POSTCARD FROM THE REALITY-BASED UNIVERSE: "WISH YOU WERE ALL HERE!"

A MEDITATION ON THE RELATIONSHIP BETWEEN SCIENCE, INTELLECTUAL PROPERTY LAW, AND THE RIGHTS OF INDIGENOUS POPULATIONS IN PLANT GENETIC RESOURCES

BY

DOROTHY E. SCHMIDT*

Patents on plant-derived products, and subsequent adverse impacts on the economic and environmental well-being of indigenous populations, have generated numerous high-profile controversies. Critics of intellectual property law typically call the actions and outcomes involved "biopiracy" or worse. On the other hand, critics of "biopiracy" arguments reasonably point out that revisions in the law would not adequately address the underlying causes of harm. However, the two sides are not in disagreement as to the desirability of protecting natural resources and traditional lifestyles. Rather, their disagreement is largely about how to frame the problem rhetorically, and which alterations in patent law would achieve this goal.

This Comment posits that a major factor in this disagreement is a lack of rigor in addressing the separate roles of science, technology, and expertise in the events which inspire biopiracy accusations. It considers the nature of these three systems of human knowledge, and their respective roles in human advancement, patent law, and traditional knowledge. The Comment then considers specific cases of harm to indigenous populations, the extent and nature of patentability of inventions based on living things, and arguments on each side of the biopiracy debate.

The Comment concludes that a fresh approach would be useful in reconciling the disparate views of science, technology, and expertise that have fueled the biopiracy debate. Specifically, those who decry "biopiracy" should embrace the creative energies of science to serve their ends, while their critics should embrace the goal of altering patent law in ways that would support innovation more efficiently.

* J.D., Lewis and Clark Law School, 2007; Ph.D. Human Nutrition, The Ohio State University, 1998; B.S. Engineering, Northrop University, 1981. The author is deeply grateful to Professor Joe Miller for his invaluable input on this Comment.

I. INTRODUCTION

What, then, is the waste land?
It is the land where the myth is patterned by authority, not emergent from life; where there is no poet's eye to see, no adventure to be lived, where all is set for all and forever: Utopia!
– Joseph Campbell[1]

[1] JOSEPH CAMPBELL, THE MASKS OF GOD: CREATIVE MYTHOLOGY 373 (1968).

Over the past couple of decades, I have heard many news reports claiming various egregious abuses of patent rights in food crops or medicinal plants by some large corporation. The underlying accusation generally goes like this: Someone with lots of money is claiming exclusive rights in a plant, thereby depriving a population of traditional users of their rights to grow their own crops, or use their own traditional medicines. Having studied patent law, I wanted to understand what was really behind these reports, because in reality, patents cover only new inventions by individual inventors and cannot cover widely-used traditional crops or knowledge. As it turns out, such stories are generally misleading, based on misunderstandings of the law or distortions of fact. Yet they also contain a kernel of real injury and a causal link between the injury and patent law that is not especially tenuous.

A. The Debate

The "biopiracy" debate concerns the ways in which corporations in "developed" nations have used intellectual property (IP) law to reap substantial profits based on biological resources from "developing" countries. One side argues for the rights of relatively poor "developing" nations to benefit from their remaining riches in biodiversity—riches that often are rapidly vanishing. On the other side, IP scholars point out that current IP laws simply do not apply to the rights being asserted, not least because the main rationale of IP law is to stimulate new creations. The arguments on either side are rooted in fundamentally different attitudes toward science and technology, a difference central to this Comment. Biopiracy is a broad topic, but I will limit my discussion to patent rights in plant resources as a central issue in the debate, and one that illustrates how science figures into the argument. I will then explore the arguments on either side, consider their assumptions about science, innovation, and creativity, and conclude by arguing for a central role for science in formulating a new relationship between intellectual property and indigenous rights grounded in objective reality rather than hostile rhetoric.

Since rhetoric—the artful use of language—plays such an important role in this area, I should clarify my policy for using certain terms of art. The astute reader will have noticed that I placed the words "developed" and "developing" in quotes above. This illustrates a feature of the debate that deserves notice. These terms are used by both sides, but they are loaded with assumptions that, if unexamined, contribute to a disconnect in understanding. They are not used differently by the two sides; there is consensus as to which nations belong in which category. But the terms seem to imply two things: first, that all "developing" nations are inevitably on track to become like their "developed" peers, and second, that this is a good thing. The former seems unlikely, and there is fierce debate as to the latter point, yet the fact remains that use of these terms tends to mask a more nuanced, complex reality—even a reality well-known to those using them. On the other hand, "developed" and developing" are useful terms because they are

consistently used in the literature, so I will also use them without further quotes. This is true of several terms in the debate. I will not avoid using them, because my purpose is not to challenge such potentially problematic conventions but to point them out.

B. Setting the Stage

Since misunderstandings underlie so much of this debate, before diving into specifics, two areas of background information should be clarified. These are, on one hand, the complex relationships of various parties and their interests, and, on the other hand, the fundamentals of IP law. Clarifying these will help to sort through the issues.

1. Stakes and Stakeholders

First, a wide range of interests exist on the global stage of the biopiracy story. Aside from the scholarly camps, several diverse groups have stakes in the game. One is the large corporations who hold the controversial patents and who have played a major role in the development of international IP law. At stake for them are the profits they derive from the monopoly rights conferred by patents. Another group is the governments of the relatively wealthy developed nations that are home to these corporations, mostly in the Northern hemisphere. Their most obvious stakes are the contributions of the corporations to their national economies. Third are the governments of the relatively poor countries that possess biological riches, largely in the Southern hemisphere, which are also hoping to realize benefits to their economies through international agreements. Fourth are the indigenous[2] populations which still inhabit much of the biologically rich forest lands which have been the source of much of the controversy, and, for them, the stakes are their survival as cultural entities. Finally, one stakeholder has been largely invisible in the debate thus far. That is the human species as a whole, whose stake at minimum is our collective ability to develop creative solutions to our ills, and at maximum our continuing wealth, health, and global political stability.

2. The Nature of IP Law

Most people have only a vague idea about what IP law protects and why. Physical property rights are easily grasped; they are based on consumption of and/or exclusion from places and objects which are the property of an individual, organization, or government. But ideas and information are neither consumable nor excludable. My singing of "Happy

[2] This is one of those words whose meaning and connotations are the subject of some dispute but which is nevertheless used almost universally in the literature. *See* Paul J. Heald, *The Rhetoric of Biopiracy*, 11 CARDOZO J. INT'L & COMP. L. 519, 519 n.3 (2003) (discussing the term "indigenous" and providing the exception to the rule by using instead the term "long-term occupant communities").

Birthday" does not reduce your ability to sing "Happy Birthday" whenever you choose, nor will it impede your great-grandchildren from singing it in a hundred years. IP law in general "fences off" rights to such intangibles, creating monopolies in what would otherwise naturally fall into the public domain. For example, the holders of the copyrights in "Happy Birthday" aggressively defend their exclusive rights to public performances of the song, which explains why restaurant employees always sing some other song when you come in for a free birthday dessert.[3]

The principal justification for creating monopoly rights to intangibles is stated succinctly in Article I, Section eight, Clause eight of the U.S. Constitution: "Congress shall have 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." To understand what the Framers meant to protect requires some translation of "science" and "useful arts," whose meanings have changed over the centuries. By "science" the framers meant a broad conception of knowledge of all sorts, whereas "useful arts" referred to technological arts such as manufacturing and farming.[4] Federal IP law, then, exists to promote collective human knowledge and technology through a mechanism of giving temporary monopolies to creative individuals. The protectable rights are divided into two categories, which have become the basis of federal copyright and patent law. That is, copyrights are intended to promote our collective store of knowledge by giving exclusive rights to "Authors," and patent rights are intended to promote technology by granting exclusive rights to "Inventors."[5]

Like any constitutional grant of power, the IP clause has enjoyed its share of controversy. Interestingly, although so many provisions of the Constitution were very hotly debated by the founders, there appears to have been almost no debate over this specific grant of federal power.[6] Madison dismissively called it "an instance of inferior moment."[7] This casual attitude makes it hard to nail down precisely what the framers had in mind, but they surely would be surprised by its current legal and economic prominence. They might also be amazed at the specific shape IP rights have taken. For example, patents are granted exclusively to human individuals, but the specific rights they confer are alienable property rights,[8] which means large corporations can accumulate them. Yet, the popular consciousness is

---

[3] *See, e.g.*, Kembrew McLeod, *Happy Birthday Screw You*, http://www.boycott-riaa.com/article/15999 (last visited Jan. 27, 2008) (reporting on the origins of the song and its copyright litigation history). Maybe in the year 2030 waiters in restaurants will start singing "Happy Birthday" to customers, but only if Congress can be restrained from further extensions of copyright duration. *Id.*

[4] ROGER E. SCHECHTER & JOHN R. THOMAS, PRINCIPLES OF PATENT LAW 15 (2004).

