. It was widely reported that this meant that higher life forms are not patentable. This is wrong in a technical but important detail. The holding was that higher life forms per se are not patentable. In other words, a claim for “a mouse with genetic characteristics X” is invalid. Harvard Mouse also said, however, that claims for modified cells are patentable, so that a claim for “A transgenic non-human mammal cell” with specified genetic characteristics would be valid. That did not help Harvard College, the patentee, which had only claimed the mouse per se (a claim which was valid in the US). But since plants and animals are of course composed of cells, a claim to a cell should give the same practical protection as the claim to the plant or animal itself. This view, that a plant or animal cell patent is valid and gives the same protection as a patent on the plant or animal itself, was affirmed in the Supreme Court’s subsequent decision in Monsanto v Schmeiser (Monsanto Canada Inc. v. Schmeiser, 2004).

It may seem peculiar to say that a plant is not patentable, but a plant cell is patentable—and indeed it is peculiar. There is no principled reason for this distinction. Depending on how one looks at it, the explanation is either muddled thinking on the part of the majority in Harvard Mouse, or the change in composition of the Court between Harvard Mouse and the subsequent decision in Schmeiser. Nonetheless, the practical result is that plants and animals are patentable in Canada, with the important qualification that the cells and not the plant itself must be claimed. This qualification is important because, it is currently very difficult to describe traditionally bred varieties at a cellular level. This means that in practice the Canadian position is quite close to the European position: varieties produced by traditional breeding can only be protected by the Plant Breeders’ Rights Act and not by the Patent Act. It appears that in Canada, however, any patent claim at the cellular level is valid subject matter, so traditionally hybridized varieties could be patented if enabling disclosure at the cellular level is possible. In contrast, in Europe a variety is not patentable no matter how it is described.

With this background in place, we can turn to consider the protection avail-
Siebrasse: Intellectual Property Protection

able for innovations in animals. The basic principles are straightforward. There is no separate animal breeders’ rights corresponding to plant variety rights under UPOV. It simply does not exist. Therefore animals must be protected by patent if they can be protected at all. In the patent context, the principles applying to plants apply equally to animals.

So, it is now clear that genetically modified animals can be protected by patent in the US, the EU and Canada. In Canada, as we have seen, the animal must be claimed at the cellular level: “a genetically transformed oncogenic mouse cell” is a good claim, while a claim to “a genetically transformed oncogenic mouse” is invalid. This does not present any practical obstacle to patenting of genetically modified animals.

Traditionally hybridized animals face a different problem, however, in the disclosure requirement. As noted, the usual means of satisfying the disclosure requirement for plants is a deposit of propagating material in a recognized depository. The current depository system is not adequate for storage of viable animal gametes.

Animals developed by marker assisted breeding may be able to avoid this problem by disclosure of the breeding process. Description of the breeding process in traditional hybridizing is not enabling because there is no guarantee that the same combinations of genes will arise from crossing of the same parents. In the case of marker assisted breeding, description of the markers used in breeding may be adequate for enabling disclosure. This possibility has not yet been tested in litigation.

In summary, hybridized plants, whether developed by marker assisted breeding or traditional hybridizing, can be protected by the Plant Breeders’ Rights Act and its equivalent in other jurisdictions, while genetically modified plants can be protected by the Patent Act, while. In contrast, there is no equivalent to the Plants Breeders’ Rights Act for animals. Genetically modified animals can also be protected by the Patent Act, but traditionally hybridized animals cannot, and patent protection for animals developed through marker assisted breeding is questionable.

3 Are Intellectual Property Rights in Higher Life Forms Necessary?

With this description of the current state of the law as background, we can turn to the policy question of whether IP protection is necessary to promote innovation in higher life forms. Protection for new breeds of traditionally hybridized animals is lacking. Is this sound policy? The law relating to animals developed through marker assisted breeding is unclear. Certainly the law should be clarified; but should that be done by granting or denying IP protection to new breeds of animals. This section discusses the desirability of IP protection in general terms, while the next section considers what specific form of IP protection is best for animals.
Are Intellectual Property Rights in Higher Life Forms Necessary?

The rationale for intellectual property protection generally is that for some types of goods the cost of innovation is high, but once the research and development (R&D) is done, the cost of the product itself is low. If one company develops a new product at great cost and another company simply copies it, the copier will be able to make a profit while undercutting the original innovator. The innovator will not be able to recover its R&D costs if it matches prices with the copier. Recognizing this, the innovator will choose not to innovate in the first place. By prohibiting copying, intellectual property rights allow the innovator to charge prices high enough to recover its costs of creation.

