8

Bio-legal Subject Matter

INTRODUCTION

The history of intellectual property and its interaction with biological subject matter is a subject waiting to be written. Much of the research into biological-based subject matter has, perhaps even more so than with chemical inventions, been overshadowed by a focus on mechanical inventions. It has also been distorted by the fact that biological subject matter has consistently been judged by its ability to fit within a mechanical framework. While there is no denying the influence that the mechanical narrative has had on the way intellectual property law has interacted with biological subject matter, it is important that the subject matter is understood on its own terms. The need to understand how intellectual property has engaged with biological innovations has been made all the more pressing as a result of the recent discussions about the dematerialisation of biological material, which are premised on the historical claim that what is happening with biological subject matter today is fundamentally different from what has occurred previously.[1]

Intellectual property law has been interacting with biological innovations for nearly a century and a half. The first type of biological subject matter that intellectual property law encountered were new types of plants. One of the notable things about the way that the law has responded to plant-based subject matter is that it has been graduated and staged. After initial attempts to protect the names of plants failed,[2] protection was granted to asexually reproduced plants (in the 1930 *Plant Patent Act*), then to sexually reproduced plants (in the 1970 *Plant Variety Protection Act*), and eventually extended to include utility patent protection in the 1980s.[3] The

[1] Mark Janis and Stephen Smith, 'Technological Change and the Design of Plant Variety Protection Regimes' (2007) *Chicago-Kent Law Review* 1557, 1570.

[2] While discussions about the form that this protection might take had begun by 1876, it was not until the end of the nineteenth century that organisations such as the American Association of Nurserymen began to formulate more concrete proposals. On the arguments made in 1876 by grape grower and Nurseryman Jacob Moore see Richard White, *A Century of Service: A History of the Nursery Industry of the United States* (Washington: The American Association of Nurserymen, 1975), 128.

[3] *JEM AG Supply* v. *Pioneer Hi-Bred International* 534 U.S. 124 (2001).

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incremental change continued when the 2018 *Farm Act* extended plant variety protection to include asexually propagated plants.[4] As we will see, the type of protection granted and with it the nature of the intangible property was closely tied to the ability of breeders and scientists to satisfy the demands that intellectual property law made of the subject matter. As a result, there is a hierarchy of protection that reflects the idea that the nature and type of legal protection is commensurate with the level of scientific skill and expertise associated with the subject matter.[5]

If we leave aside the piecemeal and gradual way in which the subject matter was accommodated, the process of extending the reach of intellectual property to include plant-based subject matter has a familiar feel about it. As is often the case when a new type of subject matter is presented to the law for protection, one of the first questions that arose when intellectual property law was first confronted with plant-based subject matter was whether protection was desirable. In responding to this question, the proponents of intellectual property protection appealed to moral arguments (about how it was wrong for people to steal the fruits of the labour that breeders had used to develop new plants) and to economic arguments (about how intellectual property protection would stimulate investment in research and breeding).[6] In many ways these arguments were similar to the arguments that were made to justify extending protection to software-related subject matter (and to many other types of subject matter). The notable difference being that the argument that was first made in the 1930s and then repeated in the 1970s that intellectual property protection was needed to shift the responsibility for developing new plants from the public to the private sector. While these justificatory arguments played an important role in the passage of the 1930 *Plant Patent Act* and the 1970 *Plant Variety Protection Act*, by the 1980s (when plants were first protected by utility patents) the nature of the normative arguments had changed. Specifically, the justificatory arguments that had been so prominent over the last 50 or so years were supplemented by questions about whether intellectual property protection for plants had led to the loss of genetic material, encouraged the acquisition of seed companies by larger corporations, and increased the cost of seed.[7]

As well as asking whether the protection of plant-based subject matter was desirable, when intellectual property law was first confronted with this new type of

[4] The 2018 Farm Act, extended plant variety protection to include asexually propagated plants. Deposit of asexually reproduced plant vanities was delayed until 6 January 2023.

[5] Brief Amicus Curiae of American Crop Protection Association Cargill in support of affirmance, *JEM Ag Supply* v. *Pioneer Hi-Bred International* 2001 WL 674207 (US) No 99, 1996, 15 June 2001, 3.

[6] Luther Burbank, the famous Californian plant breeder, appealed to a different type of moral argument when he said in 1911: 'No patent can be obtained on any improvement of plants, and for one I am glad that it is so. The reward is in the joy of having done good work, and the impotent envy and jealousy of those who know nothing of the labour and sacrifices necessary, and who are by nature and cultivation, kickers rather than lifters'. Luther Burbank, *How to Judge Novelties* (Santa Rosa, CA: Burbank's Experimental Farms, 1911), 2.

[7] See *Hearings before the subcommittee on Agricultural Research and General Legislation of the Committee on Agriculture, Nutrition, and Forestry*: United States Senate, Ninety-Sixth Congress, Second Session on S 23. 17 and 18 June 1980, 1.

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subject matter, questions were also raised about whether protection was possible. While the normative discussions about the desirability of extending intellectual property protection to plants were similar to those that had taken place in relation to software-related subject matter, the same cannot be said for the discussions that took place about the feasibility of granting protection, which largely turned on the peculiarities of plant-based subject matter.[8]

THE PECULIARITIES OF PLANT-BASED SUBJECT MATTER

One of the notable characteristics of plant-based subject matter was that no matter how much breeders and scientists tried, they were unable to explain why plant innovations had occurred. While breeders may have been able to stimulate change by crossing plants or subjecting plants to extreme conditions, they could not explain the reasons why the biological innovation had taken place. As David Burpee said of a new type of nasturtium, a super-double nasturtium, with very large double flowers that he discovered growing among several thousand experimental plants on one of his company farms, it was unclear whether the gene for super-doubleness was induced by exposure of the experimental plants to the places where they had been grown (including California, Miami, Porto Rio, Argentina, Chile, and Australia), or whether the gene was present in latent form in one of the parents used in the crosses. At best, all Burpee could say was that its expression was the result of experiments that were planned for the creation of new varieties of nasturtium. Although breeders may have 'assisted nature' in the development of new plants, for example by the cross-pollination of selected parent plants, the 'actual creation of the new plant, because of the almost infinite number of possible combinations between the genes and chromosomes, is not presently the subject to a controlled reproduction by act of man'. As Smith J. said in the 1960s, while those skilled 'in this art now understand the mechanics of plant reproductions and the general principles of plant heredity, they are not presently able to control the factors which govern the combinations of genes and chromosomes required to produce a new plant having certain predetermined properties'.[9] Despite the range of innovations and discoveries that have taken place over the last hundred or so years, the 'world of plants remains one that we cannot entirely access. The encounter with plants is an encounter with alterity and there are aspects of plant being that will always remain untranslatable to us'.[10]

While breeders worked on the basis that the external physical traits of plants were determined by their underlying units of inheritance (whatever they were called), breeders were unable to get access to this hidden domain; they could only observe

[8] The 'unique aspects of plants … have posed numerous problems to various tribunals'. *In re LeGrice* 310 F.2d 929 (CCPA 1962) 1127, 1129.

[9] *In re Le Grice* 310 F.2d 929, 939 (CCPA 1962) 1137 301 F.2d 929, 938 (CCPA 1962).

[10] Hannah Stark, 'Deleuze and Critical Plant Studies' in (ed) J. Roffe and H. Stark, *Deleuze and the Non/Human* (London: Palgrave Macmillan, 2015), 180.

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and intervene in these 'genetic' elements through the medium of their external phenotypic expression. In this situation breeders were forced to distil what went on inside a plant from what occurred on the outside. As with other empirical sciences such as nineteenth-century organic chemistry, breeders, scientists, and farmers were forced to work backwards from the end-results in an attempt to explain what had happened inside the plant.[11]

The secretive nature of plant-based subject matter created a number of problems for law makers when they first began to think about extending intellectual property protection to this new type of subject matter. As had occurred with organic chemicals, questions arose as to whether in producing a new plant a breeder was an inventor. While questions of this nature had arisen previously, they came to a head in the lead up to the 1930 *Plant Patent Act*, which was the first occasion when intellectual property law grappled seriously with the possibility of extending protection to plant-based subject matter.

One of the most vocal critics of the proposed new plant patent law was the Commissioner of Patents who was 'very strongly of the opinion' that the plant patent scheme was unconstitutional, primarily because he did not think that breeders were inventors. The reason for this was that he 'doubted whether a valid patent can be granted for a plant even if it is a new variety, when that plant is *reproduced by the operation of nature*, aided only by the act of the patentee in grafting it by the usual methods, and a very serious question arises as to whether the definition given to the words "invention" and "discovery" in the proviso in the [Plant Patent] Bill', namely that they shall be interpreted 'in the sense of finding a thing already existing and reproducing the same as well as in the sense of creating' does not go beyond the power which the Constitution grants to Congress'.[12] The problem, in short, was that the 'person has done nothing in any way toward creating that variety'.[13] That is, the Commissioner doubted whether a person who developed or produced a new plant was an inventor.

[11] Smith J. said that after the plant breeder had completed cross-pollination of the parent stock they needed to recall the lines of Tennyson's 'Flower in the Crannied Wall':

> 'Flower in the crannied wall
> I pluck you out of the crannies
> I hold you here – but if I could understand
> What you are, root and all, and all in all.
> I should know what God and Man is'.

In re Le Grice 310 F.2d 929, 939; 1137 301 F.2d 929, 938 (CCPA 1962).

[12] Thomas E. Robertson (Commissioner of Patents), 'Memorandum to Secretary R. P. Lamont (Secretary of Commerce)', 8 March 1930, *Hearings of the House Committee on Patents* (1930) 71st Congress, 2nd Session on HR 11372 (A Bill to Provide for Plant Patents). R. P. Lamont (Secretary of Commerce), 'Letter to Albert Vestal (Chair of the House Committee on Patents), 12 March 1930', *Hearings of the House Committee on Patents* (1930) 71st Congress, 2nd Session on HR 11372 (A Bill to Provide for Plant Patents).

[13] Thomas E. Robertson, ibid., As Senator Dill said, 'I have some doubt about the constitutionality of patenting a new form of plant somebody may develop through the process of nature' (14 April 1930) 72 Congressional Record, Senate Proceedings, 71st Congress, 7017–18.