[5] *Id.*

[6] *See* Edward C. Walterscheid, *To Promote the Progress of Science and Useful Arts: The Background and Origin of the Intellectual Property Clause of the United States Constitution*, 2 J. INTELL. PROP. L. 1, 54 (1994).

[7] *Id.*

[8] 35 U.S.C. § 261 (2000).

dominated by the notion of a solo author or inventor, working in lonely splendor, whose creative genius must be nurtured and rewarded for the betterment of us all.[9] Thus, there is a disconnect between rhetoric and reality.

Two other forms of law collected under the umbrella term of IP law are trademarks and trade secrets.[10] These are not constitutional grants; they grew out of state common laws. They are more specifically directed toward business competition than creativity, but they are considered part of IP law because they involve intangibles.[11] Trademarks are intended to protect their owners' reputations and to protect the public from unscrupulous passing-off of goods that appear to be made by someone other than the true source.[12] The protection is tied to use, however, both in time and space. Roughly speaking, if there is no chance of confusion, there is no harm, so there is no right to exclusive use. Trade secrets are just what the name implies. Because the right is to keep secrets through reasonable precautions, this is more of a negative right than other IP forms.[13] That is, the holder's right is to punish thievery rather than to profit from sharing his knowledge voluntarily. Also, if someone else figures out the secret independently, she is entitled to use it, and, if it becomes public knowledge, the right is extinguished; no one can exclude others from using it.[14]

Those who criticize corporate biopiracy have proposed various expansions of existing IP law to protect biodiversity and indigenous cultures, either under one of the existing forms or by means of *sui generis* proposals.[15] For example, some favor vesting intangible property rights in the traditional knowledge and practices of indigenous communities.[16] The two sides in this debate disagree as to whether such proposals are reasonable goals or self-defeating fallacies. To some extent, they are both right.

---

[9] *See* Bradford S. Simon, *Intellectual Property and Traditional Knowledge: A Psychological Approach to Conflicting Claims of Creativity in International Law*, 20 BERKELEY TECH. L.J. 1613, 1617 (2005).

[10] *See, e.g.*, ABA SECTION OF ANTITRUST LAW, INTELLECTUAL PROPERTY AND ANTITRUST HANDBOOK 17 (2007) [hereinafter INTELLECTUAL PROPERTY HANDBOOK].

[11] *Id.* at 17, 26, 29.

[12] *See id.* at 26 (detailing how trademarks allow consumers to make confident purchases without detailed inspection).

[13] *See, e.g.*, WIPO MAGAZINE, TRADE SECRETS: POLICY FRAMEWORK AND BEST PRACTICES 17 (2002), *available at* http://www.wipo.int/sme/en/documents/wipo_magazine/05_2002.pdf; INTELLECTUAL PROPERTY HANDBOOK, *supra* note 10, at 29 (discussing that states oftentimes require a business to take steps to prevent trade secrets from being disclosed to the public when the business is seeking trade secret protection).

[14] DONALD A. GREGORY ET AL., INTRODUCTION TO INTELLECTUAL PROPERTY LAW 3 (1994).

[15] *See infra* Part III.A.

[16] *See, e.g.*, Robert K. Paterson & Dennis S. Karjala, *Looking Beyond Intellectual Property in Resolving Protection of the Intangible Cultural Heritage of Indigenous Peoples*, 11 CARDOZO J. INT'L & COMP. L. 633, 635–36 (2003) (arguing why it is not necessary to recognize new intellectual property rights).

C. In Search of a Center

When I began to research this topic, I imagined that I would find two opposing views whose differences were based on ideology, and that there would be a middle ground to be found in between two extremes. Instead, I found that one side's arguments are largely normative and based on equitable principles of how the powerful should deal with the relatively powerless, whereas the other side's arguments are technical and based on legal realities as they currently exist. The upshot is they are both right by their own terms, and there is no conceptual middle ground. Therefore, I have attempted a strategy of triangulation in order to find a balance between the two views. In the interest of full disclosure, I am hardly a neutral observer. I am a scientist as well as a law student, so those perspectives influence my view from the side-lines. Therefore, I argue that science as a tool can suggest an essential common ground, tying together the concerns of environmental advocates and traditional cultures on the one hand and patent law purists on the other.

Section II of this Comment considers the nature of science and technology as we currently use the terms and why this understanding is important to the biopiracy debate. Section III outlines the arguments advanced by critics of uncompensated corporate use of biological resources and knowledge from developing countries. Section IV considers how patent law has evolved to encompass biological information in a way that has fueled the controversy. Section V considers the IP law arguments for why current IP law simply does not support the notion that actions labeled "biopiracy" are legally improper, and considers proposed alternative solutions. In conclusion, Section VI considers how a science-based vision of creativity may help protect intangible human resources and bring the two views into harmony.

II. SCIENCE, TECHNOLOGY & EXPERTISE

The naming of cats is a difficult matter,
It isn't just one of your holiday games;
You may think that I am as mad as a hatter
when I tell you, a cat must have THREE DIFFERENT NAMES.
– T.S. Eliot[17]

Much of the biopiracy/IP debate turns on differing attitudes towards the proper role of knowledge in human culture. We tend to blur different systems of knowledge into a single blob, but there is a critical distinction to be made between science, technology, and expertise. This distinction helps to clarify what is and is not protected by current IP law on the one hand, and to understand the disconnect between IP law and traditional knowledge on the other. This section first considers the unique power of Western science,[18]

[17] T.S. ELLIOT, OLD POSSUMS BOOK OF PRACTICAL CATS 1 (1982).

[18] "Western science" is another of those terms that can get one into trouble. Hopefully, the

as well as its limitations. It then discusses why new technology is at the heart of patent law, and finally addresses expert knowledge and its unique role in human systems of knowing.

A. What is Science?

My favorite example of how the relationship between science and environmentalism has changed over the past two generations involves Lucille Ball and Desi Arnaz, Sr. The couple starred together in the 1956 movie, *Forever, Darling*, in which Desi plays brilliant chemist Bill Finlay, who is working on a new super-insecticide, "Number 383."[19] The couple is vacationing in nature, when at one point, Bill enthuses about his latest research project, "383 is going to make DDT look like talcum powder!"[20]

What struck me when I first saw this film was how perfectly confident the chemist was in the purity and goodness of his quest for an absolutely deadly neurotoxin which, liberally applied, would wipe out all the mosquitoes on earth. A half-century later, we still have not wiped out any mosquito-borne diseases, while actual DDT is responsible for threatening the extinction of quite a few species with which we have no quarrel.[21] In addition, DDT is still being used against mosquitoes to control malaria in the Southern hemisphere, and its effectiveness and toxicity are both subjects of ongoing debate.[22]

My point is to illustrate that science and environmental advocates have had a rather bumpy ride together over the past half-century. Also, we in the developed nations tend to suffer from a high degree of hubris about the benefits of scientific meddling. This hubris, so startlingly and unintentionally illustrated in *Forever, Darling*, is not limited to disregard for the immediate effects of our meddling. Rather, we also seem at times to believe that science will inevitably solve all problems, including the ones it caused in the first place. While that may be theoretically true, I believe it is a poor substitute for prudent planning and appropriate humility.

Here I should explain precisely what I mean by "science." This is because its meaning has changed considerably since the days when it included all manner of knowledge, and there is no cultural consensus as to what we mean when we say a thing is science. The on-line Encyclopedia Britannica features this excellent definition:

---

following section will demonstrate that my view of the competency of science is relatively humble.

19 FOREVER, DARLING (MGM 1956).

20 *Id.*

21 *See* EPA, DDT: A REVIEW OF SCIENTIFIC AND ECONOMIC ASPECTS OF THE DECISION TO BAN ITS USE AS A PESTICIDE 251–52 (1975), *available at* http://www.epa.gov/history/topics/ddt/DDT.pdf (discussing the background of DDT regulatory history as well as public concern regarding the pesticide); *see generally* RACHEL CARSON, SILENT SPRING 8 (1962) (discussing the history, impact, and destructive nature of DDT).

22 Celia W. Dugger, *W.H.O. Supports Wider Use of DDT vs. Malaria*, N.Y. TIMES, Sept. 16, 2006, *available at* http://www.nytimes.com/2006/09/16/world/africa/16malaria.html?_r=18n=Top/Reference/Times%20Topics/Organizations/u/United%20Nations&oref=slogin.

> Science, in the broadest sense of the term, refers to any system of knowledge attained by verifiable means. In a more restricted sense, science refers to a system of acquiring knowledge based on empiricism, experimentation, and methodological naturalism, as well as to the organized body of knowledge humans have gained by such research. Scientists maintain that scientific investigation must adhere to the scientific method, a process for properly developing and evaluating natural explanations for observable phenomena based on empirical study and independent verification. Science typically, therefore, rejects supernatural explanations, arguments from authority and biased observational studies.[23]

For my purposes, two things are important here: first, science is a system of finding objective realities, as well as the knowledge which the system produces, and second, the knowledge thus produced can be verified independently.

