The Inscription of Technology in Life

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Abstract

With innovation in the genetic engineering now being rewarded in the form of intellectual property rights, there are new things that are beginning to count as property and as objects of human invention – plant varieties, seeds, germplasm, genetic sequences, DNA and so on. To bring the realm of "biology" within the ambit of intellectual property, to juridify aspects of the biological as products of human invention is to bring new epistemic objects into visibility. While these are revealed through practices of biotechnology, law translates it into a capacity for monopolistic appropriation for biotech innovators. The new correlatives of innovation and intellectual property re-engineer not just the biology of an organism, but the very categories that organized property and intellectual property. What instrumentalities of technology and law co-produce biotic property? I examine these instrumentalities in a two paper series: while the first paper seeks to lay out the work of technology in the creation of new biological artefacts, and consequently new economic spaces and property claims, the second paper would seek to examine the role of law in translating inventive claims as property claims.

Introduction

Londa Schienbinger, in her remarkable book, *Plants and Empire*,[1] reveals the geopolitics of plants in the so-called "early modern world". Drawing connections between the narrative of the Empire and prospecting of plants, between the development of colonial science and the making of markets, she draws attention to the transfer of knowledge and plant resources between continents and heterodox traditions. In her account, historians of science and "plant mercantilists" converged in emphasizing the importance of plants for the political and economic expansion of western European states: "exact knowledge of nature was key to amassing national wealth and hence power."[2] Schienbinger directly links this transatlantic network to experimental traditions in northern Europe dedicated to the development of new, financially lucrative medicines emphasizing what she calls the "global culture of secrets" that governed these exploitative and monopolistic networks.[3]

[1] Schienbinger, Londa L., "Plants and Empire: Colonial Bioprospecting in the Atlantic World", (Harvard University Press, 2004).
[2] Ibid. at p.5.
[3] Ibid. at p.17.

Empire connections did not cease with decolonization. The critical link between plant science and the creation of economic spaces only became stronger with the surge in bioprospection in the 20th Century.[4] A term likely to have been coined by Eisner,[5] bioprospection describes the search for naturally occurring chemical compounds and biological material, especially in biodiverse hot-spots of the world, for the development and commercialization of new cures and remedies.[6] It broadly signifies not only the search for useful compounds which may be extracted from nature, but also the genetic information contained in those organisms that allows modification, development, and commercial synthesis of these compounds. Mid 20th Century onwards, coinciding with the spurt in biotechnology, there begins intensification in bioprospection and use plant genetic resources and "traditional knowledge" as leads for developing new pharmacological compositions.[7] As the intensification of life's management advances, through what can be best described as, new technologies of control, the project of conflating technology with life is stabilized through new institutions and networks of intellectual property rights.

For a long time in history, ideas of ownership and property rights over plant and animal resources related to ownership claims over grain, plants and animals as factors of production. It did not exist in a form that excluded simultaneous use, exchange, breeding, sale that are associated features of contemporary IP claims over the biological realm. It was quite like other ownership claims over tangible property that coincided with the physical possession of the owned object but exhausted once it was transferred through exchange or sale.

What contributed to the emergence of new ownership discourse, in the form of intellectual property rights in plant varieties, was the emergence of the biotechnology industry,[8] which needed to exploit

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[4] See generally Posey, Darrel A. & Dutfield, Graham, "Beyond Intellectual Property: Toward Traditional Resource Rights for Indigenous Peoples and Local Communities", Ottawa: International Development Research Centre, 1996. See in particular "Chapter 1: Who Visits Communities, What Are They Seeking, And Why?", at pp. 6-20.

[5] Weiss, C. and Eisner, T., "Partnerships for Value-added Through Bioprospecting", Technology in Society, (1998), at pp. 481-498.

[6] See Eisner, T., "Prospecting for Nature's Riches", Issues in Science and Technology, Number 6:(2) (1990), at pp. 31-34; Eisner, T., "Chemical Prospecting: A Global Imperative", Proceedings of the American Philosophical Society, Volume 138 (1994), at p.385.

[7] Reid, Walter V., et. al., (Eds.), "Biodiversity Prospecting: Using Genetic Resources for Sustainable Development", (World Resources Institute, Washington, D.C. 1993), at pp.6-15; Brush, Stephen B. and Stabinsky, Doreen, "Valuing Local Knowledge: Indigenous People and Intellectual Property Rights", (Washington, DC: Island Press, 1996); Bye, Robert A and Linares, Edelmira, "The Role of Plants Found in the Mexican Markets and Their Importance in Ethnobotanical Studies", Journal of Ethnobiology Vol. 3(1), at pp.1-13; Laird, S.A., Wynberg, R.P. and Mclain, R.J., "Natural Products and the Commercialization of Traditional Knowledge", in Greaves, T. (Ed.), Intellectual Property Rights for Indigenous Peoples: A Sourcebook (Society for Applied Anthropology, Oklahoma City, 1994) pp. 145-149.

[8] The term "biotechnology" is broadly used in patent law to cover a wide variety of inventions. A convenient definition is found in Article 2 of the United Nations Convention on Biological Diversity, 1992: "... any technological application that uses biological

commercially the genetically rich parts of the globe. Biotechnology is a constantly evolving industry and one that is heavily reliant upon patent protection for its commercial development and continued growth. Most biotechnology companies rely upon patents as valuable assets to provide, among other things, a source of revenue through licensing and sale of patented technology. Intellectual property rights, it was/is argued, would provide incentives and help allocate resources towards new biotechnological endeavours which would address issues of health, nutrition, food confronting the poorer parts of the world. The instrumentalist logic, that conventionally premised property rights in tangible resources – that property rights would help incentivize production, allocate and distribute resources – was "transplanted" to provide a justification for IP rights in genetic resources. The scope of patentable subject matter expanded, slowly and incrementally until it covered plants, plant varieties, germplasm, genetic sequences, plant, animal and human DNA and so on.

Capitalist expansion constantly seeks reorganization of property. Mid 20th century saw innovation in the genetic engineering being rewarded in the form of intellectual property rights and with it the materialization of an entirely new domain of property and rights. What distinguished this realm from the other enclaves and enclosures of property were that this realm was biological. To bring the realm of "biology" within the ambit of intellectual property, to juridify aspects of the biological as products of human creation was to bring, as Fischer states, new epistemic objects into visibility.[9] While new epistemic objects – DNA sequences, peptides, proteins, genetic codes – are objects that are revealed, or made visible, through the practice of biotechnology, it translates into a capacity for monopolistic appropriation, granted to biotech innovations by intellectual property law. The new correlatives of innovation and intellectual property re-engineer not just the biology of an organism, but the very categories that organized property and intellectual property.

systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use." Products of biotechnology can be either non-living or living. Generally, "non-living" products are the structural components of living organisms (e.g. proteins, antibodies, enzymes, and DNA), and are, for the most part, patentable subject matter. "Living" products, on the other hand, may or may not be patentable. But the distinction does not find a clear articulation in patent law as I discuss shortly.