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As well as raising concerns about the constitutional validity of plant-based intellectual property, the secretive nature of plants also made it difficult to apply a number of the doctrinal rules of intellectual property law. This was the case in interference actions where the law was called on to determine when an invention was created. One of the features of American patent law for much of the twentieth century was that it employed a first-to-invent system where priority was given to the first inventor rather than as under a first-to-file system where priority is given to the party who files their application first. One of the consequences of this was that in determining priority between claimants, it was necessary to fix the moment of invention.

In determining when an invention first came into existence, patent law typically built on a mechanical model of invention which saw invention as a two-stage process: a mental operation involving the conception of an idea (form) and a physical operation involving the reduction of the mental concept to practice (matter). To determine when an invention came into existence, it was necessary to work out when the idea behind the invention first took shape. While this was possible with mechanical inventions, it was not with plant-based subject matter. While there was little difficulty in determining when a plant-based invention was reduced to practice, this was not the case when it came to ascertaining when the concept that was meant to underpin the invention was first conceived.[14] The reason for this was that unlike mechanical inventions, plant inventions were not the product of a prior mental design that was subsequently reduced to a material form. Rather, the secretive nature of plants meant that the inventor was only ever able to deal with the results of the inventive process, with the plant's external, empirically verifiable, physical characteristics or traits.

Another problem created by the secretive nature of plant-based subject matter was that breeders were unable to satisfy the longstanding requirement of patent law that required them to describe the invention so that a third party could recreate the patented invention without further inventive effort.[15] While mechanical inventions that consist of an idea that is subsequently reduced to practice are able to be translated into and out of a written form, the secretive nature of plant innovation meant that this was not possible with plant-based inventions. The secretive nature of plant invention also meant that breeders and scientists were not in a position where they could reduce the design or inventive concept that lay behind an invention to a written form that could be repeated.[16] As the Supreme Court said in *Chakrabarty*, one

[14] *Dunn* v. *Ragin* v. *Carlile* (Orange Tree) Final Hearing in the US Patent Office; Patent Interference No. 77,764 (6 December 1940).

[15] See Hearing Before the Subcommittee on Departmental Operations of the Committee on Agriculture, 91st Cong., 2d Sess 7, see *Ex Parte Hibberd* 227 USPQ (BNA) 444.

[16] The fusion of form and matter (conception and reduction to practice) that occurred with chemical inventions was only a temporary aberration. Even if the concept needed to be modified in light of the experiment, once the experiment was successfully completed the invention was able to be reconfigured to take its traditional form: as an originating conception that was able to be reduced to practice.

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of the reasons why plants were not protected by patents for so long was because they were not amenable to the written description requirements of patent law.[17]

The fact that it was not possible to recreate a plant from a written form had other ramifications for intellectual property law. This can be seen for example in *Le Grice*, a 1962 decision that arose when the English rose breeder Edward Burton Le Grice applied to patent two roses that he had bred: *Rosa Floribunda* Charming Maid (see Figure 8.1) and *Rosa Floribunda* Dusky Maiden (Figure 8.2). The problem that Le Grice faced was that information about the Charming Maid and Dusky Maiden roses had already been published when the applications were filed on 15 January 1958. For example, the 1949 National Rose Society Annual of England contained the following information:[18]

> Dusky Maiden (Hy. Poly) raised and exhibited by E.B. Le Grice, North Walsham – Glowing dark scarlet with dusky velvet sheen. Single blooms carried in large trusses. Size when open 3-in on diameter. Vet fragrant. Vigorous. Foliage dark green and abundant. Trial Ground Certificate 1945. Prune 34.[19]

In addition, a number of nursery catalogues also included colour photographs of the Dusky Maiden and Charming Maid roses.[20] The problem Le Grice faced was that these prior disclosures potentially triggered section 102(b) of the Plant Patent Act, which provided that a plant patent would not be granted where the invention had been described in printed publications more than one year prior to the filing date of the application.

After the Patent Office Examiner and the Patent Office Board of Appeal rejected the applications on the basis that they fell foul of section 102(b),[21] Le Grice appealed to the Court of Customs and Patent Appeals. As there was no dispute that the publications were of the plants in the applications and that publication had occurred outside the one-year grace period, the only question on appeal was whether the publications anticipated the plant patent, that is, whether the prior publications had 'put the public in possession of the invention'.[22]

[17] *Diamond* v. *Chakrabarty* 447 U.S. 311, 312 (1980). The other reason was that plants, even those artificially bred by man, were products of nature not subject to patent protection.

[18] Similar information and photographs relating to the Charming Maid rose had also been published more than a year before Le Grice had applied for plant patent protection.

[19] *1949 National Rose Society Annual of England* (1949), 155.

[20] 'In each case, the prior catalogues publications included a colour picture of the rose clear enough to establish identity in appearance between the rose illustrated and the applicants variety, and the catalogue publication with the picture establishes that the rose described and illustrated is the variety described and claimed in the application, and the rose so described and illustrated is, in fact, the variety so described and claimed in the application'. *In re Le Grice* 310 F.2d 929, 936 (CCPA 1962).

[21] Section 102(b) read: 'A person shall be entitled to a patent unless … (b) the invention … was described in a printed publication … more than one year prior to the date of the application for patent in the United State.' 35 USC 102(b).

[22] *In re Le Grice* 310 F.2d 929, 936 (CCPA 1962).

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FIGURE 8.1 *Rosa Floribunda* Charming Maid
Edward Burton Le Grice, 'Rosa Floribunda Plant' US Plant Patent No. 2,210 (8 Jan 1963). Courtesy of the National Archives at Kansas City.

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FIGURE 8.2 *Rosa Floribunda* Dusky Maiden
Edward Burton Le Grice, 'Rosa Floribunda Plant' US Plant Patent No. 2,209 (8 Jan 1963). Courtesy of the National Archives at Kansas City.

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The Court of Customs and Patent Appeals rejected the findings of the Patent Office and accepted Le Grice's argument that the written publications and photographs did not invalidate his patent applications.[23] While the court accepted that mechanical and chemical inventions could be recreated from a written and/or pictorial description, they found that this was 'not true of living matter'. The reason for this was that the 'description of a plant patent or in a printed publication at best can only recite, as historical facts, that at one time a certain plant existed, was discovered in a certain manner, and was asexually reproduced'. While this information may have been interesting historically, it did not 'enable others to reproduce the plant'.[24] The only way that a plant-based invention could be placed in the hands of the public was by ensuring that the public had access to the physical plant itself.[25]

As well as being secretive, plant-based subject matter was also fluid, malleable, and unstable. One of the consequences of this was that plant-based subject matter could (and did) take different forms. While lobby groups may have known what they wanted to protect, modern intellectual property law's preference for more abstract categories of subject matter rather than the tailored subject-specific protection favoured by pre-modern intellectual property law meant that the law had to translate these specific demands (that changed over time) into more abstract classes of subject matter. In creating these categories and deciding the form that the plant-based subject matter should take, the law was faced with a number of options. For example, one possibility was to limit protection to the process by which the subject matter was created (such as a novel breeding method), rather than the end products of those processes (new plants). To the extent that the focus was on the material object, decisions had to be made about whether the law should focus on the physiological or functional dimensions of that subject matter (such as how the plant performed therapeutically or in different environmental conditions) or whether protection should be detached from what the plant did. It also had to be decided whether protection should extend to part of a plant: its fruit, flower, seed, and so on. It also had to be decided, when it became feasible, whether protection should extend to the hidden and invisible aspects of a plant. Another important issue that had to be considered was the level of protection that should be granted. That is, it had to be decided whether protection should be limited to something that equated to the physical plant (or a part thereof) or whether protection should extend to more abstract groupings such as a species or genus of plants.

Another problem created by the fluid and malleable nature of plant-based subject matter was that breeders could not describe plant inventions with the specificity and detail demanded by intellectual property law, making it difficult if not impossible

[23] Le Grice argued that unlike with manufactured articles, processes, and chemical compositions that a written description of a plant, whether in a patent application, a plant catalogue, or a Rose Society Annual was not enough to enable others to reproduce or recreate the plant. Ibid., 935.

[24] Ibid., 939.

[25] Ibid., 944.

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to apply the existing rules and procedures to plant-based inventions.[26] This was particularly the case where the novel characteristics of a plant lay in its odour, flavour, or taste.[27] As a critic of the 1930 *Plant Patent Act* noted, applicants were unable to provide 'the botanical finger prints by which the plant may be identified and distinguished from other varieties'.[28] These problems were compounded by the fact that while a lever was always a lever, a cam was always a cam, and even a complex chemical compound stays the same in molecular structure, this was not so with plants, which change depending on the environment where they are grown.[29]

The problems that arose in describing plants with the specificity demanded by intellectual property law were compounded by the fact that certain types of plants – namely those that reproduced sexually – were non-uniform and unstable, and therefore ineligible for protection. As Rossman said, a 'machine, once made, stays put: it cannot grow or change. But it is impossible to determine whether a Baldwin apple is like the original Baldwins that grew on the first tree of that variety when it was discovered in 1793'.[30] As Mendel's laws of heredity had shown, when a plant was reproduced sexually, for example by seed, many of the desirable characteristics found in the parents divided up among the offspring.[31] While the characteristics of an asexually reproduced plant, that is a plant that has been propagated clonally from buds or cuttings remained constant when they were reproduced, there was no guarantee that the characteristics of a sexually reproduced plant would remain the same from generation to generation:[32] making patent protection difficult, if not impossible.[33]

[26] Joseph Rossman, 'The Preparation and Prosecution of Plant Patent Applications' (1935) 17 *Journal of the Patent Office Society* 632, 635–38. Harry C. Robb, 'Plant Patents' (1933) *Journal of the Patent Office Society* 752, 753. Robert Starr Allyn, *The First Plant Patents: A Discussion on the New Law and Patent Office Practice* (New York: Educational Foundation, 1944), 18.

[27] Robert Starr Allyn, *The First Plant Patents: A Discussion on the New Law and Patent Office Practice* (New York: Educational Foundation, 1944), 46.

[28] Joseph Rossman, 'The Preparation and Prosecution of Plant Patent Applications' (1935) 17 *Journal of the Patent Office Society* 632, 640–41. This was because 'botanists have not been completely successful in evolving accurate verbal diagnosis of species differences. Since this botanical experiment in plant description has been going on with varying success since Linnaeus' time, it may be that a valid definition of varieties differing only in a few rather variable characters may be virtually impossible. Robert Cook, 'Editors Note' (1936) 27 *Journal of Heredity* 478 (written in response to Keith Barrons, 'A Defense of Basic Plant Patents: From the Plant Breeder's Point of View' (1936) 27 *Journal of Heredity* 475).