Much of accepted "science" is really not science, a fact startlingly revealed last year by scientists studying mouse reproduction.[24] They decided to study the "scientific fact" that female mammals are born with all the eggs they will ever have, a "fact" enshrined in medical textbooks for generations.[25] When these scientists—finally armed with the right tools—decided to see if that was really true, they determined it was not! There was considerable shock among physicians and biological scientists that a fact so fundamental and so unquestioned turned out instead to be an old doctor's tale.[26] So, what else do we "know" that is a myth?

Another fallacy involves seeing "science" as encompassing every activity or object that involves technology beyond what is easily understood. This is imprecise because it includes technology and expert knowledge that is not based on science, and it is misleading because it fails to recognize the central role of objective verification in science. This tendency is evident in some of the scholarly criticism of biopiracy, such as one author who calls indigenous people's traditional knowledge of medicinal plants "scientific knowledge."[27] However, this type of knowledge was not amassed through a scientific process, but through experience, and thus is a form of expertise. Of course, corporations may be interested in testing specific bits of such empirically-derived information scientifically. That is, if a plant has long been used medicinally, then a drug company might wish to extract the active

---

[23] *Science,* ENCYCLOPEDIA BRITANNICA ONLINE, http://www.search.eb.com/eb/article-9066286 (last visited Jan. 27, 2008).

[24] *See, e.g.*, *NPR's Morning Edition*, *Study: Ovaries May Replenish Eggs* (radio broadcast Mar. 11, 2004), *available at* http://www.npr.org/templates/story/story.php?storyId=1760136; *see also* Medical News Today, Stem Cells in Bone Marrow Replenish Mouse Ovaries (July 28, 2005), http://www.medicalnewstoday.com/medicalnews.php?newsid=28210 (last visited Jan. 27, 2008) [hereinafter *Stem Cells*].

[25] *Stem Cells*, *supra* note 24.

[26] *Id.*

[27] *See* Naomi Roht-Arriaza, *Of Seeds and Shamans: The Appropriation of the Scientific and Technical Knowledge of Indigenous and Local Communities*, 17 MICH. J. INT'L L. 919, 921–26 (1996).

molecule(s) and experimentally test the resulting drug's efficacy.[28] The danger in failing to distinguish science from expertise, I believe, is that the value of the latter tends to be lost in translation.

There is a further split between "hard" and "soft" scientific approaches. In general, the more objective the techniques used, the "harder" the science. Hypothesis testing and statistical analysis are the particular tools of the "hard" sciences, as opposed to the "soft" sciences, which are based more on observation, inference, and logic.[29] Both categories, however, have as their goal to predict and control the future based on observations of the past. Further, even the most sophisticated descriptive knowledge of one's environment is not science unless its purpose is essentially manipulative and creative. A body of empirical knowledge, whose purpose is to maintain cultural stability, is not science but expertise. On the other hand, even a cultural anthropologist seeks to perceive a wider reality than can be grasped from tallying up observations of the way a society lives, and thereby create for herself a new understanding of the wider world. Science and expertise are not mutually exclusive. Every scientist possesses expertise about his corner of science. But the two ways of knowing have different strengths.

Finally, science can be a worldview, but not every worldview is a science. By this I mean that each indigenous culture has a sophisticated system of knowledge, customs, stories, and a host of other elements that together make up its way of knowing the world, including predicting future events such as the phases of the moon and the movements of game. These worldviews are powerful tools, but they are not science, which seeks to predict future events through extrapolation, rather than simply expecting the past to be repeated.

To illustrate, astronomers once used the concept of epicycles to explain planetary motion that did not conform to what could be explained through perfectly circular orbital paths.[30] These were little theoretical circles tacked onto the single big circle of the orbit.[31] One set of epicycles explained a lot of the variation but not all of it.[32] So a second set of even smaller epicycles was proposed, tacked onto the first set of epicycles, but there was still a bit of unexplained orbital wiggling.[33] A third set explained some of that, and so forth. Ultimately, an infinite series of ever-smaller epicycles could be

[28] *See infra* note 83 and accompanying text (citing the example of a glaucoma drug derived from an uncultivated plant used traditionally by indigenous people in Brazil).

[29] *See* Larry Hedges, *How Hard is Hard Science, How Soft is Soft Science? The Empirical Cumulativeness of Research*, AM. PSYCHOL. 443, 443 (1987) (explaining differences in how scientists perceive physical and social sciences).

[30] *See Celestial Mechanics*, ENCYCLOPEDIA BRITANNICA ONLINE, http://www.britanica.com/eb/article-9110308/celestial-mechanics#77425.toc (last visited Jan. 27, 2008) (explaining the views of Ptolemy and Nicolaus Copernicus).

[31] Originally, epicycles were proposed as part of the system which had the earth at its center, to explain why the planets sometimes went backwards, unlike the sun. However, astronomers still needed epicycles even under the Copernican system, although fewer, smaller epicycles were adequate to attain the same degree of predictive accuracy. *Id.*

[32] *Nicolaus Copernicus*, ENCYCLOPEDIA BRITANNIA ONLINE, http://www.search.eb.com/eb/article-8436#262.hook (last visited Jan. 27, 2008).

[33] *Id.*

computed to explain an ever-finer degree of planetary motion, with an arbitrary degree of predictive precision being thus made possible, but no one could explain why there should be epicycles in the first place. That is, why should planets travel in fractal minuets instead of just going in circles? Ultimately, Johannes Kepler developed the mathematics of elliptical orbits in the 17th century, which rendered all of the epicycles unnecessary at a stroke.[34] In my view, epicycles were not science, although they were useful technological tools for predicting planetary motion. Elliptical orbital mechanics, however, fall within the realm of science. Put another way, epicycles predict where you will see a planet in the sky, but only elliptical orbits let you go visit the planet.

This distinction between science and technology is central to IP law. This is because the products of "hard" science cannot be protected by any flavor of IP law.[35] Experimental techniques such as hypothesis testing are designed to discover evidence of what was already there, and only the new inventions of humans are patentable. The Supreme Court put it this way in 1852: "[A] principle is not patentable. A principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented . . . ."[36] Therefore, Kepler's elliptical orbital theory could not have been patented in our system, nor could Einstein have awarded himself a patent for his theory of relativity.[37] But the technology which was later developed to fly to Mars and to make atomic bombs and power plants could be patented.

Let me hasten to say that I do not propose that Western science is the be-all, end-all to human knowing. Vast swaths of human knowing do not lend themselves to pure scientific inquiry (objective verifiability). However, no one can deny that science has been and will continue to be a tool of immense power in the vast human experiment of global transformation of which we are all a part.[38] The unique power of science, as distinct from technology or expertise, is that it allows us to escape our own cognitive biases, which are pervasive, powerful, and largely invisible to us unless we uncover them scientifically.[39] Willingness to embrace this fact is crucial to

---

[34] *Id. See generally*, JOHANNES KEPLER, EPITOME OF COPERNICAN ASTRONOMY (Klaus Reprint Co. 1969) (1620) (explaining the movement of the planets).

[35] What a scientist writes as an author is covered by copyright law, of course, so the descriptive written products of the sciences can be copyright-protected like any other work of authorship. *See generally* SCHECHTER & THOMAS, *supra* note 4, at 26–27 (explaining that "[m]any judicial decision recite the maxim that . . . scientific principles are not patentable").

[36] *Id.* at 27.

[37] Einstein worked as a patent clerk while he was working on relativity. RONALD W. CLARK, EINSTEIN: THE LIFE AND TIMES 73–74 (Avon Books 1984) (1971).

[38] Illustrations abound, perhaps none more exemplary than in Albert Einstein's 1939 letter to Franklin D. Roosevelt warning that advances in theoretical physics had made possible the atomic bomb. *Id.* at 674–77. Note that the letter was actually written by Leo Szilard, with Einstein lending his notable name. *Id.* at 676.

[39] *See, e.g.*, Simon, *supra* note 9. *See generally* D. Michael Risinger et al., *The Daubert/Kumho Implications of Observer Effects in Forensic Science: Hidden Problems of Expectation and Suggestion*, 90 CAL. L. REV. 1, 6–27 (2002) (discussing the history, nature and specific instances of observer bias).

any rational way forward in determining how best to apply science and IP law to the environmental and related social problems which underlie the biopiracy debate.

Cognitive bias is distinct from personal prejudice, and recognizing the difference is vital to avoid getting bogged down in judgmental arguments. Cognitive bias can contribute to prejudice, but it is far deeper than that. The archetypal and original example of cognitive bias also comes from astronomy.[40] Before the days of automation of such things, people used a bit of judgment when recording the precise location of objects in the sky, and it so happened that individual observers were biased towards thinking the objects were either a little behind or ahead of their actual location.[41] Since these observers presumably had no stake in the location aside from accuracy, the only logical conclusion is that their brains had a slight unconscious bias. Once it had been measured, each individual's bias could be subtracted out.[42] A great deal of scientific methodology is arguably devoted to avoiding bias, and this, at least as much as deliberate bias, is the purpose of requiring objectively verifiable methods. Thus, science attempts to answer the question: Do I know what I think I know?