[9] Fischer, Michael M.I., "Technoscientific Infrastructures and Emergent Forms of Life: A Commentary", American Anthropologist, Vol. 107, No. 1. (2005), pp. 55-61,

"Inventing" Biology: Conceptual Issues

What is commodity and what can be property was never a static concept. Slaves at one point in history were considered commodities and traded but are no longer so.[10] Distinctions between things and persons, objects and life, nature and culture were complicit in the earlier legal doctrines that abolished slavery and underlined the hesitation in extending patent rights to plant and genetic resources as creations of nature, and not man. While the abolition of slavery was predicated on this distinction, it was also operative in the initial hesitation in extending the domain intellectual property to include plant genetic resources. Conventional Intellectual property, especially patents, focused on technical or industrial inventions and did not extend to living materials such as plant or plant varieties. A large part of the discomfort relates to claiming inventive rights over forms of life and their molecular components.

It was only after intense deliberations, beginning the decade of 1930s, that for the first time patent jurisprudence extended its ambit to include life forms. Until the early twentieth century, plants were considered products of nature and hence 'unpatentable'. The Plant Patent Act, 1930 (US) overrode this principle, extending a modified form of patent protection to new plant varieties of asexually reproducing plants.[11] In 1970, Congress went even further, enacting the Plant Variety Protection Act, 1970, including new and distinct sexually reproducing plant varieties. [12]

The question addressed in the debates leading up to the enactment of both these Acts in the US are worth looking at for they prefigure in many genome patents debates globally, across forums. A number of articles published in the US following the passage of Plant Patent Act, 1930, shared the scepticism of

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[10] The principle of self-ownership instituted body as the inalienable foundation of liberal and legal individualism. Self-ownership as a principle was employed to denote the sovereignty of the individual over his self, i.e. over his body and mind, which cannot be enslaved against his will. There is an egalitarian premise in self ownership, that each of us has equal rights over our bodies, skills, talents etc. It is condition for the realization of a person's

autonomy based on the belief that individuals have a distinctive moral position as self-governors of some sort.

[11] 35 U.S. Code § 161 - Patents for plants: "Whoever invents or discovers and asexually reproduces any distinct and new variety of plant, including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state, may obtain a patent therefor, subject to the conditions and requirements of this title."

[12] Plant Variety Protection Act, 7 U.S.C. §§ 2321-2582: "To encourage the development of novel varieties of sexually reproduced plants and to make them available to the public, providing protection available to those who breed, develop, or discover them, and thereby promoting progress in agriculture in the public interest."; Section 42A states: -"The breeder of any sexually reproduced or tuber propagated plant variety (other than fungi or bacteria) who has so reproduced the variety, or the successor in interest of the breeder, shall be entitled to plant variety protection for the variety, subject to the conditions and requirements of this Act".

claiming something natural as product of human invention. Sherman and Pottage's inquiry into the history of plant inventions,[13] draws attention to how these authors reflected on the question of whether artificial selection was indeed a mode of invention. Many authors, most of whom were professional breeders (protecting their new-found status as inventors), and patent attorneys (protecting the traditional patent doctrine) complained about the number of plant patents granted to individuals who had merely discovered and then asexually reproduced a new mutation. The objection was that the breeder had, "not produced something new from the sport [mutation], but ha[d] duplicated nature's sport and claim[ed] that sport."[14] The problem with giving protection to sports, buds and mutations was, precisely, that it did not accord with the doctrinal paradigm of invention as origination. Some interlocutors argued about the absence of any inventive faculty in merely finding a fortuitous mutation.[15]

What kinds of human intervention qualified as an "inventive step" in the naturally propagating, self-organizing plant-genetic realm? What acts of invention constituted a manufacture? To what extent was the reproduction of the invention contingent on human intervention and to what extent on the plants' internal mechanism? In general the analytic differences between manufactures and organisms appeared too marked to allow the inclusion of plants in the general patent statutes. In the context of such marked ambiguities and blurred lines, the Plant Variety Protection Act (1970) represents, as Fowler states, a *sui generis* statute that "allowed lax descriptions of the invention, a liberal policy regarding discoveries, and no clear indication that the new plant variety constituted an improvement over existing ones." [16]

What the Act succeeded in doing was to demarcate a new doctrinal realm of patentability that was, in due course, to become a matter of doctrinal interpretation. By holding that living organisms were eligible for patent protection, the decision in *Diamond v. Chakrabarty*[17] gave rise to the idea that there was no categorical difference between organisms and manufactures, and hence no need to define the limits of 'manufacture'. The US Supreme Court affirmed the novelty of an invention, rather than its mode of origination or reproduction, as the essential qualification for patentability. A 'new' organism was every bit

[13] Pottage, Alain and Sherman, Brad, "Organisms and Manufactures: On the History of Plant Inventions" Melbourne University Law Review, Vol. 31 (2), 2007, at pp. 539-568.
[14] Allyn, Robert Starr, "Plant Patent Queries", Journal of the Patent Office Society, Vol. 15(3) (March, 1933), at pp. 180-186, quoted from Brad Sherman and Alain Pottage, Ibid. at p.555.
[15] For details see Sherman and Pottage, supra no. 13, at p.555.
[16] Fowler, Cary, "Unnatural Selection: Technology, Politics, and Plant Evolution", (Gordon & Breach Science Publishers, 1994), at p. 93.
[17] 447 U.S. 303, 1980.

as 'novel' as a 'new' machine. The basic criterion in the post-Chakrabarty phase, has been to regard biotechnological interventions in plants (animals and human beings) as turning organisms into "manufactures", collapsing the distinction between the "grown and the "made".

Patent doctrines, outside of the US have retained, in varying degrees, some scepticism about totally collapsing the distinction between man-made (manufactures) and grown (organisms/life forms). The scepticism is animated by concerns other than utility. The Canadian rule makes a distinction between "higher" life forms that are not patentable, and "lower" life forms that are patentable.[18] Unicellular organisms are traditionally classified as lower life forms in Canada while multi-cellular organisms are considered to be higher life forms.[19] European Patent Convention (EPC) excludes essentially biological processes for the production of plant and animals (Art 53(b) EPC), i.e. classical breeding comprising crossing and selection. At the same time it confirms that plants or animals are patentable if the technical feasibility of the invention (e.g. a genetic modification) is not confined to a particular plant or animal variety (Art. 27(b) EPC). Indian Patent Law (Second Amendment), 2002, added a new section 3(j) to the Patents Act, 1970 that expressly excludes as inventions, "plants and animals … including seeds, varieties and species and essentially biological processes for production or propagation of plants and animals."

The exclusion of biological processes, plant, animals from almost all initial patent regimes indicates an acknowledgement of the distinction between the realms of biology and manufactures. However, inventive claims in biological artefacts arise precisely out of the collapse of the distinction between the biological and the man-made, between nature and culture. The emergence of new biotechnologies is often used to define production of plants and animals through genetic engineering as not being essentially biological.

The legal status of the patentability of genetic sequences in living organisms continues to be ambiguously interpretative and rests on whether genetic engineering constitutes "novelty"[20] or "inventive step"[21]. In other words, the question of whether DNA sequences should be patented or not, directs attention away from questions that relate to "origins" or genesis towards the question of novelty. This ambiguity relates to an absence of a foundational set of criteria that delineates a realm of what counts as property. In response,

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[18] See Harvard C. v. Canada, [2002] 4 S.C.R. 45, 2002 SCC 76, at p.158 (Can.).
[19] Canadian Intellectual Property Office, Manual of Patent Office Practice (2007), at Section 12.04.
[20] 35 U.S.C. 8.
[21] EPC, 1973, Art . 56.

a whole host of conceptual and moral reversals have been mandated for property law which seeks to inscribe life in law.