[29] Joseph Rossman, 'Plant Patents' (1931) 13 *Journal of the Patent Office Society* 7, 15.

[30] Ibid.

[31] Joseph Rossman, 'The Preparation and Prosecution of Plant Patent Applications' (1935) 17 *Journal of the Patent Office Society* 632, 633. Rossman said that another reason why protection did not extend to sexual reproduction was because the seed (grain) was an article of commerce. Joseph Rossman, 'Plant Patents' (1931) 13 *Journal of the Patent Office Society* 7, 16.

[32] Robert Cook, 'Patents for New Plants' (1932) 27 *The American Mercury* 66, 66–67. Thus 'a verbal patent description, and even accurate coloured illustrations are not likely to prove altogether satisfactory in describing new plants'. Ibid.

[33] See, for example, (US) H. Rep. 1129 71st Congress 2d. Sess. (1930), 4; (US) S. Rep. 315, 71st Congress 2d. Sess (1930), 3; Peter Forbes Langrock, 'Plant Patents: Biological Necessities in Infringement Suits' (1959) 41 *Journal of the Patent Office Society* 787, 788.

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While some of the complaints that greeted plant-based subject at the beginning of the twentieth century disappeared over time, one concern that endured related to the instability of sexually reproduced plants. The persistence of these concerns can be seen in the arguments that the Secretary of Agriculture, Orville Freeman, made against a 1967 Bill that proposed to extend the *Plant Patent Act* to include sexually reproduced plants, primarily on the basis that the law would have been unenforceable. As Freeman said, protection was 'scientifically difficult or impossible because of the inherent variability of seed-propagated plants'.[34] The reason for this was that many varieties of crop plants exhibit a change in genetic composition from year to year, so that a variety, in a few years would no longer fit the description of the basis on which it was patented'.[35] The 'variability in sexually reproduced varieties and changes in type attributable to genetic shift would vitiate the intent of the patent system, which rests on the protection of unique and reproducible' discoveries.[36] Despite the concerted efforts of the American seed industry, these concerns created enough doubt in the minds of the Senate Agriculture Committee and the Patent Office for them to reject the proposal to extend plant patent protection to sexually reproduced plants.[37]

RESPONDING TO THE PECULIARITIES OF PLANT-BASED SUBJECT MATTER

Over time, a number of different strategies were used to allow intellectual property law to accommodate the peculiarities of plant-based subject matter. Of these two stand out. As well as changing the way that the process of invention was configured in accommodating plant-based subject matter, intellectual property law makers also changed the way they viewed the intangible property that lies at the core of intellectual property protection.

[34] Patent Law Revision Hearings on S. 2, S. 1042, S. 1377, S. 1690, S. 2164 before the Subcommittee on Patents, Trademarks, and Copyrights, Committee of the Judiciary US Senate 90th Congress 2d See, Part 2, 30, 31, January 1968 at 715–19.

[35] Because of 'difficulty of proof of in infringement litigation as difficulty of enforcement of a patent in seed-producing plants' patenting would interfere with the free exchange of information. Patent Law Revision Hearings on S. 2, S. 1042, S. 1377, S. 1690, S. 2164 before the Subcommittee on Patents, Trademarks, and Copyrights, Committee of the Judiciary US Senate 90th Congress 2d See, Part 2, 30, 31 January 1968, 715–19.

[36] Patent Law Revision Hearings on S. 2, S. 1042, S. 1377, S. 1690, S. 2164 before the Subcommittee on Patents, Trademarks, and Copyrights, Committee of the Judiciary US Senate 90th Congress 2d See, Part 2, 30, 31 January 1968 at 788, 792.

[37] Faced with these doubts the Patent Office did not comment on the Bill not at least until supporters of the Bill could develop 'more convincing factual evidence that the Amendment is both feasible and necessary'. Patent Law Revision Hearings on S. 2, S. 1042, S. 1377, S. 1690, S. 2164 before the Subcommittee on Patents, Trademarks, and Copyrights, Committee of the Judiciary US Senate 90th Congress 2d See, Part 2, 30, 31 January 1968 at 715–19. (Letter from Edward J. Brenner, Commissioner of Patents, 31 May 1968). The 1968 Presidential Commission on the Patent System rejected the use of the patent system as the proper vehicle to protect the work done by plant and seed breeders – 1968 proposed amendment to plant patent act died in committee pending further study of appropriate means of protection.

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The concerns that were raised in the 1930s about whether the creation of a new plant qualified as an act of invention and thus whether breeders were inventors were dealt with relatively easily and quickly. Despite the misgivings that had been raised when discussing the *Plant Patent Bill*, the House and Senate Committees on Patents Committees had no hesitation in reporting that they believed that breeding was a form of inventing and, as such, that the proposed law was constitutional. In explaining why they had reached this decision, the House and Senate Committees on Patents began by providing a history of the term 'inventor'. They started by noting that when the US Constitution was written, inventor meant both 'discoverer and finder' as well as someone who created something new.[38] This was reflected in the language of the Constitution, which provided Congress with the power 'to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries'. While there was little doubt that a person who discovered and reproduced a plant fell within the scope of the way that the patent clause was originally interpreted, by the 1930s the idea that someone who found or discovered something was an inventor was seen as an obsolete and archaic idea. In a sense the Committee had to deal with the fact that while the language of the Constitution linked inventions and discoveries, over the course of the nineteenth century the distinction between what is made and what is found, between invention and discovery, had come to be treated as a given.[39]

In light of this, the Committees turned to consider whether for the purposes of patent law breeding was a form of invention. The question of the status of breeders had attracted the attention of supporters of the *Plant Patent Bill* who in an attempt to ensure that breeders were cast as inventors emphasized the time, skill, and ingenuity that was needed in traditional breeding programs to develop a better flavoured fruit or a new flower with a pleasing perfume or graceful petals. By highlighting the fact that over 65,000 hybrid bushes had been grown and eliminated in the development of the white blackberry or that Burbank had selected his famous seedless plum from 300,000 artificially produced variations,[40] proponents of plant patents

[38] H Rep 1129 71st Congress 2d Sess (1930), 8–9; S Rep 315, 71st Congress 2d Sess (1930), 8.

[39] '[O]nly in the course of the eighteenth century did the distinction that matters so centrally to us eventually drive a wedge between "invention" and "discovery"'. Lorraine Daston, 'The Coming into Being of Scientific Objects' in (ed) Lorraine Daston, *Biographies of Scientific Objects* (Chicago: University of Chicago Press, 2000), 4. It was suggested that by 1841 US courts had decided that the word 'discoveries' in the Constitutional provision merely meant 'inventions' (which were a 'specifically human affair'). Charles E. Ruby, 'Patents for Acts of Nature' (1939) 21 *Journal of the Patent Office Society* 538, 539. A 'person who invents or discovers any new manufacture, merely discovers an art of practically applying some of the laws of nature on the manufacture or production of articles of commerce … An inventor … does not create, but only invents or finds something which had no prior existence, although unknown to the world, in precisely the same way as persons make discoveries in geography and astronomy'. W. M. Hindmarch, *A Treatise on the Law Relating to Patent Privileges* (London: V. R. Stevens, G. S. Norton & W. Benning, 1846), 227–28.

[40] Joseph Rossman, 'Plant Patents' (1931) *Journal of the Patent Office Society* 7, 10. It took Burbank 19 years to perfect the amaryllis and over 20 years to produce a new hybrid lily.

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were also able to show that the development of a new plant required a considerable amount of experimentation and breeding.[41]

Supporters of plant patent protection also argued that as a result of scientific and technological developments largely facilitated by the rediscovery of Mendel's laws of heredity at the turn of the twentieth century, breeding was now a science and thus worthy of patent protection.[42] Luther Burbank summed up these changes when he said that 'plant breeding has developed into a practice, and as we learn more about the underlying principles of the art, we realize that it is beginning to be fixed as a science'.[43] The House and Senate Committees on Patents embraced the idea that breeding was a science when they drew an analogy between the efforts of a plant breeder and the work of a chemist in the development of new compositions of matter. More specifically, the Committees said that there 'is no apparent difference … between the part played by the plant originator in the development of new plants and the part played by the chemist in the development of new compositions of matter which are patentable under existing law. Obviously, these new compositions of matter do not come into being solely by act of man. The chemist who invents the composition of matter must avail himself of the physical and chemical qualities inherent in the materials and of the natural principles applicable to matter … He may simply find the resulting product and have the foresight and ability to see and appreciate its possibilities and to take steps to preserve its existence … The same considerations are true of the plant breeder. He avails himself of the natural principles of genetics and of seed and bud variation'.[44]

The House and Senate Committees on Patents went on to say that even if the contribution made by a plant breeder was less creative than that of a chemist (an assumption which the Committees did not believe), nonetheless they still felt that breeders were inventors and as such that the proposed law was within the constitutional power of Congress.[45] This was because there was 'a clear and logical distinction between the discovery of a new variety of plant and of certain inanimate things, such … as a new and useful natural mineral. The mineral is created wholly by nature unassisted by man and is likely to be discovered in various parts of the country'.[46] In contrast, the Committees said that a plant discovery resulting from cultivation is unique, isolated, and is not repeated by nature, nor can it be 'produced by nature unaided by man, and such discoveries can only be made available to the

[41] R. France, 'Experiments with Animals and Plants: Studies in Artificial Mutation' (3 April 1909) 1735 *Scientific American Supplement* 216, 217.

[42] H Rep 1129 71st Congress 2d Sess (1930), 1; S Rep 315, 71st Congress 2d Sess (1930), 1. See also Cary Fowler, 'Protecting Farmer Innovation: the Convention on Biological Diversity and the Question of Origin' (2001) 41 *Jurimetrics Journal* 477.

[43] Luther Burbank, 'Prodigal Mother Nature' (June 1926) 134 *Scientific American* 366. Sere also Henry D. Hooker, 'Horticulture as a Science' (14 April 1922) 55 *Science, New Series* 384–5; Randall Howard, 'An Inventor of Roses' (2 June 1916) 25 *Illustrated World* 481.

[44] H Rep 1129 71st Congress 2d Sess (1930), 8; S Rep 315, 71st Congress 2d Sess (1930), 7–8.

[45] H Rep 1129 71st Congress 2d Sess (1930), 3; S Rep 315, 71st Congress 2d Sess (1930), 3

[46] H Rep 1129 71st Congress 2d Sess (1930), 7; S Rep 315, 71st Congress 2d Sess (1930), 6.