B. Technology & Patents

Technological innovation is the principal target of patent law. The Patent Act of 1952 states that a person who "invents or discovers any new and useful *process, machine, manufacture, or composition of matter*, or any new and useful improvement thereof, may obtain a patent therefore . . . ."[43] Thus, there are four categories of patentable items. Three are physical objects, and patents on them are called "product" patents. The fourth category, the "process" patent, is wholly intangible, and includes new uses for existing products.[44] A patent does not directly cover any specific physical property; rather, it confers on its holder an exclusive right to make, use, or sell the patented invention or discovery.[45]

Two controversial categories of plant-related patents concern medicinal plants and food crops. Medicinal patents grant rights in a molecule or

[40] *See* Risinger, et al., *supra* note 39, at 7–8 (explaining observations astronomers were observing beginning with Nevil Maskelyne in 1795).

[41] *Id.* at 7.

[42] *Id.* at 7–8.

[43] 35 U.S.C. § 101 (2000) (emphasis added).

[44] SCHECHTER & THOMAS, *supra* note 4, at 31. Note that if someone else has a patent on the existing product, you can still patent a new use, but you cannot do anything else with your patent without the permission of whoever holds the rights to the product. *Id.*

[45] *See* 35 U.S.C. § 271(a) (2000) (stating that "[e]xcept as otherwise provided in this title, whoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States or imports into the United States any patented invention during the term of the patent therefore, infringes the patent"). Naturally, once the patent holder sells or gives away a copy of his invention, permission to use or sell it is included. *See* Jazz Photo Corp. v. Int'l Trade Comm'n, 264 F.3d 1094, 1105 (Fed. Cir. 2001) (stating that "[t]he unrestricted sale of a patented article, by or with the authority of the patentee, 'exhausts' the patentee's right to control further sale and use of that article by enforcing the patent under which it was first sold").

extract purified from plants as "compositions of matter." They also may cover methods of extracting such drugs and their medical uses, as patentable "processes." Patentable food crops may be produced through breeding or direct genetic modification. Patents on human genetic materials from indigenous people have sparked intense controversy[46], but I will not to discuss them, since they have no direct bearing on biodiversity, and the issues are similar to those of plant genetic materials.

Note that those who generate new, patentable technology in the developed world use science intensively, yet new technology can also come from non-scientific creative inspirations, pragmatic dogged trial-and-error, from accidental serendipitous discoveries, or any combination of the above. Patent law makes no distinction among the methods of discovery, so long as the result is "new and useful."[47] In fact, no matter how much sweat-of-the-brow goes into generating a new product, if the necessary process of sweating it out to that conclusion was obvious, then it is not patentable.[48] Of course, it need not be obvious to everyone how to achieve a certain result for it to be unpatentable, but it does have to be obvious to an expert in the relevant field.[49] This leads naturally to a consideration of the final category: expertise.

C. Who is an Expert?

Expertise, for our purposes, can be thought of as any specialized body of knowledge arrived at through experience, which may include intensive training in an apprenticeship or formal educational setting, or may simply be accumulated by life experience. Such expertise may be thought of as "technical" even where it has nothing to do with technology, as when lawyers, for example, say that an area of law is highly "technical" if it involves complex statutory rules. Similarly, a traditional herbalist might

---

46 *See, e.g.*, Laura S. Underkuffler, *Human Genetics Studies: The Case for Group Rights*, 35 J.L. MED. & ETHICS 383, 383–84 (2007) (detailing protests by indigenous peoples about lack of control over genetic testing; noting rejection of such concerns by "many researchers, ethicists, and legal scholars").

47 35 U.S.C. § 101 (2000).

48 *See* KSR Int'l v. Teleflex Inc., 127 S. Ct. 1727, 1746 (2007). In striking down a patent for an innovation on gas-pedal assemblies, Justice Kennedy wrote eloquently for a unanimous court:

> We build and create by bringing to the tangible and palpable reality around us new works based on instinct, simple logic, ordinary inferences, extraordinary ideas, and sometimes even genius. These advances, once part of our shared knowledge, define a new threshold from which innovation starts once more. And as progress beginning from higher levels of achievement is expected in the normal course, the results of ordinary innovation are not the subject of exclusive rights under the patent laws. Were it otherwise patents might stifle, rather than promote, the progress of useful arts.

Id.

49 *See* 35 U.S.C. § 103(a) (2000) (stating that "[a] patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains").

possess an enormous body of accumulated "rules" for the harvesting and use of plant products which grow in a given geographical region. Such knowledge, having been developed over time through empirical trial and error processes, presumably contains some accumulated rules with no intrinsic value. That is, like the mammal-egg story, some pieces of "knowledge" are simply customary beliefs whose origins are forgotten.[50] Indeed, the mammal-egg shock resulted from the fact that Western medicine was an art for a very long time before it was imbued with science, and no one had done a systematic review of its assumptions. Similarly, I would argue that traditional agricultural knowledge can be considered highly technical in terms of its complexity and depth, in spite of having arisen out of long tradition rather than a laboratory.

Medicinal and agricultural expertise possessed by indigenous people is typically called "traditional knowledge." The origins of such knowledge are long forgotten and, therefore, it is not subject to protection as IP under current law, yet it has obvious appeal to biotechnology firms as a way to narrow the search for new products. For this reason, those wishing to protect the holders of this expertise have proposed expanding IP law to include such knowledge.[51]

Finally, hunter-gatherers possess expertise about the landscapes they inhabit that goes well beyond specific plants to embrace whole ecosystems. Advocates for placing value on such expertise argue that Western science fails to appreciate it. For example, Winona LaDuke describes the complex traditions of sustainable game management traditionally practiced by her own nation, the Anishinabe people of Eastern North America.[52] She advocates that "urban-based environmentalists" make use of this accumulated expertise rather than defer to an over-simplified view based on current scientific understanding and political goals.[53]

This last point illustrates the inherent tension between expertise and science, which has important implications for the biopiracy debate. Like the chemist in *Forever, Darling*, I would argue that we humans often find the raw power of science and new technology to be dangerously seductive. The early history of DDT provides a chilling example of the potential for destructive consequences when we over-rely on the products of science while discounting the value of existing accumulated expertise.[54] The upshot is a jettisoning of common-sense caution about the unknown effects of new technology. James Scott has written an insightful exploration of this phenomenon.[55] One early example is the German monocultured "scientific

[50] *See supra* Part II.A.

[51] *See infra* Part III.A.2.

[52] *See* Winona LaDuke, *Traditional Ecological Knowledge and Environmental Futures*, 5 COLO. J. INT'L ENVTL. L. & POL'Y 127, 128–30 (1994) (citing Frank G. Speck, *The Family Hunting Band as the Basis of Algonkian Social Organization*, 17 AM. ANTHROPOLOGIST 289 (1915)).

[53] *See* LaDuke, *supra*, note 52, at 137–39.

[54] *See generally* RACHEL CARSON, SILENT SPRING (40th anniversary ed. 2002) (describing the dangers of indiscriminate use of pesticides).

[55] JAMES C. SCOTT, SEEING LIKE A STATE: HOW CERTAIN SCHEMES TO IMPROVE THE HUMAN CONDITION HAVE FAILED (1998).

forest," from which all biodiversity had been rigorously expunged.[56] The result was a series of ecological disasters which led the Germans to coin a new word, meaning "forest death," to describe the worst cases.[57] This outcome will not surprise the modern reader, but was apparently inconceivable to the technocratic minds that created the "scientific forest" in the 1800s. Further, what Scott calls "high-modernist agriculture" has led to numerous ecological disasters.[58] As he points out, "the very strength of scientific agricultural experimentation—its simplifying assumptions and its ability to isolate the impact of a single variable on total production—is incapable of dealing adequately with certain forms of complexity. It tends to ignore, or discount, agricultural practices that are not assimilable to its techniques."[59] He also hastens to add that he does not oppose modern agronomic science, only applying it without acknowledging its inherent limitations. He terms this practice "radical simplification."[60] The lesson for developed nations is to approach traditional knowledge as an integrated body of information deserving respect, not just a source of the occasional jackpot of information tidbits.

The distinctions made in this section have laid the groundwork for an exploration of the biopiracy debate. The next section will address the asserted grievances and rights of developing countries and indigenous peoples relating to claimed abuses of IP law by foreign corporations.