What Can Be Property?

The question of 'what can be property' is often linked to 'why we have property' or questions about the justification of property. One of the commonly accepted explanations of property is that property performs a social function – it helps to allocate and distribute scarce and valuable resources efficiently and leads to their optimal utilization. Functionalist histories of property suggest that property rights are established to promote efficiency in socio-economic relations and are a response to needs for clear signals in market relations.[22] "Strong and clear" property rights, affirmed routinely by economists and neo-liberal theorists, are a prerequisite for an efficiently functioning and growing market economy.[23] Further, it is argued that an institutional framework characterized by strong private property rights, free markets and free trade liberates individual entrepreneurial freedoms and skills.[24]

This rationale has a long, variously articulated history,[25] but I want to bring to attention perhaps its most visually evocative enunciation in the "tragedy of the commons" thesis.[26] The idea that resources held in common will tragically be depleted by overuse received its most famous elaboration from Professor Garrett Hardin. Hardin's story centres on a pasture open to all, upon which herdsmen let their cattle graze.

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[22] Sell, Susan K. & May, Christopher, "Moments in Law: Contestation and Settlement in the History of Intellectual Property", 8 Rev. Int'l Pol. Econ. (2001) 467, at p.471.; See North, Douglass C., (1990). "Institutions, Institutional Change and Economic Performance", (Cambridge University Press, 1990).: Property rights, like other institutions, are "the rules of the game" of a society. Property rights create incentives for investment that in turn fuel economic growth. Weak property rights lead to low investment levels and low growth. The more likely it is that the sovereign will alter property rights for his or her own benefit, the lower the expected returns from investment and the lower in turn the incentive to invest." See further North, Douglass C. & Weingast, Barry R., "Constitutions and Commitment: The Evolution of Institutional Governing Public Choice in Seventeenth-Century England", The Journal of Economic History, Vol. 49, No. 4 (Dec., 1989), pp. 803-832 at p. 803.

[23] Beginning from the earliest to the more recent enunciations of this perspective: Bentham, Jeremy, "The Theory of Legislation", (Oceana Publications, 1975 [1690]), at p. 81; Smith, Adam, "An Inquiry into the Nature and Causes of the Wealth of Nations", (University of Chicago Press, 1977); De Soto, Hernando, "The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else" (New York: Basic Books, 2000); See also, Barros, D. Benjamin (Ed.), "Hernando de Soto and Property in a Market Economy", (Burlington: Ashgate 2010).

[24] Adam Smith (1977); Jeremy Bentham (1860); Hayek, Friedrich Von, "The Road to Serfdom", (Routledge 1944, 2008); See for example James Buchanan and the "Virginia School" with its focus on public choice theory, in Buchanan, James, "The Limits of Liberty: Between Anarchy and Leviathan", (Liberty Fund, Indianapolis, 1975), and in the (largely libertarian) "Chicago School" with Milton Friedman as its most prominent representative (See Freidman, Milton, "Capitalism and Freedom", (University of Chicago Press, 1962)). On the Chicago School as a whole see Emmett, Robert D, "The Elgar Companion to the Chicago School of Economics", (Edward Elgar Publishing, 2010).

[25] Adam Smith (1977) and Jeremy Bentham (1860), ibid.

[26] See Hardin, Garrett, "The Tragedy of the Commons", Science, New Series, Vol. 162, No. 3859.(Dec. 13, 1968), pp. 1243-1248.

Herdsmen have an incentive to put as many cattle as possible on the commons because they are able to appropriate the entire gain from the cattle that they add, but suffer only a fraction of the loss from overgrazing. The herdsmen therefore add continually more cattle to the commons, leading to overuse and the "destination of ruin." Garrett Hardin's recounting of the tragedy of the commons inspired a search for solutions, the most popular of which remains privatization of property. [27] In the absence of property rights, common use of resources would lead to the 'tragedy of the commons' where no individual would have the incentive to preserve its value, given that the cost of not doing so will be spread among his co-owners, compared to his immediate private benefit gained from overuse.

This line of reasoning argues that possession of things by individuals is superior to individual use of common possessions.[28] If something is scarce, the best way to ensure that it is put to its most productive and optimal use, is to assign it to an owner motivated to find its best use. For instance, Harold Demsetz suggests that allocation of property rights, which grants the owner the right to exclude, creates incentives for efficiently utilizing resources. It also internalizes many of the transaction costs and externalities of communal ownership.[29] Allocation of property rights emerged from this line of thinking as a precondition for the efficient functioning of markets.

Scarcity and Property

Implicit in the above line of reasoning is an assumption that property rules would not be needed to govern appropriation and allocation if resources were freely available. For instance, we do not have property rights in the air we breathe, simply because there is enough and as good for everyone.[30] There exists, as many have argued, a causal connection of property to conditions of scarcity. Property is thus understood as "a system of rules governing access to and control of scarce material resources."[31] Benjamin Tucker for

[27]Ibid.

[28] Aristotle too remarks that individual ownership creates a more thorough and stable community of interests and better promotes efficient, economical, and careful use of things than does common ownership. Aristotle, "Politics", Book II, Chapter 5, in McKeon, Richard (Ed.), "The Basic Works of Aristotle" (NY: Random House, 1941), at p.1151.

[29] Demsetz, Harold, "Toward a Theory of Property Rights", The American Economic Review, Vol. 57, No. 2, (May, 1967), at pp. 347-359.

[30]Of course there are rights in air spaces, but they usually not property rights and they are usually not held by private individuals. Hardin too recognizes the conundrum that "indivisible" property places for private property rights. For air and water, that cannot easily be fenced, he proposes taxing devices to avoid these succumbing to the "tragedy of the commons". See further G. Hardin, "Tragedy of the Commons", supra n.26 at p.1245.

[31] Waldron, Jeremy, "What Is Private Property?", 5 Oxford J. Legal Stud. (1985), at p.318.

instance, says that property was meant to serve a purpose, i.e. to solve the problem of 'scarcity'.[32] Certainly property rights are more likely to develop in things that are scarce than things that are common. Demsetz states, "[i]n the world of Robinson Crusoe property rights play no role."[33] Hunter-gatherers did not consider land to be property, since there was no shortage of land. Agrarian societies later made arable land property, only when it got scarce. When items are relatively scarce with respect to people's desires they become objects of property, property outlining the domains of ownership and the rights associated with it. Waldron points out that societies that do not face severe conditions of scarcity, may exhibit an absence of property rules for allocation issues may be resolved through social rules and/or 'more or less coordinated instinct and impulses'.[34] But, in conditions of scarcity, the absence of these rights would plausibly lead to the use of force to resolve conflicts arising out of tussle over ownership. It is important to underscore the linkages that the origins of property had with conditions of scarcity because it is precisely this condition that is circumvented by the legitimating premises of intellectual property, a point I will discuss shortly.