This basic scenario of high cost to develop a new product which can then be easily copied generally holds true with respect to plant innovation. For example, developing a new variety of potato typically requires selecting for desirable crosses from an initial sample of 50,000 or more seedlings in a process which requires roughly a decade. Once the new variety is developed it can be readily propagated at much lower cost simply by cutting up and planting any individual potato of the new variety. In practice propagation of potatoes is not quite so simple because of phytosanitary requirements under, for example, the Canadian Seeds Act (Government of Canada, 1985b), and equivalent legislation in other jurisdictions. Nonetheless, it is true that propagation is much cheaper than development.

This alone is not enough to establish that intellectual property rights are desirable, since there is a downside to IP protection, namely higher prices. The question is whether the increased innovation compensates for the higher prices. For this reason the intellectual property rights are usually described as striking a balance between incentives to create and restrictions on dissemination.

In assessing this balance it is important not to fall prey to the “Nirvana fallacy,” which consists of comparing the real world, with plentiful new products, IP protection and consequent high prices, with a Nirvana in which we would have the same new products, no IP protection and low prices patent (Demsetz, 1969). The premise of IP protection is that it is needed to encourage innovation. In US law the “non-obviousness” standard for patentability means that an invention is, in principle, not patentable if it would have been developed even in the absence of the patent incentive (Graham v. John Deere Co. of Kansas City, 1966). While this principle is sound, it is extremely difficult to apply in practice, so there is little doubt that patents are issued even for inventions that would have been developed in any event. But nonetheless, it is also certain that at least some inventions would not have been invented as soon without the lure of patent protection. So, without the incentives provided by IP protection at least some new inventions would never have been developed. It is not reasonable to take higher prices for an invention as part of the downside of IP protection, if that invention wouldn’t otherwise have existed at all. The real downside of IP protection is only the higher prices for those inventions which would have been developed even without the protection granted by IP rights.

This story must be refined in many details. Innovation will undoubtedly proceed without any IP protection at all, as it has for millennia. There are many non-IP incentives to innovate, even apart from government funding, from the
immediate return to the individual farmer who uses his prize bull for breeding his own herd, to the first-to-market advantage for professional breeders. Intellectual property does not create innovation; at most it accelerates innovation. The advantage of IP is the benefit stemming from an earlier creation date for the particular new variety. On the other hand, the disadvantage of IP is the extra cost for the variety if the term of IP protection extends beyond the date at which the variety would have been developed in the absence of IP protection. But it is not the higher price in itself that is a problem from an overall societal viewpoint, as the price is a transfer payment from one group to another that has no effect on the wealth of society as a whole. The disadvantage is the consequent restriction on dissemination, as some who could have profitably used the new variety are priced out of the market. This represents a net loss to society.

Even this is an over-simplification of the problem. It does not consider the effect of competitive innovation, for example, nor the fact that current innovation builds on past innovations which may themselves be protected. But it is enough to illustrate the complexity of the problem. Addressing the questions posed above in any case requires some knowledge of the innovator’s expected return to investment in the innovation during the protected term, the marginal supply of innovation, the consumer demand curve, the innovator’s pricing policy and the transaction costs associated with licencing. The result is that it is essentially impossible to determine by direct economic analysis whether IP protection for a particular innovation is desirable, and it is only slightly less difficult to determine whether IP is desirable in a particular industry. There is a reasonably widespread view that IP protection is desirable in some fields but not in others, but there is little consensus as to which particular fields require IP protection.

The complexity of the problem means that direct economic analysis of the effect of IP protection in specific industries remains difficult and as yet inconclusive. In the context of agricultural products, however, historical and comparative methods can also be used. Plant variety protection is a relatively recent phenomenon in many jurisdictions. And animal breeding continues to operate largely without effective IP protection, as there is no regime that provides direct protection for new breeds. This does not mean that IP is irrelevant to animal breeding, as patents are available for subject matter such as genes, genetic markers, and even breeding methods which can be important in the breeding process.