III. THE POLITICS OF BIOPIRACY AND THE RIGHTS OF INDIGENOUS POPULATIONS

> *At best, the new order was fragile and vulnerable . . . . At worst, it wreaked untold damage in shattered lives, a damaged ecosystem, and fractured or impoverished societies.*
> *– James Scott*[61]

The term "biopiracy," which was coined to protest certain business practices, has ruffled many feathers.[62] Before delving into specific arguments it is useful to consider the backdrop against which they arose. The inflammatory word "piracy" was used first by corporations and governments in connection with violations of IP rights, especially mass copying of copyright-protected music CD's and movies, often in developing

---

56 *Id.* at 11–22. "The fact is that forest science and geometry, backed by state power, had the capacity to transform the real, diverse, and chaotic old-growth forest into a new, more uniform forest that closely resembled the administrative grid of its techniques." *Id.* at 15.

57 *Id.* at 20.

58 *Id.* at 262–306 (describing why modern, scientific agriculture often fails when deployed in developing countries).

59 *Id.* at 264.

60 *Id.* at 262.

61 *Id.* at 352.

62 *See* Cynthia M. Ho, *Biopiracy and Beyond: A Consideration of Socio-Cultural Conflicts with Global Patent Policies*, 39 U. MICH. J.L. REFORM 433, 450–51 (2006) (describing the reaction of various groups to the definition of biopiracy).

countries.[63] It has also been applied to generic drugs produced in violation of patents.[64] Calling patents on biological resources "piracy" was, therefore, an attempt at verbal jujitsu—turning the inflammatory language against its original coiners.[65] Arguably, the outrage expressed by companies defending their IP rights against inhabitants of developing countries is a bit disingenuous, since many consumers of such goods cannot afford to buy them at the monopolistic prices set by the copyright and patent owners.[66]

By contrast, the outrage of those who argue against practices characterized as biopiracy is entirely understandable, even when it is somewhat misplaced. That is, they are advocating the rights of indigenous populations, which have collectively been subjected to several centuries of extermination, impoverishment, and wholesale theft of territory and natural resources by more technologically advanced societies. However, justifiable outrage is not a legal principle. Also, companies against whom the biopiracy charge is leveled were not the authors of past centuries of misery which gave rise to the bulk of this outrage, even if they are among its latest faces. Corporations and researchers may be forgiven for feeling the protests are out of proportion, if not irrelevant, to their specific current activities. But it is also undeniable that specific harms have been inflicted in some cases and that the use of traditional knowledge by corporations has produced some genuine inequities.

A. Issues and Arguments: Biopiracy, Biocolonialism, and Scientific Imperialism

There are numerous tangled issues involved in this debate. For instance, there are several categories of objectionable activities. As discussed earlier, I will focus on two kinds of patents on plant-derived materials. I will not discuss human gene patents or trademarks and copyrights in cultural heritage elements such as visual designs, songs, or names. Additional complexity arises from the types of objections raised, ranging from the purely monetary to the deeply cultural. Lastly, there are several types of asserted rights, including the right to equitable compensation for contributions made to the development of patentable products and the right of indigenous populations to exercise control over

---

63 Keith Aoki, *Neocolonialism, Anticommons Property, and Biopiracy in the (Not-So-Brave) New World Order of Intellectual Property Protection*, 6 IND. J. GLOBAL LEGAL STUD. 11, 49 (1998); Lara E. Ewens, Note, *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*, 23 B.C. INT'L & COMP. L. REV. 285, 305 (2000).

64 Ranjit Devraj, *India: Government Rebuts Drug-Piracy Charge*, THIRD WORLD NETWORK (Mar. 11, 2001), http://www.twnside.org.sg/title/rebuts.htm (last visited Jan. 27, 2008).

65 *See* Aoki, *supra* note 63, at 49 (describing the conflict that arises when piracy claims are made against developing nations regarding intellectual property, when there is also piracy of those nations' biological and cultural resources).

66 *See* Heald, *supra* note 2, at 542 (discussing concessions by Big Pharma in enforcing international drug patent agreements with developing countries); *see also* Ewens, *supra* note 63, at 305 (stating that developing countries pay a high premium for patented products that are reintroduced in their countries).

access to their territories. This section will consider several specific instances of behavior that has been called biopiracy, as well as specific criticisms of them.

Significant distortion exists in the popular media about the specific injuries claimed by developing countries as a result of patents on plant products.[67] This is likely the result of over-simplified arguments combined with lack of general understanding of how patent law operates. While considering the arguments in this section, it is important to keep in mind what patent law does and does not protect. Since only the "new" aspect of a device or plant can be patented, a patent confers no ownership over the rest of the device or any pre-existing plant strains.[68] Therefore, even though a new plant species may be only slightly altered from its original form, the original cannot be patented. On the other hand, one can patent an existing molecule in newly-purified form, a new method to extract a useful product from an existing plant, or a new use for a known extract.[69] Over-simplified criticism can convey the impression that indigenous people can no longer use their own crops because those crops have been patented, but the reality is more complex than that.[70]

On the other hand, independent invention is not a defense to patent infringement.[71] This is central to the patent policy goal of encouraging disclosure; if you invent something, but keep it secret and someone else gets a patent, then you lose your right to exploit your knowledge. This gives rise to a logical puzzle in the case of a living organism. Evolution could cause infringement if a patented genetic alteration were to be duplicated by natural mutation and a farmer or traditional herbalist used it. Obviously, the probability of this is vanishingly small, yet it is not zero. A farmer could, theoretically, find himself infringing a plant patent without having any knowledge of his offense. I raise this not as a probable scenario, but to point out one instance in which the assumptions that underlie patent law, which historically has dealt with inventions that are entirely of human technology, are not well matched to the realities of biological science.

1. Examples of Harm

The neem seed is one of the most-cited examples of objectionable patents, and is also one instance where the European Patent Office struck

---

67 *See* Ho, *supra* note 62, at 464 n.121 (describing widespread misconceptions and confusion about the implication of patents on the use of the natural products).

68 35 U.S.C. § 101 (2000); *see also infra* Part IV.A (describing why it can be difficult to patent living things in nature).

69 *Infra* Part IV.A.

70 *See* Ho, *supra* note 62, at 464 (describing complexities that convey the impression that people will not be able to use the underlying natural products).

71 *See* 35 U.S.C. § 271(a) (2000) (stating that "whoever without authority makes . . . any patented invention . . .infringes the patent"); *see also* Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank, 527 U.S. 627, 645 (1999) ("[A]n infringement may be entirely inadvertent and unintentional and without knowledge of the patent" (quoting 5 D. CHISUM, PATENTS § 16.02[2] (rev. ed. 1998)).

down patents on a plant-derived product.[72] Various parts of the neem tree had been used for a wide variety of purposes traditionally in India, including several medicinal and agricultural uses.[73] The entire neem story is quite complex, but for our purposes it will suffice to consider the patents that were struck down. These involved supposedly novel uses as a pesticide and insecticide.[74] However, India argued successfully that the traditional methods constituted prior art. The U.S. Patent Office upheld its neem-based patents, however, because the traditional uses were not supported by adequate written documentation, which is required under the statute for uses outside of this country.[75] This quirky outcome is the result of a feature of U.S. patent law that is becoming anachronistic in an ever-more-globalized world, and one which Congress could easily fix.[76] In fact, Congress may be poised to make major revisions to the Patent Act, including a simplified definition of prior art that omits the need for foreign publication.[77]

Neem patents raise two concerns. First, enforceable patents on compositions and processes for stabilizing neem extracts would prevent Indian researchers from independently developing like compositions and processes and giving them away for free, which is their traditional practice.[78] Second, there is the specter that if a traditional use infringes a valid patent, then it would appear that the patent-holder could prohibit the use. However, this happens only if the use occurred in the country where the patent was valid. That is, the U.S. cannot directly enforce its laws in India, and even if it were theoretically possible to enforce a patent to prevent a centuries-old activity, politically the likelihood of getting away with it seems awfully

---

[72] *See* Olufunmilayo B. Arewa, *TRIPS and Traditional Knowledge: Local Communities, Local Knowledge, and Global Intellectual Property Frameworks*, 10 MARQ. INTELL. PROP. L. REV. 155, 171 n.90 (2006). *See, e.g.*, *India Wins Landmark Patent Battle*, BBC NEWS, http://news.bbc.co.uk/2/hi/science/nature/4333627.stm (last visited on Jan. 27, 2008) (reporting on the EU decision striking down neem patents); Vandana Shiva, Third World Network, *The Neem Tree—A Case History of Biopiracy*, http://www.twnside.org.sg/title/pir-ch.htm (last visited on Jan. 27, 2008) (providing a descriptive history of traditional neem uses and objections to patenting neem products).

[73] *E.g.*, Shiva, *supra* note 72. *See* Vandana Shiva & Radha Holla-Bhar, *Intellectual Piracy and the Neem Tree*, 23 THE ECOLOGIST 223, 223–24 (1993) (saying that parts of the neem tree have been used to treat a wide variety of diseases from diabetes to leprosy and as an insecticide for protection from over 100 insects such as locusts and boll weevils).

[74] Shiva, *supra* note 71.