Along with scarcity, the other foundational and necessary criterion for commodification is value, as measured in monetary terms. A commodity's worth can be understood in terms of exchange value, i.e. the monetary value for which an object can be exchanged in a market transaction. Such a valuation implies that these commodities are fungible and commensurable (i.e. capable of their use value or intrinsic value being measured in monetary terms). One of the chief proponents of "universal commodification", Richard Posner argues in Economic Analysis of Law, that everything people value should be ownable: "if every valuable resource (meaning scarce as well as desired) were owned by someone (universality), if ownership connoted the unqualified power to exclude everybody else from using the resource (exclusivity) as well as to use it oneself, and if ownership rights were freely transferable, or as lawyers say alienable (transferability), value would be maximized." [35]

What can be property? If we take scarcity and value to be a foundational premise, necessary criterion, the answer would read something like this: Those things that are scarce and are of value can be property. If we ask a further question: Can only those things that are scarce comprise the universe of things that count as

[32] Waldron and Macpherson call this "the sufficiency limitation," and Nozick calls it "the Lockean proviso." Waldron, Jeremy, "The Right to Private Property", (Oxford: Oxford University Press, 1988), p. 210; Macpherson, C.B., "The Political Theory of Possessive Individualism: Hobbes to Locke", (London: Oxford University Press, 1962), p. 211; Nozick, R., "Anarchy, State, and Utopia", (New York: Basic Books, 1974), pp. 178-182.

[33] Harold Demsetz, "Toward A Theory Of Property Rights", The American Economic Review, Vol. 57, No. 2, (May, 1967), at p.347.

[34] Waldron, supra n.31, at p.319.

[35] Richard Posner, "The Economic Analysis of law", (Aspen Publishers, 5th edition, 1998), at p. 34.

property? For tangible forms of property – the "thing" domain – scarcity is a necessary and often enough a sufficient criterion as well. However, the realm of intellectual property deconstructs the instrumentality of scarcity. Scarcity as a criterion for propertization does not account for those things that were not limited by finitude and scarcity. Ideas, for instance are not limited by finitude. Depletion or exhaustion, that affects tangible 'things', does not affect the world of ideas because there is an infinite source of ideas and an idea can exist forever. You singing my copyrighted song does not wear out the tune. Nor does your use of the idea underlying my patented invention destroy the idea. In other words, repeated use neither depletes nor exhausts an idea.

The de-coupling of the idea of scarcity and (intellectual) property holds good for biological property as well, albeit differently. Species, unlike ideas, can become scarce, endangered or even extinct. They require conditions to thrive. However despite this, biological property demarcates its own realm distinct from "things". Unlike things, it is endowed with an inherent capacity to reproduce and adapt. The "technology" to reproduce is internal to the organism, within its own genetic make up, which endows it with an ability to reorganize and replicate itself. It is precisely because living organisms are reproducible, that biological property does not face the barrier of scarcity in quite the same way as things do. Take the example of a seed: because of its regenerative capacity, the replica of the same seed can be used by more than one person concurrently. Biological materials therefore do not share with tangible property their inherent propensity to exclude, at least to the same degree. While you can prevent seed A from being used by someone else (because it is in your physical possession), you cannot extend a similar claim of ownership to reproduced replicas – unless of course the terms of exclusion are superimposed by legal regimes and rules of intellectual property.

Because biogenetic goods are self-replicating, capital faces an apparent accumulation problem.[36] To use the question Berland and Lewontin ask to explain this proposition: 'Why would a rational farmer pay a second time for something he has already bought and still possesses in the form of a seed crop?'[37] Capital accumulation, in biogenetic property especially, relies heavily on the legal regimes to institutionalize intellectual property rights, which in some developed countries makes the farmers' right to save, reuse and

[36] See Rangnekar, Dwijen, "Geneva Rhetoric, National Reality : The Political Economy of Introducing Plant Breeders' Rights in Kenya", New Political Economy, Vol. 19 Issue 3 (2014), at pp. 359-383.

[37] Jean-Pierre Berland and Richard Lewontin, "Breeders' Rights and Patenting Life Forms", Nature, 322, 28 August (1986), at p.786.

to exchange, unlawful. Intellectual property rights become a necessary, contingent condition for the valuation of these genetically engineered goods, a valuation that is secured in legal frameworks that protect monopoly and innovation.

Commodification of the organic, biological domain is effected through the explicit mechanism of law and technology. The idea of propertization is not implicit in the "essence" of organic systems. Canguilhem says that organic systems at best display a capacity or a potential to integrate interventions.[38] The task of biotechnology becomes, as Rabinow put it,[39] as a mode of revealing potentials, not essences – a potential to be disaggregated into genetic components, each of which are ascribed value through the networks of law. While the rest of this paper looks at the production of life through technologies of engineering life, the precise moves that law makes to stabilize the newly revealed and sequenced "potential", are explored in the next paper.

Inscribing Technology in Life

Life sciences are in the midst of a historical period analogous to the early 20th century in the physical sciences. A primary pursuit of life sciences projects is to understanding the functional potential of microbiological organisms and to generate predictive knowledge of complex biological systems. It is the issue of predictability that ties the life sciences with engineering. Engineers seek to advance a constitutive understanding of complex biological systems and predict combinations and mutations can operate reliably under circumscribed conditions. Labelled as "reductionism", engineering of biological resources involves a focus on the molecular and cellular components and processes that govern life. Reductionism 'dissects and analyses individual components of living systems to infer mechanisms and to account for the behaviour of the whole'.[40]

With the rise of molecular biology in the 1950sand 60s research in the life sciences became mostly reductionist. In order to understand the behaviour of a biological system the system was dissected into its

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[38] Georges Canguilhem, cited from, Paul Rabinow, "Assembling Ethics in an Ecology of Ignorance", presented as the closing plenary lecture of the First Conference on Synthetic Biology, held 10-12 June 2004 at MIT. Available at http://openwetware.org/images/7/7a/SB1.0_Rabinow.pdf (as accessed on 24 May, 2011), at p. 4.

[39] Ibid, at p. 5.

[40] "A New Biology for the 21st Century", National Research Council (National Academic Press, 2009), 48

parts (mostly, into molecular parts) and the parts were studied in isolation. In the 1970s and 80s, reductionism went a step further when molecular biology "went genomic" (Darden and Tabery 2009). The attention shifted towards discovering the DNA-sequence of the genome of various organisms, including humans (Venter et al. 2001).[41] 'Information about genetic structure and about the molecular processes that are involved in the expression of genes was expected to explain the occurrence of phenotypic traits.'[42] One of the purposes was of course to isolate the broken gene, fix it and cure the disease. The isolation of BRCA1 and BRCA2 gene (and the subsequent litigation surrounding its patent claims by Myriad Genetics) can be cited as an example of both the technique and a purpose for which it was deployed. Biotechnologies, as Pottage puts it, have already made a break with Darwinian genealogies by suspending the potentialities set in motion by evolution and making them available as the unmotivated elements of a rewritable text.'[43]

Inscribing Teleology in Biology

Engineering of life forms has been marked by one discerning feature – the disaggregation of organisms into its constituent parts such that each part becomes a potentially ownable component. This replaces the earlier "teleological conception of an organism" where practically all vital processes are considered to be so organized that they are directed to the maintenance, production, or restoration of the wholeness of the organism.[44] This concept of teleology had an "organismic sense" i.e. the part only had significance within an organism, to the extent that it helped maintenance of the whole. An organism bound to a telos yields the possibility of conceiving nature differently. In the pre-biotech era, organisms had a history, usually as a whole. Seldom did the parts claim a detached, non-relational history of their own.