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public by encouraging those who own the single specimen to reproduce it asexually and thus create an adequate supply'.[47] The Committees concluded that while nature originally creates plants, it could not be denied that breeders often control and direct the natural processes and produce a desired result.[48] From this perspective, the Committees concluded that plant originators were creators (or inventors) and as such that the proposed law was constitutional.

In reaching this conclusion, the House and Senate Committees on Patents not only paved the way for the passage of the *Plant Patent Act*, they also provided an insight into the way intellectual property law makers reconciled the peculiarities of plant-based subject matter with legal doctrine (or at least the mechanistic reading of doctrine which by this time had begun to dominate) across the twentieth century. Specifically, they provided an insight into how law makers reconciled the secretive nature of plant subject matter with a mechanistic understanding of invention, which presumes that the only entity able to exercise agency in the development of a novel invention is the human inventor. In line with this, it is also presumed that the inventor was not only the source of the 'concept' that was meant to lie behind invention, but that they could also reduce that concept to a written form that allowed third parties to repeat the invention at a distance.

Instead of using the asymmetrical relationship between nature and invention presupposed by a mechanical view of invention, plant-based subject matter forced the law to draw on a different conception of agency. The starting point for the reconfiguration of the process of invention was, as had occurred with organic chemicals, the recognition of the positive role that nature plays in the creation of plant inventions.[49] As well as altering the notion of agency that underpins the inventive process, plant patent law also reversed the roles played by the participants involved in the creation of the invention. While under the mechanical view of creation, nature provides the underlying material which the human inventor then shapes into the resulting invention, with plant intellectual property nature does the inventing and the breeder is relegated to the task of identifying and then reproducing nature's creations. As the Supreme Court said in *Chakrabarty*, in producing a new plant the breeder worked 'in aid of nature' to bring about the resulting invention.[50] In this sense, plant patent law developed a notion of agency that saw the breeder and nature working together as joint inventors in the development of plant inventions. Nature and breeder operated like Siamese twins in the creation of plant inventions; neither could operate independently of each other to develop a novel plant invention.[51] It

[47] H Rep 1129 71st Congress 2d Sess (1930), 7; S Rep 315, 71st Congress 2d Sess (1930), 6–7.
[48] H Rep 1129 71st Congress 2d Sess (1930), 8; S Rep 315, 71st Congress 2d Sess (1930), 7.
[49] Harry Robb, 'Plant Patents' (1933) 15 *Journal of the Patent Office Society* 752, 753.
[50] *Diamond* v. *Chakrabarty* 447 U.S. 311, 312 (1980).
[51] Burbank spoke of the breeder using his intelligence and skill in assisting Mother Nature. Luther Burbank, 'Prodigal Mother Nature' (June 1926) 134 *Scientific American* 365–66. 'Nature in such instances, unaided by man, does not reproduce the new variety true to type'. Joseph Rossman, 'Plant Patents' (1931) 13 *Journal of the Patent Office Society* 7, 18.

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was only when the skill and effort of the two were combined together that a plant invention's existence could be guaranteed. The fact that the plant invention would not have recurred in nature without the efforts of the breeder meant that the plant invention was simultaneously both natural *and* artificial. Importantly, the fact that the plant invention did not exist in a natural state meant, at least for patent law purposes, that it was not a product of nature and thus potentially patentable.

As well as being used to respond to the concerns raised about the constitutional standing of plant intellectual property law, the reconfigured invention was also used to modify the traditional rules of patent law so that they could be applied to plant-based subject matter. For example, in interference actions where it was necessary to determine when an invention first came into existence, patent law typically relied on a mechanical model of invention, which saw invention as a two-stage process: a mental operation involving the conception of an idea (form) and a physical operation involving the reduction to practice of the mental concept (matter). Confronted with the fact that the secretive nature of plant innovation meant that this model could not be applied to plant-based subject matter, intellectual property law abandoned the traditional approach where conception preceded reduction to practice when deciding priority disputes relating to plants. Instead, it adopted the approach pioneered in relation to chemical inventions whereby 'conception or discovery of the new variety' occurred '*concurrently* with the actual reduction to practice'.

Instead of drawing upon the image of an invention as an originating and creative act, as the conception or discovery of a new idea which was subsequently embodied or applied in a concrete physical form, plant-based intellectual property law came to focus upon the physical form of the protected intangible as an end in its own right. In this context, reduction to practice only occurred when the 'concept' was physically visible and empirically verifiable. Thus in a decision where the tribunal had to decide when a new type of sugar cane was invented, it was said that 'there could be no invention or discovery of new varieties of sugar cane prior to the time that the plants were grown and their characteristics determined'.[52] In a similar manner, in an interference action over a variety of seedless orange it was held that the invention was only reduced to practice when 'citrus trees would be established which bore fruits having all the attributes of the variety known as a pineapple orange with the exception of its habit of containing seeds'.[53] In what was to become a pattern that was repeated again and again, intellectual property law makers turned to the physical manifestation of the protected subject matter in order to accommodate the problems created by the peculiarities of the subject matter.

Accepting that breeders (qua scientists) were inventors helped to end the doubts that had arisen about whether the creation of a new plant qualified as a patentable

[52] *Bourne* v. *Jones* (1951, DC Fla) 114 F Supp 413, 98 USPQ 206.

[53] *Dunn* v. *Ragin* v. *Carlile* (Orange Tree) Final Hearing in the US Patent Office; Patent Interference No. 77,764 (6 December 1940).

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act of invention. By reconfiguring legal doctrine to accommodate the peculiarities of plant-based subject matter (or at least those rules that drew upon a mechanistic image of invention), intellectual property law makers also ensured that the related doctrinal rules could be applied to plants. While there were exceptions, these changes were successful enough that the question of whether breeders were creative enough to qualify for intellectual property protection did not arise again. The same cannot be said, however, for the way that law makers dealt with the fluid, malleable, and unstable nature of plant-based subject matter, which created an ongoing and in some ways intractable set of problems that the law is still grappling with.

When horticulturists and their supporters appealed to Congress in the early part of the twentieth century to extend intellectual property to plant innovations, they were rebuked and told that protection was not possible – not at least until the way that plants were named was improved. This legal impetus for scientific change prompted the American Joint Committee on Horticultural Nomenclature to standardise the names given to cultivated plants – a process that ultimately resulted in the 1923 publication of *Standardized Plant Names: A Catalogue of Approved Scientific Names of Plants in American Commerce*.[54] While not complete, the list of officially sanctioned plant names was enough to overcome the nomenclatural stumbling block that had greeted breeders when they initially turned to the law for protection. With this problem resolved, intellectual property law makers began to take the possibility of extending protection to plant-based subject matter seriously.

Rather than merely seeing the fluidity of plant-based subject matter as a stumbling block that had to be overcome, intellectual property law makers used this malleability to accommodate the new subject matter. In many ways the law's response to the problems created by the fluidity and malleability of plant-based subject matter was directly tied to the way breeders, scientists, and agricultural agencies interacted with plants: specifically, it was tied to their ability to describe plants and to understand why plants performed in a particular way or why they took on certain characteristics or traits. It was also tied to the extent to which they were able to standardise unruly plants so that they could conform to the demands made by the law of the subject matter. One of the consequences of this was that the scope and ambit of plant-based subject matter was constantly reconfigured across the twentieth century in light of scientific, technical, and regulatory developments that either changed how plants were described and understood or the way they were stabilised and tamed.

Over time a range of different strategies were adopted to deal with the instability and fluidity of plant-based subject matter. In some ways, the simplest and most straightforward response was the decision to exclude sexually reproduced plants

[54] American Joint Committee on Horticultural Nomenclature, *Standardized Plant Names: A Catalogue of Approved Scientific Names of Plants in American Commerce* (Harrisburg: Mount Pleasant Press, 1923).

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from the scope of the 1930 *Plant Patent Act*.[55] By limiting protection to unauthorised asexual reproductions of the patented plant, that is to vegetative propagations or clones of the patented plant,[56] the US Congress avoided the problems created by the fact that sexually reproduced plants changed from generation to generation, which made intellectual property protection difficult.[57] The decision to limit plant patent protection to asexually reproducing plants – which was reportedly taken on the advice of various agricultural scientists[58] – provided a 'guarantee that the variety's new characteristics had the genetic (rather than, say, environmental) causes and would prove genetically stable over time'.[59] By separating variations resulting from fluctuations in environmental conditions that were acceptable from variations in the plant that were not, the process of asexual reproduction helped to stabilise the new variety.[60] The fact that protection was limited to asexual clonal reproductions meant that plant inventions, like industrial artefacts, were near-perfect copies of each other.[61]

While in the 1930s sexually reproduced plants were thought to be too unstable to qualify for intellectual property protection, by the 1970s the situation had changed to such an extent that law makers felt comfortable enough to extend intellectual property protection to sexually reproduced plants, which took place when they passed the 1970 *Plant Variety Protection Act*.[62] The concerns that were raised in the 1920s and 1930s about granting intellectual property protection to sexually reproduced plants that were repeated until the 1970s were resolved by a host of interconnected factors. One of the most important was the gradual emergence of scientific breeding, notably the adoption of hybridisation, in-breeding, and pure line breeding.[63] Hand-in-hand with these shifts in breeding practices

[55] John Townsend Jr., 'The Importance of Plant Patents to Agriculture: A Statement by Senator John G. Townsend Jr' (April 1930) 38 *National Nurseryman: For Growers and Dealers in Nursery Stock* 5. Peter Forbes Langrock, 'Plant Patents': Biological Necessities in Infringement Suits' (1959) 41 *Journal of the Patent Office Society* 787.

[56] See *Imazio Nursery* v. *Dania Greenhouses* 69 F 3d 1560 (Fed. Cir. 1995) (plant patent infringement occurs only by actual taking of shoots from the protected plant; a mere showing of genetic similarity between protected and allegedly infringing plants is insufficient).

[57] H Rep 1129 71st Congress 2d Sess (1930), 4; S Rep 315, 71st Congress 2d Sess (1930), 3.

[58] Robert Cook, 'Patents for New Plants' (1932) 27 *The American Mercury* 66.

[59] *JEM AG Supply* v. *Pioneer Hi-Bred International* 534 U.S. 124, 150 (2001).

[60] 'Change the conditions and the plant changes. The Washington navel orange, which is the basis of the Californian orange industry, is practically worthless in Florida. The conditions are different and the plant is different'. Robert Cook, 'Patents for New Plants' (1932) 27 *The American Mercury* 66.