[75] *See* 35 U.S.C. § 102(b) (2000 & Supp. 2004) (explaining conditions for patentability). Ancient Sanskrit texts were considered to be prior art in striking down U.S. Patent No. 5,401,504, issued Mar. 28, 1995, which was for the use of turmeric in wound healing. *See* Arewa, *supra* note 72, at 172.

[76] *See* Jim Chen, *There's No Such Thing as Biopiracy . . . and it's a Good Thing Too*, 37 MCGEORGE L. REV. 1, 28–29 (2006) (discussing how minor modifications of current IP law could go a long way to eliminating objectionable practices, including revising this hole in U.S. law).

[77] *See* H.R. 1908, 110th Cong. (2007). This bill would amend § 102(a) substantially; among other provisions, it prohibits granting a patent if "the claimed invention was patented, described in a printed publication, or in public use or on sale" before the effective filing date of the patent application, with exceptions that are not relevant here. *Id.* Two identical bills were introduced in the House and Senate on April 18, 2007 in a bi-partisan, bi-cameral effort.

[78] Shiva & Holla-Bhar, *supra* note 73, at 223, 225.

remote.[79] On the other hand, the U.S. and other developed countries have been aggressively pursuing reciprocal international agreements for IP enforcement.[80] The neem story illustrates why India resists signing onto such agreements.[81]

There is another more immediate and less hypothetical problem with neem: international demand for the extracted products. Global demand has driven up the local prices of neem-derived raw materials and resulting goods, harming the local economic activities based on neem.[82] Further, the cost of the raw materials will remain high as long as demand is high enough to create this price pressure. Patent law, then, was not necessary to produce this harm, but it was directly instrumental. That is, without patent law's provision for monopoly rights, large companies would have had less incentive to generate global demand for their innovations on neem products.

Another example of specific harm incidentally caused by bioprospecting is depletion of medicinal plants that, unlike the hardy and widely cultivated neem tree, grow in relatively undisturbed ecosystems. For example, the Guajajara of Brazil traditionally used the native plant, *Pilocarpus jaborandi*, to treat glaucoma.[83] Extracts from the plant with therapeutic properties were patented, but exploiting these patents required a steady supply of the plant itself. Native populations of the plant have been depleted by the national government's policy of exporting it to make the patented drug.[84] This illustrates another source of friction, the mismatch between the interests of traditional communities versus national governments.[85] Like the neem story, demand based upon popularizing the plant's usefulness was the catalyst behind the harm. In both stories, the hope of hitting a patent jackpot drove companies to explore such plants in the first place. Also, like the rise of neem prices, the role of IP law in depleting this uncultivated plant was incidental, so changing the law will not remedy the problem.

There is also intangible but real cultural harm in patenting certain types of knowledge. That harm takes the form of a deep sense of violation felt by those whose culture forbids private ownership of knowledge that is beneficial to the group, which is precisely what patent law seeks to

---

[79] For instance, when The American Society of Composers, Authors and Publishers (ASCAP) threatened to sue the Girl Scouts of America over campfire sing-alongs of songs such as "Puff the Magic Dragon," it sparked a public relations disaster. Elisabeth Bumiller, *Battle Hymns Around Campfires: Ascap Asks Royalties from Girl Scouts, and Regrets It*, N.Y. TIMES, Dec. 17, 1996, at B1.

[80] *See infra* Part IV.B.3.

[81] *See* Lakshmi Sarma, *Biopiracy: Twentieth Century Imperialism in the Form of International Agreements*, 13 TEMP. INT'L & COMP. L.J. 107, 118 (1999) (explaining the various negative impacts TRIPS would have on Indian indigenous communities).

[82] Shiva & Holla-Bhar, *supra* note 73, at 225.

[83] Laurie Anne Whitt, *Indigenous Peoples, Intellectual Property & the New Imperial Science*, 23 OKLA. CITY U. L. REV. 211, 213 (1998).

[84] *Id.*

[85] *See* Ho, *supra* note 62, at 461 (discussing the opposing interests of governments and holders of traditional knowledge).

promote.[86] The clash of cultures is most intense here, and suspicion runs so deep that granting patents that incorporate traditional knowledge has been likened to the legal doctrine of "*terra nullius*," which means "empty lands."[87] European governments used this infamous doctrine to justify evicting indigenous populations from their traditional territories during the colonial era.[88] The doctrine of *terra nullius* holds that land which was not developed according to European customs was therefore empty and up for grabs, regardless of indigenous uses.[89] The analogy of *terra nullius* with patent law equates denial of indigenous land ownership in the case of the former with the assumption that indigenous knowledge is available for uncompensated use in the latter. The difference is at the heart of IP law: land is consumable, but knowledge is not. Invoking *terra nullius* illustrates the deeply-rooted distrust and hostility behind biopiracy arguments.

The final category of harm is patented agricultural crop varieties, particularly those that are slight variations on traditional crop strains obtained without payment from seed banks or farmers, which have sometimes been sold back to the countries of origin at a profit. As one critic phrased it, "So what went out free, would return with a price tag."[90] Yet the original seeds cannot be patented, so farmers are theoretically free to continue using what they have always used. If they are buying higher-priced seeds it is due to economic or social forces beyond the scope of patent law. Indeed, the economic pressure to abandon low-yield, hardy varieties for high-yield but expensive and input-intensive commercial varieties can be overwhelming.[91]

---

[86] *See, e.g.*, Whitt, *supra* note 83, at 252–53 (discussing cultural objections of Zuni and Maori peoples to commoditizing knowledge of the natural world). *See* Ho, *supra* note 62, at 436 (citing traditional beliefs that ownership of such sacred knowledge is "morally offensive"); Roht-Arriaza, *supra* note 27, at 956 (calling privatization of such resources "incomprehensible and reprehensible" in the eyes of some groups).

[87] Whitt, *supra* note 83, at 254; Aoki, *supra* note 63, at 48 (quoting VANDANA SHIVA, BIOPIRACY: THE PLUNDER OF NATURE AND KNOWLEDGE 2–5 (1996)).

[88] *See* ROBERT J. MILLER, NATIVE AMERICA, DISCOVERED AND CONQUERED: THOMAS JEFFERSON, LEWIS & CLARK, AND MANIFEST DESTINY 21 (2006) (explaining that England and France justified their rights to native lands by the *terra nullius* principle).

[89] Whitt, *supra* note 83, at 257. *Terra nullius* is one element of the broader Doctrine of Discovery, which was meant to prevent disputes between colonial powers by setting rules for dividing up the "uncivilized" part of the world. MILLER, *supra* note 88, at 11 (discussing how the Doctrine of Discovery prevented conflict amongst European powers), 21 (introducing *terra nullius* specifically as an element of the Doctrine of Discovery). However, *terra nullius* is not just an archaic relic. For example, the House Report on the Alaska Native Claims Settlement Act of 1971 says the treaty under which the United States bought the rights to Alaska from Russia: "conveyed to the United States . . . title to all public lands and vacant lands that were not individual property. The lands used by the 'uncivilized' tribes were not regarded as individual property . . . ." H.R. REP. NO. 92-523, at 2193 (1971), *reprinted in* 2 U.S. CODE CONG. AND ADMIN. NEWS, 92ND CONGRESS — FIRST SESSION 1971, at 2193 (1972).

[90] *International Experts Debate Patents and Biodiversity Issues*, CGIAR HIGHLIGHTS (Consultative Group on Int'l Agric. Res. Secretariat, Wash., D.C.), Feb. 1994, *available at* http://www.worldbank.org/html/cgiar/newsletter/Feb94/v0106406.html (quoting Norah Olembo).

[91] *See* James O. Odek, *Bio-Piracy: Creating Proprietary Rights in Plant Genetic Resources*, 2 J. INTELL. PROP. L. 141, 151 (1994) (discussing how sophisticated seed varieties are designed and propagated by developed countries but may be "ill-suited to the needs of most developing

Three specific types of harm result from the practice of replacing traditional crops with high-yield monocultures. First, farmers may become overly dependent on the high-tech techniques and therefore vulnerable to exploitation by patent-holding companies.[92] Second, loss of hardiness increases the risk of massive crop failure due to disease.[93] Third is the problem of "thin simplifications;"[94] we cannot predict the long-range consequences of promoting radical, technology-based alterations of farming practices. On the other hand, what we do know about the risk of high-yield monocultures is not necessarily comforting.

The above are but a few of many stories in the literature about "appropriation" of resources and knowledge that have been held out as outrageous examples of biopiracy, or biocolonialism.[95] Yet the challenged activities have been legal, even when patents were struck down. What, then, are the criticisms of IP law in this context?