What biotechnology does is to disaggregate living tissues and organisms to their components, assigning them distinct teleologies and function. If organisms are members in a process of historical evolution, then

[41] For details see, Marie. L. Kaiser, " The Limits of Reductionism in Life Sciences", in *History and Philosophy of the Life Sciences* 33/4 (2011), 253-276
[42] Ibid
[43] Venter, cited in Alain Pottage, "Too Much Ownership: Bio-prospecting in the Age of Synthetic Biology", *BioSocieties* (2006), 144
[44] Bertalanffy, Ludwig Von, "Modern Theories of Development: An Introduction to Theoretical Biology", (Oxford University Press, 1933), at p. 8; See also Koutroufinis, Spyridon "Between Teleology and Mechanism: A Philosopher looks at the History of the Concept of Organism", Lecture at the Centre for Philosophy and the Natural Sciences, March 7, 2012, as accessed at www.csus.edu/cpns/events/3_7_13%20Lecture_CPNS.pdf, where he outlines the evolution of organismic theory from ancient times up to the 21st century, focusing on the tension between two antagonistic concepts – teleology and mechanism.

the segregated physico-chemical part (which, in the first place is a contingency of that history) is detached from its internal organizing principle and its evolutionary history and acquires a de-historicized purposiveness of its own, seeking newer modes of actualization. Biotechnology described and articulated parts, assigning them particular functions.[45] Technical developments of synthetic biology, and its recombinant DNA technology, offered the hope that cells could be transformed into factories for valuable biological materials and thus open up business opportunities. Organisms began to be treated as physico-chemical systems, capable of being isolated, selected and assigned distinct functions and telos of their own.[46] It is through this process of artificial selection and segregation that much of the advance in medical and agro sciences have been made.

A basic feature of diverse life systems is the means by which they acquire their order and structure. The organic forms of nature are self-developing in the sense that they exhibit the principle of change within themselves – *physis* (nature) as the "arising out of something from itself," a natural self-genesis. In self-organizing systems, pattern formation occurs through interactions internal to the system, without intervention by external directing influences.[47] Moreover, the rules specifying interactions among the system's components are executed using only local information, without reference to any global pattern.[48] Conversely, and unlike biological systems, technological systems become organized in response to commands from outside. *Techné*, unlike *physis*, implies mediation by an external agent (reason) to an object in order to bring about change in it. The principle of change is here foreign to the object. The

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[45] Rabinow, Paul, "Making PCR: A Story of Biotechnology", (University of Chicago Press, 1987). The polymerase chain reaction is variously referred to as a biotechnology idea, a discovery, an invention, a tool, a technique, a method, an experimental system, a machine, and a practice that emerged from the Cetus Corporation in the 1980s. What started as an idea in 1983 turned into an efficient and cost-effective means for taking small amounts of DNA and replicating them into large quantities. It is a technology that undergirds a wide range of biotechnology research with applications ranging from high-profile genetic research including the Human Genome Project and biotech experiments with cloning to applied diagnostics such as the DNA fingerprinting now commonly introduced as evidence in legal cases.

[46] The novelty of the field molecular biology, or what is loosely called biotechnology, was described as resulting from the divisibility of cell biology's traditional unit of analysis, and the opening of a new, more fundamental level of analysis - the sub-cellular, or the molecular. "Rockefeller Foundation Annual Report", 1938, as referred to in Abir-Am, P., "The Discourse of Physical Power and Biological Knowledge in the 1930s: A Reappraisal of the Rockefeller Foundation's 'Policy' in Molecular Biology," Social Studies of Science, 12 (1982), at pp. 344-345.

[47] See Haken, H., "Synergetics", (Berlin, Springer-Verlag, 1977), at p. 191.

[48]Scott Camazine, Jean-Louis Deneubourg, Nigel R. Franks, James Sneyd, Guy Theraulaz, & Eric Bonabeau (Eds.), "Self-Organization in Biological Systems" (Princeton University Press, 2001), at p.8: Distinguishing mechanisms of self organization of biological systems from physical systems (sand dunes, whirlpools for example). Camazine et. al. outline the following as one important distinguishing feature: "In particular, the subunits in biological systems acquire information about the local properties of the system and behave according to particular genetic programs that have been subjected to natural selection. This adds an extra dimension to self-organization in biological systems, because in these systems selection can finely tune the rules of interaction", at p.12.

opposition between *physis* and *techné* has generated the traditional divisions between nature and culture. Biotechnology subverts this natural variance principle thereby conflating the domains of the biological and the technological. Biological systems begin to be re-organized through commands from outside, distancing the ordering principles both from the 'internal' and the 'local'. On similar lines, Sherman and Pottage explain that biotech manoeuvres diffract the plants into multiple embodiments and a number of distinct legal entities, each of which can potentially correspond to multiple principles of origination or authorship.[49] In modern patent law, the distinction between the biological and the mechanical stabilised by making the biological materials emulate the life-world of the mechanical.[50]

The beginning is, as Habermas states, with biotechnologies collapsing the traditional, categorical distinction between 'the made' and the 'grown', or between "what is manufactured and what has come to be by nature".[51] Biotechnologies reduce living tissues and organisms to inert components that can be engineered and programmed: "[W]hat hitherto was 'given' as organic nature, and could at most be 'bred', now shifts to the realm of artefacts and their production".[52] When everything can be made or remade, there is no world of external immutable laws that exist independent of human action or its default. In fact, it is rendered contingent on it. Thus science no longer is a human activity that uncovers "nature". By dissolving the distinction between the grown and the made, science, and its instrumentality biotechnology, itself become nature.

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[49]Supra, n.13.

[50] See, e.g., Jack Kloppenburg, "First the Seed: The Political Economy of Plant Biotechnology", (New York: Cambridge University Press, 1987); Bruno Latour, "The Pasteurization of France" (Cambridge, Mass.: Harvard University Press, 1988); See Edward Yoxen, "Life as a Productive Force: Capitalizing the Science and Technology of Molecular Biology," in Les Levidow and Bob Young (Ed.), "Science, Technology and the Labour Process: Marxist
Studies", (Atlantic Highlands, N.J.: Humanities Press,1981), pp. 66-123; and Abir-Am, Pnina, "Beyond Deterministic Sociology and Apologetic History: Reassessing the Impact of Research Policy upon New Scientific Disciplines (Reply to Fuerst, Bartels, Olby and Yoxen)", Social Studies of Science , Vol. 14, No. 2 (May, 1984), pp. 252-263; George Basalla, "The Evolution of Technology" (Cambridge: CUP)

[51]Habermas, Jurgen, "The Future of Human Nature", translated by Hella Beister and William Rehg, (Polity Press, 2003), at p. 46. Habermas reaffirms the core 19th C understanding that echoed amply in German philosophy– that nature and technology are two separate realms that should be kept ontologically and morally distinct.