[61] Robert Starr Allyn, 'Patentable Yardsticks' (1943) 25 (11) *Journal of the Patent Office Society* 791, 816. This led commentators to remark that plants protected under the Plant Patent Act 'partake of the nature of manufacture'. John A. Dienner, 'Patents for Biological Specimens and Products' (1953) 35 *Journal of the Patent Office Society* 286, 289–90.

[62] Michael Carolan, 'The Mutability of Biotechnology Patents: From Unwieldy Products of Nature to Independent Object/s' (2010) 27(1) *Theory, Culture & Society* 110.

[63] In *Chakrabarty*, the Supreme Court said that the *Plant Variety Protection Act* was enacted to reflect advances in breeding techniques that made it possible to reproduce new varieties of plants, true-to-type, through seeds. For an overview of different breeding practices see Helen Curry, *Evolution Made*

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were a series of legal and regulatory changes that helped to standardize plant-based subject matter enough for it to qualify for protection. These laws, which form part of the unwritten history of intellectual property law, played an important role in helping to stabilise plant-based subject matter. These included State and Federal seed laws,[64] along with more crop-specific laws such as the Californian *One-Variety Cotton Act* (1925) or the *Fruit, Nut and Vegetable Standardisation Act* (1925). In their own way, these types of laws helped to reinforce and stabilise plant subject matter. The suite of legal schemes that stabilised plant-based subject matter were reinforced by other legal and regulatory schemes, including state quarantine laws (that operated like one-variety laws to control what was farmed in specific regions), the work of organisations such as the Committee of Varietal Standardization within the American Society of Agronomy,[65] the development of type books, improved methods of saving and storing seed, and changes in farming practices. While the requirements of distinctiveness, uniformity, and stability, which are often presented as a cornerstone of plant variety rights protection, played an important role in reinforcing the stability of plant-based subject matter, these legal criteria should not be mistaken for the reason or cause for the stability. Rather, these legal requirements were the beneficiaries of the scientific, agricultural, and (at least from a traditional perspective) non-intellectual property legal developments that took place over the course of the twentieth century that helped to stabilise plants and in so doing ensure that they were eligible for legal protection, 'just like any other modern technology'.[66]

RECONFIGURING INTANGIBLE PROPERTY

In accommodating plant-based subject matter, intellectual property law makers not only changed the way that they configured the process of invention, they also fundamentally changed how the intangible property that lies at the core of intellectual property was conceived. Intangible property plays a key conceptual role in intellectual property law. At its simplest, the intangible is the legal device that connects creators with their creations once they move beyond the sphere of their control (whether legal, physical, technological, economic, or social). Here, the intangible

to Order: Plant Breeding and Technological Innovation in Twentieth-Century America (Chicago: Chicago University Press, 2016).

[64] Seed certification involves the 'use of seed production and processing standards in combination with a system of record keeping, field inspections, and seed inspections to protect the genetic purity and maintain the genetic identity of crop varieties'. The 'Secretary may accept records of … any official seed certifying agency in this country as evidence of stability where applicable'. *Plant Variety Protection Act* 1970, s 52(3).

[65] See Walter A. Davidson and B. E. Clark, 'How We Try to Measure Trueness to Variety' (1961) *Yearbook of Agriculture* 448 (Washington, DC: US Government Printing Office, 1961).

[66] Brief Amicus Curiae of Cargill in support of the respondent, *JEM Ag Supply* v. *Pioneer Hi-Bred International* 2001 WL 674207 (US) No 99, 1996, (15 June 2001), 8.

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is the invisible thread that allows the intellectual property owner to control how the protected subject matter is used at a distance. One of the key features of the intangible is that it is inherently flexible; it is able to change and move between different physical forms. Put differently, the intangible is the thing that links a novel to a screenplay, a poem in English to its Spanish translation, an architectural plan to a building, a flowchart to a computer program, or a blueprint of a machine to the machine. In line with this, the intangible is also able to expand to include material manifestations that are similar but not identical to the intangible when it is first materialised. Thus, in some cases intellectual property protection extends to near-copies, look-alikes, and to inventions that are equivalent of each other. As we saw with formula-based organic chemicals, it is also possible for intangible property protection to extend to classes or groups of inventions.

While under traditional accounts of intellectual property the tangible and intangible are inextricably linked, the intangible also has an existence independent from its material form. Thus, copyright will still exist in and continue to control reproductions of a painting that is destroyed by fire (subject to questions of proof). In this context, it does not matter if the physical form of the intangible disappears: the intangible property is able to exist independently from its material form. In patent law, this separation underpins the system of paper-based representation, which presupposes that the invention can be reduced to a written immaterial form and also that it can be recreated materially from that immaterial written form. While this story, or at least a version thereof, holds for many different types of subject matter, it does not work with plants or biological subject matter generally.

For the most part, the way that plant intangible property was construed remained fairly consistent over the twentieth century as protection moved from plant patents to plant variety certificates and eventually to utility patents. One of the most important and enduring characteristics of the intangible property recognised by the law was that it was coextensive with the *plant as a whole*, rather than specific parts of a plant such as fruit, flower, or seed. For example, based upon the practice developed for design patents, plant patent law limited applicants to a single claim that set out the distinguishing characteristics of the plant.[67] While the form of the claim varied, they followed a similar pattern where after linking the claim to 'the plant as described', applicants would highlight the distinct features of the invention. While protection may have indirectly covered the novel and commercially valuable parts of a plant (such as a new flower), the intangible interest was framed in such a way

[67] Each 'plant patent has a single claim directed to the disclosed plant. One cannot claim a genus or group of plants or any part of a plant' (generic protection is thus not available). A. Diepenbrock, C. Neagley and D. Jefferey, 'Section 101 Plant Patents: Panacea of Pitfall' (1983) 1(2) *Selected Legal Papers (American Intellectual Property Law Association)* A-1, A-10. Under the Design Act, the design had to be 'a *finished* and *completed* thing – must be one entire and integral thing'. Amos W. Hart, *Digests of Decisions of Law and Practice in the Patent Office and the United States and State Courts in Patents, Trade-Marks, Copyrights, and Labels* (Chicago: Callaghan and Company, 1898), 83.

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that it covered all of the plant. As the law expanded to include sexually reproduced plants (with the passage of the 1970 *Plant Variety Protection Act*), the intangible interest continued to be treated as if it was coextensive with the whole plant.[68] This was also often the case when utility patent protection was extended to plant-based subject matter in the 1980s.[69]

Another characteristic of the plant intangible property recognised by intellectual property law, which was a consequence of the way that plants were understood scientifically, was that the intangible property was limited to the *external surface* of the protected plant.[70] In more technical terms, protection was limited to the phenotypical traits and characteristics rather than to the underlying reasons for or causes of these characteristics. While it was recognised that 'varietal characteristics were caused by the genetic complements of the cells', the secretive nature of plant-based subject matter meant that it 'was impossible to determine the genetic constitution by examination of the cells'. As a result, protection was limited to a plant's external traits and characteristics.

A third feature of the plant-based intangible property recognised by intellectual property law was that it was limited to *individual plants* rather than to more abstract groupings such as a genus or species of plants. Whether under plant patent law, where protection was limited to individual plants and their asexually reproduced progeny[71] or plant variety protection law, where protection was limited to specific varieties of plants, plant intellectual property only operated at the level of the individual plant. Interestingly, although people seeking utility patent protection for plant-based subject matter had the opportunity to decide for themselves the form that they wanted the intangible to take, plant-based utility patents were often framed in such a way that the intangible property was limited to individual plants (at least initially).

The upshot of this was that in accommodating the peculiarities of plant-based subject matter, the plant intangible property recognised by intellectual property law was configured so as to coincide with the external features of individual plants.[72] While the treatment of the plant intangible as if it coincided with the external surface of individual plants was accepted without question for most of the twentieth century, a notable exception was plant patent number 141 which was granted to David Burpee in 1935 for a new type of nasturtium with a mass of very large double flowers, a 'super-double nasturtium'[73] which David Burpee christened *Tropaeolum majus Burpeeii* (see Figure 8.3).

[68] While the 1970 *Plant Variety Protection Act* extended to 'plant groupings', this was a population of individuals.

[69] For discussion see *JEM AG Supply* v. *Pioneer Hi-Bred International* 534 U.S. 124 (2001).

[70] I discuss the shift below the surface to molecular level innovations in the next chapter.

[71] *Imazio Nursery* v. *Dania Greenhouses* 69 F.3d 1560, 1567 (1995).

[72] *Kim Bros.* v. *Hagler* 167 F. Supp 665, 120 USPQ 210 (SD Cal 1958).

[73] A double flower is a flower that has extra petals, sometimes described as a flower within a flower.

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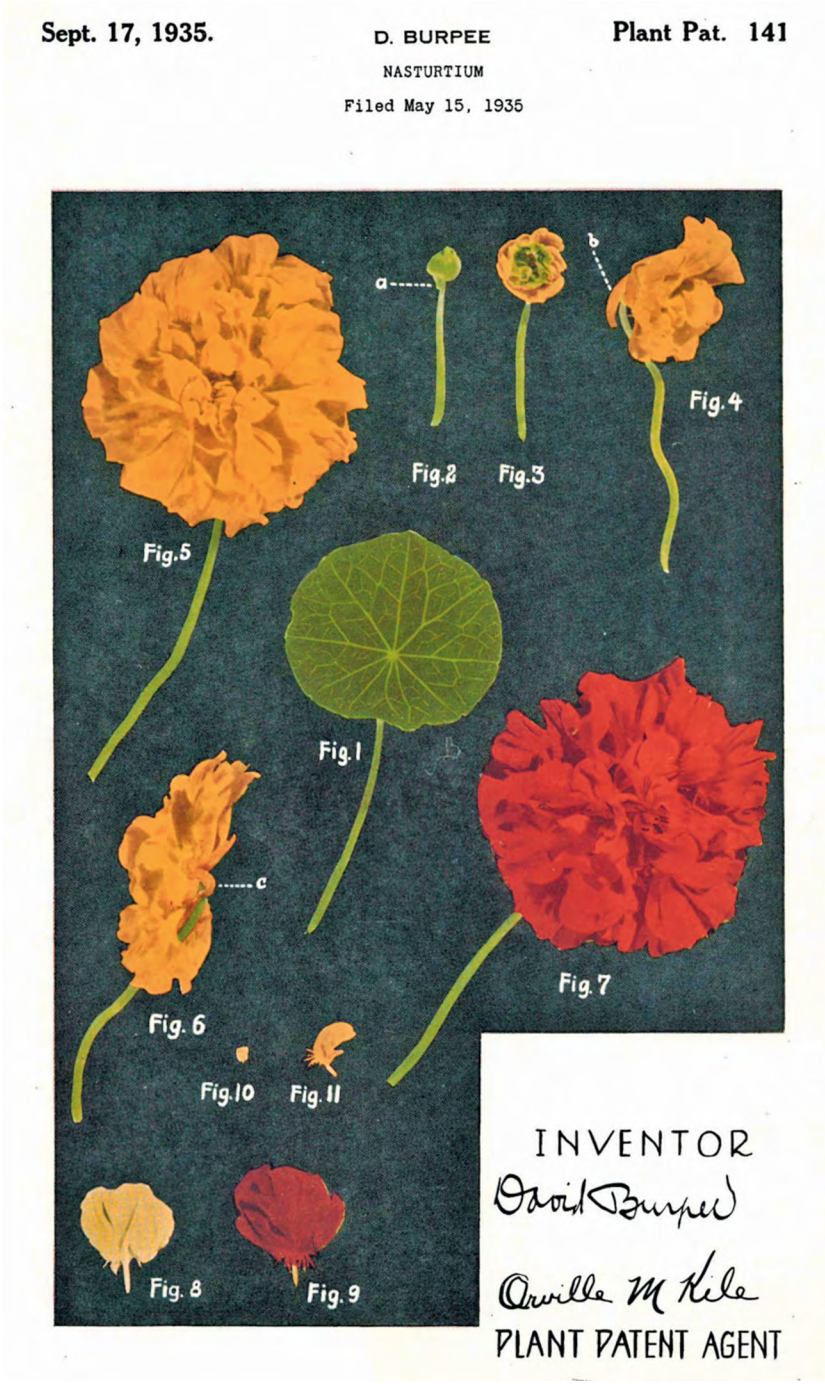