The historical Canadian experience tends to support the view that IP protection increases innovation by the private sector. Prior to the introduction of IP protection for new varieties of potato in North America, potato variety development in North America was undertaken almost entirely by the public sector. The enactment of the Plant Breeders’ Rights Act in the early 1990’s led to a major influx of foreign varieties, particularly Dutch varieties, into Canada (Canadian Food Inspection Agency (CFIA), 2008). Without IP protection two factors kept Dutch varieties out of the Canadian market. Of course the Dutch breeders would not licence their varieties for use in Canada, and they kept close physical control over potatoes, aided indirectly by import quarantine require-
ments. At the same time, no one would want to introduce the potatoes without a licence, since proving their worth in the Canadian market itself requires three to five years testing and development. Without the protection of an exclusive licence, no Canadian producer would want to undertake this testing process, since competitors would then be able to freely adopt the varieties that had been proven suitable without having to incur the development costs themselves.

This example also illustrates a refinement of the basic IP theory which is particularly important to agricultural products. For many types of inventions, if not for international treaty obligations it would make sense for individual countries to refuse IP protection in their own countries, in order to free-ride off the spur to innovation is provided by patent protection in major economies of the US, EU and Japan. But incentives are needed not just to invent a new product, but also to test it and bring it to market, as the phrase “research and development” implies. In the case of agricultural products in particular, the development process is very often specific to the country or region. A potato suited to The Netherlands will not necessarily be suited to Canada. Similarly, new varieties of cod suitable for Canadian waters are unlikely to be developed by Japanese researchers. This implies that even though international treaties do not at this time mandate IP protection for animal breeds per se, the free-riding strategy will not necessarily make sense. Thus is can make sense for a country to assess its agricultural IP policy within a largely domestic, or at least regional, framework. Of course, this is not to say that international effects are completely irrelevant, but only that they are less important than with many other types of inventions.

The Canadian examples suggests that the non-IP incentives for the development of new potato varieties is not enough to ensure introduction of desirable new varieties by the private sector. This raises the issue of state funding of innovation. Public funding can serve two roles in an innovation system: as a complement to private IP rights, and as a substitute for private IP rights. Again, this is an over-simplification, as public funding is increasing linked to private IP rights, as when private patenting is either permitted or actively encouraged by a public funder.

One function for public funding is to finance research that is so fundamental that its benefits cannot be adequately captured by IP rights. In such a case, private IP rights alone will not provide an adequate incentive for research. For example, quantum mechanics has been crucial to the development of many valuable modern technologies, yet the theoretical bases of the discipline, such as Schrödinger’s equation, would be unpatentable as being abstract theories. This is not to suggest that Schrödinger’s equation should be patentable, but this is not the place to discuss why not. Thus state funding can complement private IPRs by providing the support to develop basic theories from which patentable developments may spring.

Public funding may also provide an alternative substitute for private IPRs, as was the case in Canadian potato innovation prior to the introduction of the Plant Breeders’ Rights Act. The advantage of using public money instead of private IPRs to fund development of new varieties is that the new varieties
which result can be made freely available. Public funding solves the problem of restricted dissemination of new varieties which is the main disadvantage of IPRs. But public funding has three offsetting disadvantages. First, it is generally thought that because of the lack of direct market discipline, public institutions are normally less efficient than private institutions at any given task. This is not to say that all public institutions are less efficient than any private institution, or that public institutions rarely produce anything of value. It is simply that for a given research dollar aimed at developing commercially valuable new varieties, private research is likely to give more “bang for the buck.” More importantly, public research is often underfunded. There are many competing claims on the public resources, and in the competition with the demands of the health care system, for example, potato research does not always come out ahead. This means that relying on public funding will not necessarily result in greater dissemination of new varieties: even though varieties which are developed will be more widely disseminated (at a lower price), fewer new varieties will be brought to the market. Thirdly, there is a fairness concern. Improved potato varieties benefit potato farmers and consumers. When the research is publically funded out of general tax revenues, people who prefer rice and pasta end up subsidizing potato farmers and potato eaters. When research is supported by IPRs, the only people who pay for new potato varieties are those who eat potatoes and who like the new varieties enough to be willing to pay for them.

This theory and history suggests that IP protection for new plant varieties is desirable, but of course the analysis is not conclusive. Plant variety protection encourages private development of new potato varieties, but it is not shown that this more than outweighs any increased cost from varieties that would have been developed in any event. This second stage of the balancing equation is beyond the scope of this paper. Instead, consider animal breeds. Despite the fact that no IPRs are currently available to protect new breeds, intensive breed improvement efforts are a feature of all the main animal product industries, from beef and dairy cattle to pigs and chickens. This seems to suggest that IP protection is not required. Why not?