[52] Ibid. at p. 12.

Inscribing Authorship Into Biology

In a pioneering work, Cambrosio et. al. (1990),[53] while analysing expert testimony in a trial concerning a dispute over a biotechnology patent, state that it is necessary not only to establish ownership of a contested object but also its very existence as an *autonomous entity*. [54] Accomplishing the latter task involves constructing identity-criteria for the objects in question. This is precisely what biotechnology is able to achieve. It aids the construction of separate identity through a process that engineers biological sub-parts, ascribing each part a discrete identity and distinct telos. Rather than the 'whole' being a factor of production, the segregated parts, by themselves or in conjunction with other parts, become "separable" and therefore ownable parts, each turning into distinct commodifiable and ownable units. Hence, you have intellectual property in DNA sequences, in germplasm, in bacteria, other microorganisms and so on, displacing the earlier ownership conventions of property in "wholes" like crops, trees, seeds, cattle and so on. From crops and cattle being commodities, micro-organisms, DNA, genetic sequences are rendered commodifiable creating not just new technological benchmarks but also new economic spaces.

It is important to mark this shift in the domain of the biogenetic resources – from the organismic to the mechanistic – and see it as a move that is not merely technological, or just an advancement over previous scientific strategies. This move performs an important social function that establishes patent or breeders' claims. Each part, each embodiment that emerges out of the diffracted plant becomes, as Sherman and Pottage explain, a distinct legal entity that can potentially correspond to multiple principles of origination or authorship.[55] The establishment of authorship becomes one of the modes through which biological materials come to emulate the life-world of the mechanical that responds to *techne*, or mediation from an external source.[56]

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[53] Cambrosio, Alberto; Limoges, Camille; Pronovost, Denyse (Eds.), "Representing Biotechnology: An Ethnography of Quebec Science Policy", *Social Studies of Science* (1990), Vol. 20, S. 195-227.

[54] *Hybritech (a subsidiary of Ely Lilly) v. Monoclonal Antibodies Inc.*, United States Court of Appeals, Federal Circuit. - 802 F.2d 1367, Sept. 19, 1986. Hybritech had sued Monoclonal alleging that the monoclonal diagnostic kits infringed upon its patent defining a variety of sandwiched assays using monoclonal antibodies.

[55] *Supra*, n.13.

[56] *See*, e.g., Jack Kloppenburg, "First the Seed: The Political Economy of Plant Biotechnology", (New York: Cambridge University Press, 1987); Bruno Latour, "The Pasteurization of France" (Cambridge, Mass.: Harvard University Press, 1988); *See* Edward Yoxen, "Life as a Productive Force: Capitalizing the Science and Technology of Molecular Biology," in Les Levidow and Bob Young (Ed.), "Science, Technology and the Labour Process: Marxist Studies", (Atlantic Highlands, N.J.: Humanities Press,1981), pp. 66-123; and Abir-Am, Pnina, "Beyond Deterministic Sociology and Apologetic History: Reassessing the Impact

The collapse of the biological and the manufactured is a necessary move for making intellectual property claims. The biological and the organic have to be demonstrated as outcome of human intervention before cognitive and property claims can be made. In other words, technology has to demonstrate its intervention in reordering the matrix inherited by biology. It has to mark its technological distance from those that prevailed in their natural states in nature. A patent claim needs to distinguish itself from like or similar entities that are either its predecessor or contemporary. Originality, Novelty, non-obviousness, become the "identification marks" of a technology that has measured its distance from biology.

There are several new features of biogenetic property constructs. One, that they are not deducible from what Pottage calls, 'embedded features of the world' ordered in accordance 'with the ontological architecture of the world.'[57] The ontological architecture of the biotic realm would be amenable to propertization, but would resist its subsumption under intellectual property regimes that police the "propagating boundaries" of biology. To establish property rights in disembodied, incorporeal items like *ideas,* law resorts to translating property claims into sets of secondary symbols that fulfil the 'tangibility' requirement of property. The tangibility requirement could be fulfilled better and more numerously, by genetic sequences, codes, micro-organisms, for instance.[58]

Apart from tangibility requirement, like all property laws IP rights too have an "authorship requirement". In general, this is a tricky requirement for all entities that correspond to the ideational realm because ideas by nature are intergenerational and cumulative, making every assignation of authorship a synthetic one.[59] To claim inventive rights, an author has to demonstrate an organism's rupture with all its relational histories and states of knowledges. The tangible manifest entity – Bt gene, for instance – has to be shown to demonstrable detached from both its ideational, cultural and organismic history, so that new claims of authorship and inventiveness can be made. The scientist in the laboratory, who isolates the Bt gene from

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of Research Policy upon New Scientific Disciplines (Reply to Fuerst, Bartels, Olby and Yoxen)", *Social Studies of Science* , Vol. 14, No. 2 (May, 1984), pp. 252-263; George Basalla, "The Evolution of Technology" (Cambridge: CUP)

[57] Pottage, Alain, Mundy, Martha "Law, Anthropology, and the Constitution of the Social: Making Persons and Things", (Cambridge: Cambridge University Press, 2004), *at* p.3. [Emphasis mine]

[58] Other examples would include, a written document, a pharmaceutical drug, a machine.

[59] The biogenetic realm has an added level of complication. The physical realm – i.e the biotic realm in which ideas come to manifest themselves is not *as determinate* as the inorganic, physical realm. The biological realm is self propagating, self replicating, permitting simultaneous use not just of the ideas that relate to it but also the plants and the seeds and genes that correspond to it. This indeterminacy is overcome through legal manipulation of patent doctrines, points I discuss in the next chapter.

soil bacteria, becomes the "creator" and the author of this gene, the claim resting on the fact that this gene does not freely exist in this detached state in nature.[60] Invention of a new physical state – albeit committed to the same function that the gene/micro-organism performed in its natural state – comes to be the new mode of determining origination.

Authorship claims, relating to intellectual property, can now be established without reference to the Labour Theory,[61] or Just Acquisition,[62] or First Occupancy,[63] theories on which the classical defence of property rests on. Common to these theories was the simulation of mythic narratives of origin of "just" property on which was mounted some of the strongest and the most influential justifications of property. The justness of the "origin" of property was to arbitrate on claims of property.[64] IP rights in the biological domain have had to jettison the origins-narrative based theories of property rights. For a realm that is self-organizing and self-replicating, the location of the "first occupier" or the location of a "creator" is indistinct. Who is the creator? The microbiologist in the laboratory? Nature? Community? – All plausible contenders but seldom, unequivocal ones.

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[60] It is a different matter that this claim is also detached from the fact that the But gene (Bacillus thuringiensis) of the soil dwelling bacteria continues to perform the same function as it did in its natural, original biological state, i.e. produce crystal proteins that have insecticidal action. For details see, http://www.gmo-compass.org/eng/glossary/

[61] Locke's Labour theory does not serve IP rights for there could be many people simultaneously expending labour to "invent" simultaneously but the first-past-the-post system ensures that only the "first inventor's" claim is registered as his intellectual property.