2. Arguments Against Biopiracy

An early scholarly user of the term biopiracy is James Odek.[96] He concedes that the activities he calls biopiracy are legal, but raises two equitable arguments. First, should developing countries pay for seeds that are based on varieties which came originally from the "Third World?" Second, should traditional plant genetic resources be treated as commodities, and if so, where should rights reside?[97] Odek characterizes patents on new plant varieties based on traditional crops as "the uncompensated extraction of plant genetic resources from developing countries,"[98] thereby invoking extraction of depletable resources such as minerals, oil, and timber. Of course, "extraction" of plant genetic resources is not of a depletable resource, and Odek concedes that, "[o]n its face, this argument is air-tight."[99] His point, however, is that "the donor country . . . lose[s] the opportunity to receive a reciprocal economic return for its

countries.").

92 *See* Ewens, *supra* note 63, at 295–96 (discussing the arguments for and against biotech crops).

93 Dennis S. Karjala, *Biotech Patents and Indigenous Peoples*, 7 MINN. J. L. SCI. & TECH. 483, 517–18 (2006) (noting that when the genetic variety of crop genomes is limited, a single disease could hypothetically have devastating consequences on world food supply); Aoki, *supra* note 63, at 56–57 (discussing a genetically engineered cotton variety that actually featured an increased level of bollworm infestation).

94 *See* SCOTT, *supra* note 55, at 309 (stating that "[a]ny large social process or event will inevitably be far more complex than the schemata we can devise, prospectively or retrospectively, to map it").

95 For additional examples see Roht-Arriaza, *supra* note 27, at 921–26. *See also* Arewa, *supra* note 72, at 170–76 (giving examples of "narratives of appropriation").

96 Odek, *supra* note 91, at 142. Professor Odek hails from the University of Nairobi, Kenya. *Id.* at 141.

97 *Id.* at 142.

98 *Id.* at 145.

99 *Id.* at 156.

contribution."[100] Currently, traditional plant varieties are considered by the developed world's institutions to be part of the "common heritage of mankind" such that no one holds exclusive property rights.[101] Odek favors granting rights in traditional knowledge and biological resources to the groups which developed the resources, on the theory that they are a form of cultural property which should be used by such groups in trade with developed countries.[102] This notion of expanding IP rights has intuitive appeal, but it is fraught with practical difficulties.[103]

Naomi Roht-Arriaza also criticizes the "common-heritage-of-mankind" approach, arguing that misappropriation of "traditional scientific and technical knowledge" is aided by the IP system because it excludes such valuable knowledge from recognition.[104] In her view, "[i]ntellectual property laws appropriate indigenous and local scientific knowledge by denying it legitimacy as a protectable interest, thereby allowing others to use it freely."[105] Her focus is on indigenous people's systems of accumulating and maintaining traditional knowledge, and the ways in which they are undervalued by patent and property law.

Her argument speaks directly to the dichotomy between science and traditional expertise at the heart of Scott's argument that complex systems not easily understood by science should be respected.[106] For example, some cultures do not distinguish between cultivated and wild varieties.[107] That is, they cultivate semi-wild species, but not in a way that is obvious to Western researchers, so the entire practice is overlooked. Also, farmers who are growing food for their own consumption may have values other than maximum yield, such as flavor and hardiness. The value of these complex and nuanced systems of knowledge is often not even seen, much less valued by scientists. In addition, preserving cultivars in gene and seed banks may promote complaisance about biodiversity protection by failing to attach any value to the living knowledge concerning such plants. Roht-Arriaza argues that to end objectionable resource appropriation, indigenous and local communities must be accorded recognition for their role as stewards of knowledge, innovators, and as "practitioners of sustainable production and life systems."[108]

This last concern is echoed by other scholars. For example, Traci McClellan notes that Lahe'ena'e Gay says that "[t]raditional indigenous peoples are not just databases to squeeze and discard once science and large

100 *Id.* at 156–57.

101 *See, e.g.*, *id.* at 167 (discussing how the International Plant Genetic Resource Institute (IPGRI) has adopted this approach).

102 *Id.* at 177, 179.

103 *See infra* Part IV.

104 Roht-Arriaza, *supra* note 27, at 942–46.

105 *Id.* at 942.

106 SCOTT, *supra* note 55, at 264.

107 Roht-Arriaza, *supra* note 27, at 933–34.

108 *Id.* at 965. The author explains that "[l]ocal communities overlap somewhat with indigenous" communities but share many of the same problems while lacking international recognition and acceptance as a group. *Id.* at 964.

multinationals have extracted what they believe are the only important elements of their cultures. The data or indigenous knowledge base is valuable only as long as the living system of knowledge exists . . . ."[109] Unfortunately for these advocates, Western science in general, and patent law in particular, are not well suited to create protectable value in such knowledge.

A related approach by Winona LaDuke examines "the foundation of traditional ecological knowledge," particularly among North America's First Nations.[110] She believes that environmental scientists have much to learn from the traditional sustainable practices of indigenous people in North America, and she is critical of what she terms "environmental racism" on the part of advocates of environmental protection.[111] In her view, a combination of scientific snobbery and cultural ignorance often lead to environmental protections which come at the direct expense of native peoples' subsistence practices, such as promotion of hydroelectric dams over nuclear power.[112] In short, "[s]o long as the issue of consumption is not addressed, someone's land and lives will be traded for someone else's cappuccino machine."[113] LaDuke also believes that environmental sciences can learn much by studying property traditions practiced by groups such as her own Anishinabe people. Although she does not specifically address IP rights, as an insider, she is in a position to argue for recognition of a body of knowledge and way of knowing that is alien and therefore largely invisible to Western science.

This antagonism to science is echoed by philosophy professor Laurie Ann Whitt, who argues that science has been co-opted to become the method for implementing a new "global imperialism," legitimated by IP law.[114] She does not use the term "biopiracy." She prefers the phrase, "extractive biocolonialism," which she argues must be defined in terms of its impact, regardless of intent.[115] Whitt proposes a two-part definition involving 1) coercive activities by the agents of dominant cultures, resulting in 2) harmful outcomes to indigenous populations.[116] For the second part of her definition, Whitt enumerates eight categories of harm, including environmental damage, "loss of political and economic autonomy," and "discrediting of indigenous knowledge and value systems."[117] Thus, her definition is quite broad yet commendable in its attempt to define and focus the debate.

---

109 Traci L. McClellan, *The Role of International Law in Protecting the Traditional Knowledge and Plant Life of Indigenous Peoples*, 19 WIS. INT'L L.J. 249, 260 (2001).

110 LaDuke, *supra* note 52, at 127.

111 *Id.* at 138.

112 *Id.* at 137–38.

113 *Id.* at 138.

114 Whitt, *supra* note 83, at 211. Her particular focus is the "Diversity Project," a side-bar to the Human Genome Project which seeks to preserve human genetic diversity, but her arguments are equally valid as applied to plant patents.

115 *Id.* at 214.

116 *Id.*

117 *Id.* at 214–15.

Whitt is also highly critical of the trend towards merging of science policy and industrial policy, and between the concepts of science and property.[118] She objects to claims that science is value-neutral, on the ground that science has become a largely planned activity which serves the interests of powerful sponsors such as states and corporations, rather than humanity at large.[119] She reasons that "[t]he frontiers [of colonization] have expanded in contemporary imperialism to include intangible property. . . ."[120] In her view, IP law provides validation to activities whose ends are the acquisition of control over indigenous genetic resources, while science provides the tools to meet patent law's requirements of individual inventiveness.[121]

Whitt also criticizes law for claiming to be value-neutral. She cites law's "rhetoric of neutrality" as a "cloaking device" for imperial ideology, but she also allows that law is a potential "means of resistance to oppression."[122] However, she does not accord science a similar dual role. This is unfortunate, but perhaps understandable since she seems not to have considered that science is a tool anyone can employ, with diverse practitioners, many of whom no doubt share her views. I would argue that science, like law, contains equal measures of potential harm and hope.

Finally, Keith Aoki addresses the tendency for IP protection to be "spiraling ever upward" in response to political pressures that fail to value the intellectual commons, i.e. the public domain.[123] In particular, Aoki applies the concept of an "anticommons" to intellectual property.[124] This is the proposition that if property rights become too finely divided among individual owners, it creates "a legal 'smog'" of transaction costs.[125] This causes the resource as a whole to be underutilized because no one can put an individual piece to any productive use, and the effort required to get enough owners to cooperate exceeds the potential benefits.[126] This, he argues, is in danger of happening to IP rights generally and biotechnology rights especially.[127] In his view there is a "maximalist imperative" among corporations, leading to the logical conclusion that "if a little bit of protection is good, then a lot will be better."[128] Absent a countervailing recognition by governments that stifling the free flow of ideas is inefficient,

118 *Id.* at 244.

119 *Id.* at 215–16.

120 *Id.* at 258.

121 *Id.* at 246–47.

122 *Id.* at 259.

123 Aoki, *supra* note 62, at 27.

124 *See id.* at 28–29, 35 (employing the concept proposed in Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621 (1998)).

125 *See id.* at 35.

126 Aoki, *supra* note 63, at 35–36. *See also* Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCI. 698, 700 (1998) (discussing the impact of transaction costs on the "tragedy of the anticommons").