FIGURE 8.3 Super-double nasturtium
David Burpee, 'Nasturtium' US Plant Patent No. 141 (17 Sept 1935). Courtesy of the National Archives at Kansas City.

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The super-double nasturtium had been discovered in a greenhouse on a Burpee company farm in Pennsylvania growing among several thousand experimental double nasturtiums. Working with the new discovery, breeders at Burpee found that it was 'very simple by crosses and back-crosses with ordinary nasturtiums to produce numerous colours and other variations all possessing this peculiar type of flower'. As the common garden nasturtium had at least twelve distinct flower colours, three chlorophyll intensities, three leaf shapes, and four habits of growth, and that any combination of these elements could be combined with the super-double flower by making the proper crosses to make new super-double nasturtiums, it was found that 'no less than four hundred and thirty-two distinct clonal varieties' of the super-double nasturtium were 'within the realm of possibility'.[74] In this situation, Burpee was faced with the option of either taking out four hundred and thirty-two separate plant patents, or trying to obtain a single patent that covered all of the different variations. Given the cost of a patent application, Burpee opted for the latter option. He did this by drafting his application so that it claimed *any* nasturtium whose flower form was covered by the description regardless of colour, habit of growth, or other plant characteristics.[75] As the plant patent said, the claim was to the 'variety or genetic type of nasturtium (*Tropaeolum majus*) herein described and illustrated, characterised particularly by its vigorous stocky vegetative growth and the unusually large size and complete doubleness of its flowers'. While in the descriptive portion of the patent Burpee spoke of the different colours and forms that the super-double nasturtium could take, he did not refer to the colour of the flower in the claim. As a result, plant patent number 141, which Burpee called a 'basic patent', was broad enough to cover all of the different forms that the super-double nasturtium might have taken.[76]

While it had been suggested that the patent was commercially unimportant given that the super-double nasturtium was a 'mere oddity bound for the horticultural graveyard after a season or two of prominence as the result of extensive publicity', nonetheless it was legally important in so far as it raised the question of whether plant patents were limited to specific, singular clonal varieties (such as the Super-Double Scarlet Giant in Figure 8.4) or whether they extended to broad patent claims (as was allowed with mechanical inventions and chemical patents that used structural formula).[77] While David Burpee and one or two supporters favoured basic plant patents (primarily because it made commercial sense to allow applicants to take out one broad patent rather than a series of near identical patents), basic patents and with them plant patent number 141 came to treated as

[74] Keith C. Barrons, 'A Defense of Basic Plant Patents' (1936) 27 *The Journal of Heredity* 475, 477. Barrons was employed as a plant breeder at Watlee Burpee until June 1936, where he worked on the double and super-double nasturtium. Ibid., 476 n.

[75] Ibid.

[76] M. J. Dorsey, Letter to Editor, 'What Is a "Basic Plant Patent"?' (1936) 27 *The Journal of Heredity* 213.

[77] Keith C. Barrons, 'A Defense of Basic Plant Patents' (1936) 27 *The Journal of Heredity* 475, 477.

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FIGURE 8.4 Advertisement for Burpee's patented super-double nasturtiums W. Atlee Burpee, *Burpee's Seeds Grow: Burpee's Annual Garden Book* (W. Atlee Burpee Co, 1935). Courtesy of Biodiversity Heritage Library.

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aberrations, as it quickly became clear that plant patent protection was limited to individual plants and their asexually reproduced progeny.[78] The chief reason for this was that unless plant patents were limited to specific clonal lines, the law would have been too difficult to enforce.

While plant patent number 141 was an aberration, it is nonetheless still important in so far as it highlighted the nature of the plant-based intangible recognised by intellectual property law. Specifically, it highlighted the fact that for much of the twentieth century the intangible property recognised by intellectual property law was treated like a legal hologram of the physical plant; it was treated, in effect, as if it was a virtual plant. As the editor of the *Journal of Heredity*, Robert Cook said, a plant patent was a bio-legal hybrid: 'a biological entity rather than a verbal abstraction outlined with doubtful completeness in the specification and almost defying exact definition'.[79]

Limiting protection to the external surface of individual plants played an important role in allowing intellectual property law to accommodate plant-based subject matter. By focusing on the plant as a whole, intellectual property law makers were not only able to answer the preliminary question of what the subject matter was and how it was to be construed, they also ensured that they did not need to make difficult decisions about how individual parts related to the whole or where parts started and ended. Instead, the law could simply focus on the plant as a whole and leave it up to others to dissect the plant into parts. In this sense, the focus on the plant as a whole helped to resolve some of the issues created by the fluid and uncertain nature of plant-based subject matter. The legal focus on the external phenotypical aspects of plants also helped the law to overcome some of the problems created by the secretive nature of plant innovation which meant that breeders, scientists, and farmers were unable to explain the reasons why biological change had taken place.

While thinking of the plant-based intangible recognised by the law as if it was a virtual plant is helpful, it only tells us part of the story. This is because it does not reveal one of key ways that the intangible was reconfigured in adapting the law to accommodate plant-based subject matter. Unlike with mechanical subject matter, where the intangible property is able to be separated from its material manifestation, with plant-based subject matter the intangible and tangible are unable to be separated or decoupled from each other; one cannot exist without the other. While copyright allows for photographs of a painting destroyed by fire to be controlled by the

[78] *Imazio Nursery* v. *Dania Greenhouses* 69 F.3d 1560, 1567 (1995). In relation to Burpee's invention, this meant that protection should have been limited to super-double nasturtiums of a specific colour, shape and form (and their clonal copies), rather than to some more abstract and less specific class of plants. Protection of a single plant meant that protection was 'not capable of being extended to cover an entire class of morphological types in a given species' such as all colours known to occur' in a species. Editor (Cook), 'What is a "Basic Plant Patent"?' (1936) *The Journal of Heredity* 213, 215. See William H. Eyster and David Burpee, 'Inheritance of Doubleness in the Flowers of the Nasturtium' (1936) *The Journal of Heredity* 51.

[79] Robert Cook, 'Plant Patent 110 Declared Invalid' (1936) *The Journal of Heredity* 475.

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copyright in the (now non-existent) painting, the fused nature of plant-based subject matter means that if the material form of a plant disappears, the intangible does as well. The material nature of plant-based subject matter was expressed in the principle that the rights only persisted so long as the material objects survived or remained identifiable.[80] As Smith J. said in *Le Grice*, if a 'plant variety should become extinct one cannot deliberately produce a duplicate even though its ancestry and the techniques of cross-pollination are known'.[81]

In dealing with plant-based subject matter intellectual property law effectively wears its intangible heart on its sleeve: the 'intangible' property is always visible as the external surface of the protected plant. With plant-based subject matter, there is nothing below the surface to be found, nothing to be traced or interpreted; what you see is what you get. At the same time, the intangible was also unable to stretch to cover plants that were similar to the protected plant nor to more abstract groups or classes of plants: the plant intangible property was limited to and coextensive with the external characteristics of the protected material plant. In this sense, the plant-based intangible property was treated as if it was coextensive with its tangible instantiation or form. The ability of the tangible plant to function as an intangible was reinforced by the fact that the physical property has the intangible-like ability to reproduce itself and with it the intangible property that is carried with it.

Because the intangible effectively disappears or at least is always on show when the physical plant is present, it does not make sense to talk of an intangible being materialised or of an immaterial idea or concept taking a material form. In some ways, it does not make sense to talk of intangible property at all in relation to plant-based subject matter (or at least in the way it is ordinarily understood). Rather, it is better to talk about the plant in its material physical form as an end in its own right.

Intellectual property law's reliance on the physical plant as an end in its own right is evident in the way the law decided when a plant invention came into existence (for the purposes of deciding who was first to invent) and in the way infringement was determined (it was necessary to show that there had been a physical appropriation of the protected plant[82]). Another example of the role that the physical

[80] Alain Pottage, 'Literary Materiality' in (ed) Andreas Philippopoulos-Mihalopoulos, *Routledge Handbook of Law and Theory* (New York: Routledge, 2018), 409, 412.

[81] In contrast, however, '[m]anufactured articles, processes, and chemical compounds when disclosed are, however, susceptible to man-made duplication'. *In re LeGrice* 310 F.2d 929, 939 (CCPA 1962). 1132. *Imazio Nursery* v. *Dania Greenhouses* 69 F.3d 1560, 1569–70 (Fed. Cir. 1995). 'The court noted that there are inherent differences between plants and manufactured articles, observing … that should a plant variety become extinct, one cannot deliberately produce a duplicate even though its ancestry and the techniques of cross-pollination be known'. *Application of Le Grice* (1962) 49 CCPA 1124, 301 F.2d 929, 133 USPQ 365.