[62] Nozick (1974), *supra* n.32.

[63] The doctrine of first possession was first defined by Samuel von Pufendorf and Hugo Grotius. It found one of its most noted invocations in *Pierson v. Post*, 3 Cai. R. 175 (N.Y. 1805. The majority judgement, invoking the natural law principle of first possession, stated that "*first possession requires physical occupation"* or the actual physical capture of the beast in order to confer a property right to the hunter. Mere pursuit of the beast is inadequate. Possession could also be obtained if the beast is mortally wounded or if the beast escapes, but is subsequently recaptured. For details of the case, *see*, e.g., Fernandez, Angela, "The Lost Record of Pierson v. Post: The Famous Fox Case", *27 LAW & HIST. REV.* 149 (2009). The First Occupancy thesis (Nozick's "just initial acquisition" n.32), which shares some characteristics of the labor theory, regards possession or "occupancy" as the origin of property. The justness of the "origin" of property was to arbitrate on conflicting claims of property. There is an important supposition or sub-text in the "text" of first possession - that there is there is need to establish "first possession" because the world of that resource/object is limited by finitude. Rightful possession of the object is meant to establish an ownership claim which excludes others from similar and simultaneous claims. There is, thus, a clear reference to the origin of ownership claims leading to unequivocal property rights.

[64] Like Locke, Nozick's entitlement to property begins with rights over one's self. However, Nozick realizes that property ultimately involves more than self-produced objects and ideas. It involves, for instance, *land*. I may have improved the land but it was by no means created by me. So my title in land cannot be grounded solely in the exercise of my self-owned powers. Besides one is also an owner of things not produced or created by oneself. An entitlement to external goods like land comes from the fact that others have transferred the land to the individual, considered the owner. So, whatever has been legitimately transferred becomes an inviolable right of the owner. Property rights in Nozick are based on justice in acquisition and justice in transfer. The question about the initial acquisition, however, is prior to the question of legitimate transfer.

Establishing Social Contingency

One of the most vital aspects of biotechnology patents has been their role in forcing the re-negotiation of traditional elaborations of the distinction between nature and culture. This corresponds to what Paul Rabinow (1999) terms as “biosociality”, a transformative condition under which both nature and scientific work in the life sciences become increasingly revealed as cultural practice.[65] The concept of biosociality relates to an emerging condition whereby biological explanations of society become less dominant and where the cultural and social contingencies that underlie science emerge. In other words, science, modelled by social values, reveals the cultural preferences that underlie its construction and practice. Rabinow argues that ‘If sociobiology is culture constructed on the basis of a metaphor of nature, then in biosociality, nature will be modeled on culture understood as practice. Nature will be known and remade through technique and will finally become artificial, just as culture becomes natural. Were such a project to be brought to fruition, it would stand as the basis for overcoming the nature/culture split.’[66] Nature is socialized through a process of acculturation thus creating a potential basis for overcoming the nature/culture divide. Once nature-culture becomes hyphenated domains, it is in the interstices of the hyphen that intellectual property rights over plant genetic resources are created.

Establishing social/human/technological causality of things biological was a necessary condition for the assertion of “life” patents. Law and technology together form the discursive processes that manage social contingency by establishing a stable pattern of causal co-ordinates.[67] Biological nature is purified, properties of components identified, isolated and recombined into a product that does not exist in the same form in nature. Once biological components have been given a more distinct, “autonomous” identity, law steps in and stabilizes these products of human causation as entities and artefacts with a legal standing, its doctrinal moves I discuss in the next paper.

I want to draw attention to a rhetorical reversal that is taking place. The contemporary project of biotechnology seem to be no longer disclaiming its social antecedents. It is no longer dodging the social-

[65]Paul Rabinow, 1999. “Artificiality and Enlightenment: From sociobiology to biosociality.” *The science studies reader*, ed. M. Biagioli, 407–416. New York and London:Routledge.
[66] Ibid, p. 411
[67] See, Pottage (1998), at p. 754.

constructivist charge and asserting that science is objective because it is free from human contingency.[68] It is no longer resistant to allegations of its constituted character. Indeed, the assertion of social constituency becomes foundational to its property claims.

A close look at contemporary technology discourse reveals that the language of (what we broadly refer to as) Social Constructivism has been neatly co-opted into science-property authorial claims. In one example, Karin Knorr-Cetina, a prominent social constructivist, argues that "scientific facts" are constituted because laboratories are spaces that are manipulated by human intervention.[69] Here, she suggests that objects are detached from their natural environments and installed by scientists in a 'new phenomenal field defined by social agents.' In other words, 'laboratories allow natural processes to be "brought home" and to be made subject only to the conditions of the local social order.' [70] She alleges that scientific products can be seen as 'structured in terms of several orders of selectivity'.[71] Similarly, Fritjof Capra, physicist, philosopher of science, while questioning the claimed objectivity of science, states that whenever we isolate a pattern in nature's network and define it as a part or an object, we do so by cutting through some of its connections to the rest of the network, and that this may be done in different ways.[72] 'What we observe is not nature itself, but nature exposed to our method of questioning.'[73] Referred variously as 'social constructivism', 'social constructionism' or 'sociology of scientific knowledge', these perspectives claim that because science is wholly relative to a theoretical framework and a world-view, science amounts to a construction, and not

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[68] As I have discussed elsewhere, the 'universality' of science comes to rest on the alleged non contextuality of Science. Since scientific facts, it is argued, are socially non-contingent and are a true representation of natural phenomena, they are universally applicable. These assertions are however, intensely contested. See Chandra (2010) supra n.9 at pp. 153-54. Central to social constructivists' influence has been its endeavour to interrogate and critique the epistemological claims of uniqueness and objectivity of "big" science. They have raised questions raised about the objectivity and universality of science, notion of science as progress, universal conceptions of rationality itself. They highlight the 'constructed' nature of reality, and the mediated nature of consciousness. Scientific facts are therefore not trans-historical essences independent of conscious beings that determine the categorical structure of reality. In its essence, the sociology of science involves the study of science as a social activity, especially dealing with the social conditions and effects of science, and with the social structures and processes of scientific activity.

[69] Knorr-Cetina, Karin, "What is a laboratory?" from "Epistemic Cultures: How the Sciences Make Knowledge", (Cambridge: Harvard University Press, 1999); Karin Knorr-Cetina, "The Fabrication of Facts: Towards a Microsociology of Scientific Knowledge", in Stehr and Meja, "Society and Knowledge: Contemporary Perspectives in the Sociology of Knowledge", (New Burnswick: Transactions, 1984); Karin D. Knorr-Cetina, "The Ethnographic Study of Scientific Work: Towards a Constructivist Interpretation of Science ", (London: Sage, 1983).

[70] Ibid

[71] See Stehr and Meja (1984), at p. 228.

[72] Capra, Fritjof, "Systems Theory and the New Paradigm", in Merchant, Carolyn (Ed.), "Key Concepts in Critical Theory", (New Delhi: Rawat Publications, 1994),

[73] Ibid, at 337.

a discovery, of reality.[74] This is precisely biotechnology's case: it claims that, that part of biological nature that it isolates and "purifies" – from the "patterned network" in the laboratory where, as Knorr-Cetina suggests,[75] several orders of selection take place – is not an act of discovery but an act of human construction / innovation. A patent claim over a biological artefact rests precisely on this interruption of nature's contingency.