A large part of the reason for the prevalence of innovation in animal breeds in the absence of IPRs appears to be the fact that animals are sexually reproduced from genetically unique parents. To take cattle as an example, purebred breeders develop elite sires choosing parents based on the pedigree. Offspring of the match are assessed for measurable qualities and the most promising are further evaluated by assessing the performance of their own offspring. In the current state of the art heritability of traits of interest, which are normally influenced by the interaction of a large number of genes, cannot be directly assessed in the candidate purebred animal. Further, some qualities such as fat content of the meat are difficult or impossible to measure before slaughter. For both these reasons the candidate elite broodstock must be evaluated via their offspring. By the means an “expected progeny difference” or EPD is established for each elite sire. Once genetic potential is proven in this manner, semen from elite bulls is sold widely in large quantities to recover the cost of raising and proving the bulls. Purebred bulls of slightly lesser quality are sold directly to cattle ranchers.
for mating purposes.

This system operates without IPRs because the semen which is sold contributes only half of the genome to sexually reproduced offspring. This means that someone who purchases the semen cannot thereby reproduce the bull. Thus while it is true that the cost of development of the elite animal is high, it cannot readily be “copied” after development and proving. Thus the basic requirement for IP protection is lacking.

This does not imply that IPRs are entirely unnecessary for sexually reproducing organisms. The mechanism described above has certainly resulted in intensive development of marginal improvements within an established breed, and the cumulative effect of such marginal improvements can be very large. Whether this system provides adequate incentives for significant innovations is unclear. For example, an entirely new breed, such as the Brangus, a cross that combines the hardiness of Brahman with the meat quality of Angus, can represent a large step forward, at least for some environmental conditions. In such a case even relatively inferior members of the new breed may provide many of the advantages of the elite animals, thus providing an opportunity for free-riding by those who breed animals that were sold at a price commensurate with beef production.

The Brangus breed has in fact been established, even without IP protection. This was done partly through state funding of the initial breeding and partly by the efforts of a trade association which can use the guarantee of pedigree provided by a registration system to raise broodstock prices to profitable levels. This goes to the earlier point that IPRs are not required for innovation; the question is simply the pace of innovation. Development of the Brangus took decades from initial experiments to commercial viability (International Brangus Breeders Association (IBBA), 2010). Of course, this in itself does not prove that IPRs would have hastened the process; it may be that decades were needed to develop and prove the breed, and the development time has nothing to do with inadequate incentives to innovate.

In summary, the protection afforded by sexual reproduction provides good incentives for development of improved broodstock, it does not seem to provide adequate incentive for the development of new breeds. The issue of rapid development of substantially new breeds is increasingly important. Environmental concerns, in particular climate change and the associated need to minimize the ecological footprint of animal husbandry, is likely to intensify the need for new breeds that can adapt to changing conditions.

This brings us to the example of cod and marker assisted breeding. We began with the observation that the private sector is very active in cattle breed improvement despite the absence of IP protection. We observed that this is largely because cattle reproduce sexually and this reduces the potential for free riding even in the absence of IP protection. This suggests that because cod, like cattle, reproduce sexually, IP protection might also be unnecessary.

But sexual reproduction is not the only technological factor that is relevant to whether IP protection is desirable. The pace of change is also important. The use of genomics methods, in particular marker assisted selection, holds the
promise of accelerating the development of new breeds. The development of new varieties of cod through marker assisted breeding will represent at least as much of a leap as the Brangus.

If the Brangus, rather than the improved sire of an existing breed, is the correct point of comparison, the example of cattle improvement tells quite a different story. The development Brangus took decades, even with public funding, and the larger leap from aurochs to modern cattle took centuries. Such development times may no longer be socially desirable or technically necessary. But it appears that IP protection may be needed if the resources of the private sector are to be enlisted in this effort.

4 Which IP Regime is Best?

To this point we have seen that there is at least a *prima facie* argument that IP protection is desirable for animals produced through marker assisted breeding that represent a substantial improvement over previous breeds. The next question is what form of IP protection is best. We have two regimes available: plant variety protection and patent protection. We also have two models: the US model in which the two regimes overlap, so that a new plant variety that otherwise qualifies is entitled to patent protection; and the European model in which the two regimes are exclusive, so that a new plant variety, no matter how innovative, can never be patented.