[82] Peter Forbes Langrock, 'Plant Patents: Biological Necessities in Infringement Suits' (1959) *Journal of Patent Office Society* 787, 788. The requirement of asexual reproduction was interpreted to mean that infringement was dependent on a plaintiff bringing evidence that the defendant's plant was derived from the patented plant. See, for example, *Yoder Bros.* v. *California-Florida Plant Corp* 537 F.2d 1347, 1380 (5th Cir 1976).

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manifestation of the plant intangible played in intellectual property law can be seen in the 1970 *Plant Variety Protection Act*, which requires applicants to submit 2,500 viable seeds of the protected variety to the National Seed Storage Laboratory at Fort Collins, Colorado, as part of the application process.[83] In some cases, applicants are also required to submit physical specimens of their plants to allow examiners to test the claims made in their applications.[84] As well as being used to test the veracity and accuracy of the claims made in an application,[85] deposited samples also play a role in preserving the viability of the variety[86] and in ensuring, in the words of the American Seed Trade Association, that 'the variety will continue to be available to the public even when it is no longer protected and whether or not the former proprietor continues to produce it'.[87]

While users of the utility patent system have never had the same legal imperative to deposit a material specimen as is mandated under the plant variety protection regime, nonetheless since the first plant-based utility patents were issued in the 1980s, patentees have voluntarily deposited material samples of their plant inventions with approved public depositaries, such as the American Type Culture Collection (ATCC). For example, Pioneer Hi-Breds 1992 patent for an inbred corn line claimed 'Inbred corn seed designated PHP38 having ATCC accession No 75612'.[88] As well as being used to test the claims made in a patent, voluntary deposit in a public depositary, which were endorsed by the Patent Office, allowed patentees to satisfy the requirement of enabling disclosure; that is, the rule that in return for being granted protection over the patented subject matter, applicants were required to ensure that the invention was placed in the hands of the public. The problem patent applicants faced was that while mechanical inventions are able to be replicated

[83] Applicants were under an obligation to replenish the seed sample if germination rate falls below 85%. Janice M. Strachan, 'Plant Variety Protection in the USA' in (ed) F. H. Erbisch and K. M. Maredia, *Intellectual Property Rights in Agricultural Biotechnology* (2nd edn, Cambridge, MA: CABI Publishing, 2004), 73, 80.

[84] In other cases, applicants were required to 'furnish representative specimens of the variety or its flower, fruit or seeds, in a quantity and specified stage of growth, as may be necessary to verify the statements in the application'. It was also possible for applicants to ask examiners to inspect plants in the field so long as they paid all associated costs. Department of Agriculture, Agriculture Marketing Service, 'Plant Variety Protection: Notice of Proposed Rule Making' (18 April 1972) 37(75) *Federal Register* 7673 ('specimen requirements').

[85] The Plant Variety Protection Office sometimes used seed samples to check for correct values about seed sizes and colours and 'we have found some mistakes by doing this'. Janice M. Strachan, 'Plant Variety Protection in the USA' in (ed) F. H. Erbisch and K. M. Maredia, *Intellectual Property Rights in Agricultural Biotechnology* (2nd edn, Cambridge, MA: CABI Publishing, 2004), 73, 80.

[86] Plant Variety Protection Act Amendments; Hearings on HR 99 before the Subcomm on Department Investigations, Oversight and Research of the H Committee on Agriculture. 96th Congress 83 (1980) (statement of Bernard M. Leese, Commissioner Plant Variety Protection).

[87] Hearings before the subcommittee om Agricultural Research and General Legislation of the Committee on Agriculture, Nutrition, and Forestry: United States Senate, Ninety-First Congress, Second Session on S 3070 11 June 1970, 58 (statement by Allenby L. White, Chairman, Breeders; Rights Study Committee, American Seed Trade Association).

[88] Pioneer Hi-Bred, 'Inbred Corn Line PHP38', US Patent No. 5,506,367 (9 April 1996).

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from a written form (the patent), the secretive nature of plant innovation meant that this was not possible with plant-based subject matter. Applicants responded to this problem by turning their attention to the physical plant as a material instantiation of the intangible. By depositing the res, the plant itself, in a publicly accessible collection and by listing the location of the depositary in the patent application, patentees ensured that the invention was publicly available and thus that they had made an enabling disclosure.[89]

As well ensuring that the public has access to the patented plant, deposited samples also functioned like a type specimen to set out and define the scope of the plant intangible. According to an examiner at the Plant Variety Protection Office, if a 'question ever arises about the characteristics of a variety that has [plant variety protection], we go to the voucher specimen and confirm the variety's characteristics through a grow-out trial or genetic fingerprinting'.[90] The reason for this was that 'the voucher seed sample is the most complete description of the variety'.[91] As a result, samples of biological material did not merely verify an application for protection: 'in a very meaningful sense, they affirmatively represent the plant breeder's disclosure of its invention'.[92]

While the written description of the plant in the intellectual property documentation is important, it is secondary to the deposited materials, which were treated as the primary, original, authentic, and permanent record of the intangible. In this sense it could be said that deposited physical samples created a particular way of representing the intangible. In a form of 'metaphysics in action', the deposited sample not only stood in for the intangible, it also created a platform that ensured that protected plants were able to be identified, defined, and demarcated. The fact that protection could not exceed the deposited materials also reinforced the correlation of the plant-based intangible to individual plants.[93]

This understanding of the role played by the deposit of physical material is premised on a series of socio-legal assumptions about what the law does and the impact it has on how plants and people behave. There are a number of reasons why we

[89] USPTO, *Manual of Patent Examining Procedure* s 2404 (7th edn, July 1998).

[90] This type of confirmation was 'needed in an infringement case, where the sample was supplied to a third party under court subpoena. It was also needed when a certificate holder 'wanted to change the varietal description and needed to demonstrate that the change was retroactively accurate'. Janice M. Strachan, 'Plant Variety Protection in the USA' in (ed) F. H. Erbisch and K. M. Maredia, *Intellectual Property Rights in Agricultural Biotechnology* (2nd edn, Cambridge, MA: CABI Publishing, 2004), 73, 81.

[91] Janice M. Strachan, 'Plant Variety Protection in the USA' in (ed) F. H. Erbisch and K. M. Maredia, *Intellectual Property Rights in Agricultural Biotechnology* (2nd edn, Cambridge, MA: CABI Publishing, 2004), 73, 84.

[92] Jim Chen, 'The Parable of the Seeds: Interpreting the Plant Variety Protection Act in Furtherance of Innovation Policy' (2005) 81 *Notre Dame Law Review* 105, 147.

[93] '[V]ariety claims shall not be permitted to exceed the deposited materials. That is, while multiple varieties may be protected with a single application, a deposit will be required for each variety claimed'. William Lesser, 'The Impacts of Seed Patents' (1987) 9(1) *North Central Journal of Agricultural Economics* 37, 42.

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should question this. While examiners use plant material during the examination process to test the accuracy of the claims, once protection has been granted deposited specimens are rarely used. With some exceptions, there is little evidence that the Plant Variety Office or the Patent Office make much use of deposited samples once an application has successfully made its way through the examination process. While the courts sometimes remind us that deposited samples allow patentees to make an enabling disclosure, there is little to suggest that they are used more generally. They certainly don't appear often (if at all) in litigation, at least to set the paraments of the intangible property. What then are we to make of the deposited sample beyond its limited role in the examination process?

One option is that rather than seeing the deposit of plant material as creating an objective standard that grounds and defines the intangible, it is perhaps better seen as a theoretical mechanism that helps to generate trust in the efficacy of the registration process specifically and the legal system more generally. It could be said that deposit of specimens creates trust by completing the logic of intellectual property law. As with nineteenth-century organic chemicals, it could be suggested that because examiners are able to interrogate the physical material, they have access to information that is not otherwise available from the written description. As a result, deposit of physical material allows examiners to evaluate plant-based subject matter properly. One of the consequences of this is that it increases public trust in the legitimacy of the intellectual property protection granted over plant-based subject matter.

While there is some strength in this argument, the idea that the deposit of plant material operates to complete the logic of the intellectual property system and thus generates public trust in its operation needs to be questioned. The reason for this is that it presumes that members of the public not only know about the deposit system but also understand where and how it fits within the intellectual property system. Given the lack of attention that experts in the field have given to the topic, it is safe to presume that public knowledge about the deposit of plant material is minimal.

Given this, what are we to make of the suggestion that deposited samples not only stood in for the intangible but that they also created a platform or standard by which protected plants were identified, defined, and demarcated? This way of thinking about deposit is underpinned by a temporal assumption about the deposited physical material and its relationship to the intangible. Specially, it presumes that the deposited tangible material is not only prior in time, but that it also acts as the foundation that grounds, demarcates, and defines the plant intangible. Given the doubts that exist about the extent to which deposited material is used post-grant, what does this mean for how plant-intangible property is construed?

While the idea that deposited material acts as the foundation of the intangible property may provide a sense of trust in the ability of the patent system to work for those few who know or care about it, it is possible that we are looking in the wrong direction. Rather than looking backwards to deposited plant materials for the a priori foundations of legal property, perhaps it is better to change direction and look

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forward to the plant that is marketed and sold under the imprimatur of legal protection. In this case, the marketed (named) plant becomes the reference point for determining the intangible property.[94] Whether connected by a scientific name, a trademark, an advertisement proclaiming that the plant is protected (see Figure 8.4), or the stamp of an official seed certifying agency, the end-result is the same; in a self-fulfilling act, the seed or plant purchased by the farmer, gardener, or breeder is the intangible. While there was always the potential for this to be challenged and the accuracy of the way a protected plant was described to be tested against the foundational deposit, this rarely, if ever, occurred. At best, it was simply presumed that the plant being sold was the same as the plant that had been deposited; at worst, there was no thought given whatsoever to the deposited material. It simply does not enter into consideration.[95]

INFORMED SUBJECT MATTER

One of the explanations often given for why plant-based subject matter was initially not protected by intellectual property was that breeders lacked the ability to describe their inventions in a way that would have allowed the intangible to be identified, demarcated, and distinguished. As the Supreme Court explained in *Chakrabarty*, one of the reasons why plants were thought to be unpatentable for so long was that they were not amenable to the written description requirement that demands that the patent 'contain a written description of the invention … [in] clear, concise, and exact terms'.[96] Underpinning this argument was a particular way of thinking both about plant breeding and also about the type of expertise needed to satisfy intellectual property law's written description requirement.