If nature's causality is interrupted and intercepted by social contingency, then what do claims of scientific objectivity and universality rest on? In other words, if social contingency carries with it the social footprints of a certain locale – for instance, the genetic modification of a seed may be found to be successful in certain agronomic conditions, suited to a particular institutionalized structure of agriculture – then how do projects of biotechnology project themselves as universal solutions of disease control, increased productivity, pest resistance and so on? What has happened for biotechnology to simultaneously bear the stamp of social contingency and yet project itself as a scientific panacea capable of universal application? What do modernist techniques of purification – that Latour refers as the work of "purifying" the natural zone from the human zone and human contingency – rely on to keep the myth of universality and scientificity alive?[76] This is an important question because the goal of modern biotechnology is no longer to portray its representation of the natural world as untampered by social contingency. Indeed, it claims that it does not merely re-present, but re-creates.

[74] Similar themes echo in the works of prominent social constructivists: Collins, H.M., "The Sociology of Scientific Knowledge: Studies of Contemporary Science", Annual Review of Sociology, 9 (1983), pp. 265–85; Barnes, Barry (Ed.), "Sociology of Science", (Harmondsworth: Penguin, 1972); Barnes, Barry, "About Science", (Oxford: Blackwell, 1985); Mulkay, Michael, "Science and the Sociology of Knowledge", (London: George Allen & Unwin,1979); Mulkay, M., "Sociology of Science: A Sociological Pilgrimage", (Milton Keynes: Open Universal Press, 1991); Barnes, B. & Shapin, S. (Eds.), "Natural Order: Historical Studies of Scientific Culture", (Lon don: Sage, 1979); Shapin, Steven, "Here and Everywhere: Sociology of Scientific Knowledge", Annual Review of Sociology, Vol. 21 (1995), at pp. 289 - 321; Latour, Bruno, "Science in Action: How to Follow Scientists and Engineers through Society" (Cambridge, MA: Harvard University Press, 1987); Jasanoff, Sheila., et al. (Eds.), "Handbook of Science and Technology Studies", (Beverly Hills, CA: Sage, 1994).

[75] Cetina, Knorr K., "Epistemic Cultures: How Sciences Make Knowledge", (Cambridge: Harvard University Press, 1999).

[76] Latour, B., "We Have Never Been Modern", (Harvard University Press, 1993). The term "purification" refers to the work of making facts and values, nature and culture appear as though they are separated, to enable various translations (hybrids of nature and culture) and proliferations (1993, at p. 12). One of the practices of modernity, Latour suggests, isthe creation of 'two entirely distinct ontological zones: of human beings on the one hand; that of nonhumans [nature] on the other,' (1993, at pp. 10-11) where the natural world is made to be seen as 'independent of both reference and society'(1993, at p. 11) One of Latour's central points is that modern political forms are built, as Harman puts it, 'on the basis of an antiseptic split between nature and society'. See Harman, Graham, "Prince of Networks: Bruno Latour and Metaphysics" (Melbourne: Re Press, 2009), at p. 64; See also, Alain Pottage for an explication, application and divergence with Latour's theme of purification. Pottage, A., supra n.1, at pp. 753-755.

Latour's work on "purification" refers to the work of making facts such that nature and culture appear as though they are separated. The task of purification is to conceal various "translations" (of nature into culture, culture into nature), the creation of hybrids and their proliferations. One of the practices of modernity, Latour suggests, is the creation of 'two entirely distinct ontological zones: of human beings on the one hand; that of nonhumans [nature] on the other,' where the natural world is made to be seen as 'independent of both reference and society'.[77]

Genomics, both plant and human, stretch Latour's theme of purification. This is, I propose, because law purifies "facts of genomics" not by obfuscating its socially constituted nature but making itself contingent on it. For assertions of scientificity, and therefore universality, it relies on affirmations of scientific methodology which distil a fact into pure form. It keeps alive the appraisal of the 'context of justification' as governed by scientific laws and methods which makes the discovery of facts or the "facticity" of science, conclusive and indisputable. It holds up, as Sunder Rajan puts it, 'the method of investigation as natural, infallible, a transparent representation of "the real world" rather than the process of contingent negotiations, guesswork, and constant revision.'[78] The latter process – of constant revision, trial and error, guesswork – comes to be associated with unscientific forms of knowledge, often prefixed with terms like "traditional", "folk", "lay", "outside the margins of civic competence",[79] distinct from the 'facts of science' that are adjudged as "novel, non-obvious, capable of industrial application" and therefore patentable.[80]

The work of purification then, for biotechnological patents, is to render the absence of social contingency as no longer relevant to the creation of the scientific fact. This is a necessary manoeuvre that law makes to stabilize (intellectual) property claims. Purification, thus can be seen here as a reifying manoeuver, one that signifies and stabilizes what 'scientific' is, and who the author of that "biology" is. If parts of the "grown" biological-nature are to be demonstrated as man-made, purification no longer seeks to "purify" a fact of its social constituency. It rather, in a reversal, seeks to display its hybrid composition so that authorial claims can be asserted, legally.

Conclusion

[77] Ibid, 10-11
[78] Sunder Rajan (2006), supra n.7 at p. 346-47.
[79] Jasanoff, (2005), supra n.45, at p. 254.
[80] See also, Alain Pottage for an explication, application and divergence with Latour's theme of purification. Pottage (1998), supra n.1.

Biotechnology manipulates the structure of the biological form and then forces biotechnological instrumentalities into legal categories.[81] The precise ways in which it does so is what I discuss in the next paper, but for now I'd like to suggest the relationship between biotechnology and law is not, to borrow a phrase from Foucault, 'one of reciprocal delimitations of different domains' where law acts as an external mode of limitation upon the operations of biotechnology.[82] It is one of reciprocal facilitation where law must accompany the market, incentivize particular techniques and the market must create new realms in need of standards of adjudication. Biogenetic property, which is the essence of this market, can only appear if it is co-produced through a mutually facilitating, constituting interaction of techno-science and law. As technology creates new permutations, codes and sequences of genetic forms, law installs these gene sequences, DNA, liposomes, antisense molecules, peptides, carbohydrates, stem cells, synthetic small molecules, and many other biological materials within the boundaries of property. Legal doctrine reinvents the motifs that traditionally explained or justified the attribution of rights and property. Law then is not just a kind of regulatory force that outlines the contours of rights in relation to property– it becomes a strategy of ownership and constitutive of both a realm of new property and of new technology of production and reproduction of life

In sum, there has taken place a progressive accommodation of biotechnology within the legal system. Although the relationship of law and biotechnology is seen as being one where law is applied to biotechnology – as a regulatory force, as a prohibitory limit, as being constitutive of property in the biological domain – what happens to law itself in the process, is an interesting question, a question I probe in detail in the next paper.

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[81] Pottage, supra n.13.

[82] Michel Foucault, "The Birth of Biopolitics: The Birth of Biopolitics", Lectures at the College de France 1978-1979 (Palgrave Macmillan, 2008) at p. 121.