Is the US or European approach to plant variety protection preferable? Should plant variety protection be the exclusive form of IPR for new varieties of plants, or should patent protection also be available? A second set of questions concerns IPRs in animals. There is no animal breed protection corresponding to the plant variety rights. Should new animal breeds be eligible for some type of IP protection? And second, if animal breed protection is desirable, what form of protection would be best? Are patents or plant variety rights a better model for animals?

To take these questions in order, which of these different approaches to plant protection is best? This is a live question in Canada, given that we have arrived at our current position through inadvertence rather than conscious policy choice. The answer depends on the differences between patent and plant variety protection. If there are some aspects of patent protection which we do not want extended to traditionally bred plant varieties, no matter how inventive these might be, then the European approach is preferable. Otherwise, the U.S. approach, which sees plant variety protection as an industry specific complement to general patent law, is better.

One difference between the two systems that has attracted a great deal of attention is known as the issue of “farmers’ privilege.” Patent protection gives the inventor the exclusive right to make, use and sell the invention. Breeders rights granted under the current Canadian Plant Breeders’ Right Act are more limited. The key rights are to prevent others from selling propagating material and producing propagating material for the purposes of selling.
of Canada, 1990, s.5(a)(b)). The result is that a farmer who purchases a protected variety does not infringe the breeder’s right by using seed saved from the harvest for planting the subsequent year’s crop. In contrast, this would be prohibited “use” if the variety were patented. This ability to use saved seed without permission of the breeder is commonly known as “farmers’ privilege.”

It may seem that the ability to save seed is a clear benefit to the farmer, a consideration that might justify the European prohibition on patenting of varieties. But this conclusion is not so clear. In the first place, breeders are likely to charge more for seeds in the first place if they can be saved and used for many subsequent years, so it is not clear that the average farmer would see a net cost saving. And to the extent that the farmer does save money, this reduces incentives to produce new varieties, which may hurt the farmer in the long run. The latter point is crucial in the context of improving cod broodstocks. If the fry sold to farmers are substantially superior to wild cod for farming purposes, then an effective farmers’ privilege would effectively eviscerate the IP rights in cod.

The farmers’ privilege is normally defended as protecting the farmers’ historic ability to plant the next year’s crop from this year’s seed. But this idyllic picture of smallholder independence does not correspond to modern reality. Despite the formal right to save seed under plant variety protection, as a practical matter for many major crops saving seed is rare or non-existent. Seed corn, for example, is an F1 hybrid, with parent varieties that are not suitable for commercial production. Thus farmers never save seed because it will not breed true and a crop planted from saved seed will be uneconomic. Further, for some crops, most notably canola in Canada, the great majority of the seed planted is genetically modified and patented. Even under the EU approach to the interaction of the patent and plant variety regimes, this is permissible. The patent protection will prevent the farmer from saving seed. So, for two major North American crops, corn and canola, saving seed is almost non-existent. Farmers nonetheless choose to plant the crops for the benefits realized from the superior seed.

Further, even if a variety is not patented, the breeder can insist that the farmer agree not to save the seed, and this would normally be a legally enforceable contract, quite apart from the plant variety protection. Moreover, the 1991 UPOV Convention is equivocal on the issue of farmers’ privilege. Amendments which have been proposed to bring the Canadian Plant Breeders’ Right Act into conformity with the 1991 UPOV Convention might either abolish or further entrench the farmers’ privilege. Thus it is far from clear that farmers’ privilege is either necessary or effective even in the plant context.

Another important distinction between the regimes relates to the disclosure requirement. As we have seen, satisfying the patent law requirement of “enabling” disclosure presents a significant hurdle to patenting of new breeds developed either by traditional hybridization or by marker assisted breeding. The patent regime requires disclosure that enables a third party with expertise in the relevant technology to independently recreate the invention. A patent is normally described as an exchange in which the state grants a monopoly for a
limited period of time, in exchange for free availability of the invention at the end of that period. Enabling disclosure is required to ensure that others will be able to practice the invention once the patent term has expired.