While by the 1930s breeders may have been recast as scientists for the purpose of deciding whether they were inventors and thus within the scope of patent law, it seems that this new-found scientific status did not extend to include their ability to describe their inventions in a way that satisfied the requirements of patent law. Instead, breeders were still largely seen as artisanal dabblers, as non-scientific amateurs who were not only unable to access the underlying cause or reason for the botanical innovation and as such were forced to work backwards from the end-results; they also lacked the skills to describe the end-product with the precision

[94] Prior public use and sale of a plant are the avenues by which a plant enters the public domain'. *In re Le Grice* 310 F.2d 929, 939 (CCPA 1962).

[95] The way that a plant patent advances the public purpose is 'by making it profitable for the developer to make as wide a distribution as possible of the res, the plant itself. If the variety is deserving, hundreds of specimens are likely to be widely distributed, thereby reducing the danger of their perishing in a common disaster. The likelihood of extinction of the res before an improved variety or worthy successor is developed is thus rendered remote. Publicity informs the public where specimens exist'. *In re Le Grice* 310 F.2d 929, 939 (CCPA 1962), 1133.

[96] *Diamond* v. *Chakrabarty* 447 U.S. 303, 311 (1980).

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demanded by intellectual property law. When discussing the then new 1930 *Plant Patent Act*, a commentator sarcastically asked: 'How do you describe in words what a violet smells like or a Jonathan apple tastes like?'[97] 'Pray tell me, what does an onion taste like? Please describe the odour of the rose[98] which you purchased on the 15th day of June 1932? … The possibilities of humour as to the "flowers that bloom in spring" are quite unlimited'.[99]

Accompanying these arguments was a belief that breeders would only really be in a position to describe their creations in a way that satisfied the requirements of intellectual property law when they were able to access the hidden interior of plant subject matter: the plant genome that contained the information that was needed to build and maintain that plant. In short, intellectual property protection would only be feasible when breeders were able to describe plants genetically. Until breeders were able to access the 'discrete, objective code within the plant itself',[100] any legal protection provided to plant-based subject matter would either be, as in the case of plant variety protection, inferior to the protection offered to other types of subject matter or, as in the case of plant patents, only possible because Congress was willing to lower its standards to create a special exception for plants (which occurred in 1930 when Congress relaxed patent law's written description requirement so that breeders only had to provide 'a description … as complete as is reasonably possible'.[101])

Faced with the prospect that plant breeders were unable to meet the demands of intellectual property law, judges sometimes fantasied about a time when science would intervene to allow plant-based subject matter to be treated on the same footing as manufactured articles. As Judge Smith wrote in 1962 decision of *Le Grice*, it was necessary to be 'mindful of the scientific efforts which are daily adding to the store of knowledge in the fields of plant heredity and plant eugenics which one skilled in this art will be presumed to possess'.[102] More specifically, Smith J. raised the possibility that '[c]urrent studies to "break the chromosome code" may also add to the knowledge of plant breeders so that they may someday secure possession of a plant invention by a description in a printed publication as is now possible in other fields of inventive effort'.[103] The image of the enthusiastic but amateurish breeder who was waiting to be saved by the wonders of modern genomics not only shaped the way that the future of plant-based intellectual property was imagined, it also

[97] Joseph Rossman, 'Plant Patents' (1931) *Journal of the Patent Office Society* 7, 15.
[98] Robert Starr Allyn, *The First Plant Patents: A Discussion on the New Law and Patent Office Practice* (Brooklyn, NY: Corsi Press, 1944), 46.
[99] Robert Starr Allyn, 'Plant Patent Queries' (1933) *Journal of the Patent Office Society* 180, 185.
[100] Brief Amicus Curiae of Cargill in support of the respondent, *JEM Ag Supply* v. *Pioneer Hi-Bred International* 2001 WL 674207 (US) No 99, 1996, (15 June 2001), 9.
[101] On this basis the Plant Patent Act was 'experimental' (Anon, 'Plant Patent Criticisms and Suggestions' (1934) *Journal of the Patent Office Society* 184) and 'embryonic' (D. H. Sweet, 'Disclosure in Plant Patents' (1934) *Journal of the Patent Office Society* 61).
[102] *Application of Le Grice* 301 F.2d 929, 939 (CCPA 1962).
[103] Ibid., 939 n 7.

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shaped the way that the history of that interaction was told. As Monsanto said in its 1996 amicus curia submission to *JEM Ag Supply* v. *Pioneer*, 'plant inventors' were only able 'to describe and distinguish new varieties in a manner to satisfy the statutory requirements for utility patents' as result of 'scientific advances in new fields such as genetic mapping and gene fingerprinting'.[104]

While there is no doubt that the breeder's ability to describe their inventions improved over the course of the twentieth century and that advances in genomics played an important role in facilitating this, this way of thinking misses an important feature of plant-based subject matter that facilitated its eventual inclusion within intellectual property law, namely that across the twentieth century, plant breeders developed an increasingly sophisticated and effective range of techniques to describe and identify plants. This included the standardisation of naming practices, a growing agreement about how plants were classified and ordered, and the development and adoption of species-specific criteria to describe plant traits and characteristics (including the development of identification-aids such as colour charts to describe flower or leaf colour).[105]

Importantly, the various techniques and practices that breeders developed across the twentieth century to describe plants and the information that this generated was not something that was external to the plant subject matter. Rather, just as with chemical compounds, plant subject matter was an informed material that was constituted in relation to the informational and material environments in which it was generated. Importantly, this environment was not something that was external to the subject matter. Instead, the environment entered into the constitution of the plant: it was folded into and became part of the subject matter.[106] One of the consequences of seeing plant subject matter as informed material rather than as discrete material that is isolated from the environment in which it was created is that it reminds us that by the time that plant subject matter is presented to the law for registration, it will already have been subject to an array of tests and trials that generate a wealth of information; including how and where the plant grows, its shape and form, the length of its leaves, the colour of its flowers, the shape of its stamen, and so on.[107]

[104] Brief Amicus Curiae of Monsanto Company in support of the respondent, *JEM Ag Supply* v. *Pioneer Hi-Bred International* 2001 WL 674207 (US) No 99, 1996, (15 June 2001), 9.

[105] 'Colour differences should be reference with a standard such as the Munsell Book of Color or Royal Horticultural Society Colour Chart'. Janice M. Strachan, 'Plant Variety Protection in the USA' in (ed) F. H. Erbisch and K. M. Maredia, *Intellectual Property Rights in Agricultural Biotechnology* (2nd edn, Cambridge, MA: CABI Publishing, 2004), 73, 83.

[106] When the Plant Variety Protection Act was first passed, the Plant Variety Protection Office provided a list of around 500 descriptors for each class of plant. By 1979 the Office had computerised over 14,000 plant variety descriptions of 79 crops. House Committee on Agriculture, Subcommittee on Department Investigations, *Oversight and Research Hearings on the Plant Variety Protection Act Amendments* 96th Congress, 1st and 2nd Sess, 19 July 1972, 22 April 1980, 13.

[107] For example, where colour was claimed, it was necessary for the drawings to be as accurate and permanent as possible according to a recognised standard such as Ridgeway's Colour Chart, Maerz and Paul's Dictionary of Color, or Windsor & Newton's Specimen Tints of Artists Colours. Raymond

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The new plant will also have been classified, ordered, and given a taxonomic name that ties the named plant to its founding description and a type specimen that materially grounds the description. Drawing upon detailed rules, procedures, and guidelines that govern how the plant subject matter is described and named, the plant will not only be described in detail but also in a way that allows third parties to identify and differentiate it from similar plants at a distance.

While the format used to describe new plants differs depending on the type of legal protection used, plant patents, plant variety protection, and utility patents all tended to include similar information. As well as providing an historical account of the development of the new plant (including information on how the plant was bred, where the sport, bud, or mutation was found, or details of the parent plants), applicants also included information on how the plant differed from similar plants and detailed descriptive information about the characteristics of the plant.[108] Using a comparator variety (which was the variety most similar to the applicant variety) as the base line (and by default other taxonomically related varieties), applicants would simultaneously situate the applicant variety within the botanical order of things and, at the same time, evidence the novelty of the applicant variety by showing how the applicant plant differed from its closest comparator. For example, a 1974 plant variety certificate for a variety of onion known as 'Scanion' included a brief account of the genealogy and breeding history of the variety,[109] details of how the seed of Scanion differed from its closest comparator variety (Southport White Globe), and an objective description of the new variety that included information on growth times and the shape and size of the plant.[110]

The information embodied within the (informed) plant-based subject matter played an important role in allowing intellectual property law to accommodate some of the peculiarities of the subject matter. Specifically, in so far as the information that was folded into the subject matter allowed plant intangible property to be identified, demarcated, distinguished, and defined, it helped the law to deal with the fluid and malleable nature of plant-based subject matter. As well as explaining

Magnuson, 'A Short Discussion on Various Aspects of Plant Patents' (1948) 30(7) *Journal of the Patent Office Society* 493, 504. The colour charts were 'commercially manufactured sets of cards, much like paint-sample cards that breeders held against a plant to identify and match a name to its colours. Daniel Kevles, 'A History of Patenting Life in the United States with Comparative Attention to Europe and Canada' (12 January 2002) *Report to the European Group on Ethics in Science and New Technologies*, 11.

[108] Plant variety protection applicants were required to provide an 'Objective Description of the variety' using forms created by the Plant Variety Protection Office–to 'standardize a complete botanical description of the variety' and to determine differences between varieties. Janice M. Strachan, 'Plant Variety Protection in the USA' in (ed) F. H. Erbisch and K. M. Maredia, *Intellectual Property Rights in Agricultural Biotechnology* (2nd edn, Cambridge, MA: CABI Publishing, 2004), 73, 80.

[109] Section 52(2) Plant Variety Protection Act (1970). USPTO Section 160. *Patent Office Manual of Patent Examining Procedure* (9th Edition, Revision 10.2019).

[110] Keystone Seed Company, 'Onion Variety "Scanion"' PVP Certificate No. 7300001 (15 November 1972).

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how the law dealt with some of the peculiarities of the subject matter, recognising the expertise and skill that breeders exercised in describing plants, along with the way this was folded into and became part of the subject matter, also helps to explain why there are comparatively few (formal) legal disputes about plant intellectual property. The reason being that many of the potential problems that might spill over into the legal arena (such as questions of the novelty of a plant or whether a plant is described in such a way that it can be demarcated and identified) are resolved scientifically in greenhouses, laboratories, and fields prior to the subject matter being presented to the law for scrutiny.

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