In contrast, the UPOV plant variety protection regime requires only a description sufficient to allow the new variety to be uniquely identified. This requirement can be easily satisfied in the case of breeds developed with marker assisted breeding. The UPOV regime does not abandon the notion that anyone should be free to use the innovation at the end of the term of protection. Rather, it recognizes that as a practical matter a new plant variety is made available when the seed is sold. This is in contrast to the patent regime, which applies to a broad range of inventions, including those such as new chemical processes for production of a well known end-product that can be used profitably without public disclosure. In the case of plants, as a technological matter, the innovator cannot profit from the new variety without enabling disclosure. The description requirement simple ensures that when an innovator brings and action for breach of its rights, it will be possible to tell with certainty whether the defendant was growing the protected variety or some other related variety. On the disclosure/description issue point the UPOV regime seems preferable to the patent approach in the context of animals. We have seen that IP protection is necessary precisely when sale of the new breed releases the innovation to the world.

Another important limit on plant variety protection is the “breeders’ privilege.” This involves the use of a protected variety as parents in the development of new varieties. Under plant variety protection breeders have the right to use protected varieties belonging to other breeders as parents in breeding new varieties. The new variety developed from protected varieties can itself be protected and sold, without permission from or paying royalties to the breeders whose protected varieties were used as parents (International Union for the Protection of New Varieties of Plants (UPOV 1991), 1991, Art. 15(1)(iii)). This breeders’ privilege does not apply to “essentially derived” varieties, which are varieties which are very closely related to the original variety. The closest analogy in patent law is the “experimental use” exception. In the E.U., which has the most expansive experimental use exception, a subsequent innovator is permitted to conduct experiments for the purpose of improving on a patented plant, even without the permission of the patentee. The experimental use exception is much more limited in the U.S. and such activity is not permitted without permission of the patentee (Madey v. Duke University, 2002). The law on this point is not clear in Canada, however (Siebrasse and Culver, 2006). But while the subsequent inventor may obtain a patent for its improvement, the original patentee still has a “blocking patent” and the improver cannot market its improvement without permission from the original inventor. In other words, a breeder would have the right to use another breeders’ variety as a parent, but it would not be able to sell the new variety without permission from the breeder of the parent variety. This is perhaps the clearest and most unequivocal difference between patent and plant variety protection. Unfortunately, assessing which policy is preferable for plants depends on difficult arguments regarding the scope of protection which cannot be addressed here.
Another fundamental difference is that there is a lower standard for obtaining plant variety protection. To obtain a patent it would be necessary to show that the new variety is “inventive.” There is no equivalent requirement for plant variety protection. In this respect plant variety protection is more like copyright protection, which does not require any degree of creativity in order to attract protection. In patent protection a high standard is necessary because patent law grants a true monopoly, in the sense that independent creation is not a defence to patent infringement. In contrast, copyright protects only against copying of the protected work. The parallel issue in plant protection is whether a plant breeder’s rights are infringed if a competing breeder independently breeds a new variety with the same characteristics as the protected variety. In the US it is clear that this would not be an infringement of the Plant Variety Protection Act, though it would be an infringement of the Patent Act (International Union for the Protection of New Varieties of Plants (UPOV 1991), 1991, Art. 14(5)(a)(ii)). This supports the American position that plant variety protection and patent protection should not be exclusive, since only those varieties which meet the higher standard for patent protection gain the more powerful patent monopoly. Another point in favour of the U.S. view that plant variety protection is an industry specific complement to patent protection concerns the term of protection. The term of a patent is normally twenty years from the time the patent application is filed (International Union for the Protection of New Varieties of Plants (UPOV 1991), 1991, Art. 14(5)(a)(ii)). In the E.U. the term for potatoes has been extended to 30 years from the time the plant variety protection is granted (European Commission, 1996) providing for an extension of the terms of a Community plant variety right in respect of potatoes. Many of the national acts also provide for a 30 year term for potatoes (United Kingdom Plant Varieties Act United Kingdom, 1997). The 1991 UPOV Convention requires a minimum term of protection for twenty years from the grant of the protection for most plants including potatoes (International Union for the Protection of New Varieties of Plants (UPOV 1991), 1991, Art. 19(2)).

5 Conclusion

We began by asking whether cod are more like potatoes or more like cattle, from an IP perspective. This article has answered that they are most like Brangus cattle. While IP protection is not essential for incremental improvement in animal broodstock because of the sexual nature of animal reproduction, sexual propagation alone is unlikely to provide sufficient incentive for the rapid and major innovations promised by marker assisted breeding. Unless we are willing to leave development of new breeds using marker assisted breeding to government funded projects, some form of IP protection will be needed. The most appropriate form of IP protection will itself be a hybrid of principle drawn from the patent regime and the UPOV regime for plant variety protection.
6 Bibliography

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