127 *See* Aoki, *supra* note 63, at 31 (discussing the efforts of Heller and Eisenberg). *See* Heller & Eisenberg, *supra* note 126, at 699 (describing why anticommons issues are prevalent in the biomedical context).

128 Aoki, *supra* note 63, at 27.

this trend creates a "unidirectional drain of intellectual resources from the Third World."[129]

A common theme running through these arguments is the unfairness of an economic system in which corporations reap great financial benefits by making modest technological investments in nature's treasure-trove. This structure simply appears too lopsided to pass a gut-check, which highlights a problem with the current system. Human knowledge grows incrementally, and if we allow people to fence off every new bit of added information at the edges, soon the growth will be choked off. Aoki argues that, in order to reestablish efficient use of ideas, we need intellectual "easements" and "public trust property" analogous to concepts in real property law that establish public rights to use physical spaces such as beach-fronts.[130] This would be consistent with the public-purpose mandate implied in the constitutional directive that patents and copyrights are to be granted "to advance science and the useful arts."[131] Aoki is far from alone in his critique of the recent explosion of global IP rights. The next section considers the current state of those rights in more detail, particularly as they involve plant genetic resources.

IV. INTELLECTUAL PROPERTY LAW & BIOLOGICAL "INVENTIONS"

The next 100 years will be a search for better perception instead of better vision.
– Scott Adams[132]

Apart from patents, the remaining three categories of IP law appear in the biopiracy debate as potential tools to protect indigenous peoples' rights.[133] Copyrights protect copying and performance of writing and artwork generally, so, in theory, they could protect traditional cultural elements, but this is problematic because copyright protection is for an individual author, and for a limited time.[134] Trademarks and service marks are not tied to individual authorship, but the protections under these legal principles are limited to actual use in time and space.[135] That is, if an indigenous South American tribe wanted exclusive global use of its cultural elements, it would have to use them globally itself.[136] Finally, trade secrets

129 *Id.* at 26.

130 *Id.* at 41–42.

131 *Id.*

132 SCOTT ADAMS, THE DILBERT FUTURE 227 (1997).

133 *See* David R. Downes, *How Intellectual Property Could Be a Tool to Protect Traditional Knowledge*, 25 COLUM. J. ENVTL. L. 253, 268–73 (2000) (exploring the development of trademarks and geographical indications for the protection of traditional knowledge); Chen, *supra* note 76, at 20–24 (discussing regimes for protection of "ethnobiological knowledge as trade secrets," and arguing that it really is in the public domain). It is all well and good to say that under current law such knowledge is in the public domain, but the entire point of IP law is to remove intangibles from the public domain according to a relatively arbitrary set of rules.

134 *See* Paterson & Karjala, *supra* note 16, at 640 (stating that "[i]n Berne Convention countries . . . the minimum term of copyright protection is the life of the author and 50 years").

135 *See supra* Part I.B.2.

136 This raises interesting possibilities for the internet, however.

protect businesses from competitors who use unscrupulous means of discovering their otherwise-hidden ways of doing business.[137] Variants on trade secret law have been proposed to protect the cultural heritage and traditional knowledge of indigenous peoples, but if the knowledge is communal (not secret), it is not protectable at all.[138]

A. Boundaries of IP Rights in Biology in the United States.

Patent law's rights to intangibles do not exist in an ethereal realm of pure thought. They exist for economic reasons, to serve societal goals. The Constitution makes clear they are intended to benefit everyone by inducing inventors to pursue their ideas and to disclose the useful ones.[139] This is balanced against the potential economic harm created by granting monopoly rights over inventions. That is, there is a quid pro quo involved: inventors who timely disclose their ideas get some limited monopoly rights in exchange. In theory, this enables others to continue to innovate without having to "reinvent the wheel." Monopoly rights are anti-competitive, but if multiple actors with access to education and technology all enjoy easy access to the inventions of others, in theory overall efficiency is enhanced. One drawback is that "blocking" patents result from incremental patents on sequential breakthroughs by different inventors.[140] But enlightened self-interest on the part of those inventors encourages cross-licensing of their respective inventive increments for mutual gain. In theory.

In the case of patenting living things, however, there is a conceptual difficulty. Humans did not invent life; the myriad incremental inventions are already out there, having been produced by millennia of evolution. The search by biological scientists is not so much to invent as to discover, and the works of nature are not, theoretically, patentable.[141] Thus, it takes some human tinkering to get a patent that involves nature's handiwork. There are three ways to get such patent protection.[142] One is to purify a naturally occurring substance that is useful in its purified form, such as adrenalin.[143] Another is to find a novel use for a natural substance, in which case the use can be patented, even if the substance cannot.[144] Third, living things can be reassembled in new genetic combinations, in which case the entire organism

137 *See* WIPO MAGAZINE, *supra* note 13, at 17–18.

138 *Id.* at 18.

139 U.S. CONST. art. I, § 8, cl. 8 ("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").

140 *See* SCHECHTER & THOMAS, *supra* note 4, at 276.

141 *See id.* at 34 (discussing Funk Brothers Seed Co. v. Kalo Inoculant Co. 333 U.S. 127, 131 (1948), which held "the discovery of some of the handiwork of nature" unpatentable).

142 *See id.* at 32–38 (discussing the foundational cases for the patentability of these categories).

143 *Id.* at 32.

144 *Id.* at 35.

may be patentable.[145] In all three, though, arguably nature has done the heavy lifting for you. Still, don't we want to encourage research?

The notion that patent protections are needed to stimulate medical advances is problematic given the intense public support for such discoveries.[146] The research has long been produced by non-profit research efforts in universities and government labs and shared freely in peer-reviewed journals. Genetic decoding and manipulation is still so new that it is difficult to assess the effect of patents on these advances, but I find it personally dismaying. Scientific creativity depends on the free flow of information and ideas, and where the tradition has been disclosure without IP protection, granting monopoly rights reduces the ability to use the work of others. Further, the element of random chance is high in this particular search; much basic research is required per economically significant discovery.[147] Finally, it is obviously much harder to turn a profit on disease prevention rather than treatment. In the absence of any real analysis of the consequences, putting profit-maximization ahead of all other considerations in choosing research directions seems dangerously ill-conceived. And make no mistake; patents are very expensive to get, and to defend, so the more patent rights dictate research choices, the more profits will replace the common good in dictating directions for new research.[148]

Another logical problem with patents on living things is quantitative. That is, a patent on a better design for carrying coal on railroad cars depends for its usefulness upon extant railroad technology, the product of countless small triumphs of human ingenuity.[149] A new design produces quantifiable improvement upon a system designed entirely through human efforts and is fully understood by us. But what about a living thing? Even a eukaryotic bacteria is so vastly complex we only understand a vanishingly small fraction of how it works, and we do not even know what "life" is.[150] With our current understanding, deciphering the DNA of an organism is a bit like having an instruction manual with a trillion pages, written in a language that limits our proficiency to a small phrase book. We can ask, "Where is the bathroom?" and "When does the train leave?" but we are hardly masters of the whole enterprise. I suspect this fact plays a substantial part in our

145 *Id.*

146 For example, California's citizenry voted in 2004 to spend about $3 billion of tax money over the next decade on stem-cell research. David P. Hamilton, *California Vote Brings Windfall for Stem Cells*, WALL ST. J., Nov. 4, 2004, at B1.

147 That is why drug companies find traditional uses of medicinal plants so attractive.

148 *See* Laura Peter, *The Virtue of Patents*, WALL ST. J., Feb. 20, 2007, at A17 (noting that patents can cost from $5000 to $50,000). Technically, anyone can file a patent application for the cost of the filing fee, but that is irrelevant to the present discussion.

149 *E.g.*, Winans v. Denmeade, 56 U.S. 330, 338–44 (1854) (involving an eight-sided variant on a cone-shaped coal-transporting railcar).

150 Similarly, we don't know what gravity is either. We know masses exert an attractive force on each other, without which there wouldn't be planets or solar systems, and we can describe this force with exquisite precision, but we have no more idea of *why* than Copernicus had of why planets seemed to travel in an infinite series of ever-smaller circles. *See, e.g.*, STEPHEN HAWKING, BLACK HOLES AND BABY UNIVERSES AND OTHER ESSAYS 49–68 (1993) (discussing possible directions unifying theories of physics might take).

general uneasiness with patents on living things, even beyond cultural taboos on privatizing life.

Another problem with large-scale genetic manipulation of food crops, in particular, is that we really do not know how tinkering with one part of the system will operate on the rest. This is also true with complex man-made machines, but in that case, we can build a prototype and test it. In the case of agriculture and food, we cannot test the outcome other than the hard way—by seeing if disaster ensues. The German scientific forests took only two generations of harvesting to achieve "forest death," that is, to exhaust and destroy the complex biological systems which were the legacy of "real" forests.[151] A good example of unforeseen outcomes in nutrition is beriberi-a disease caused by modern rice-polishing technology that resulted in the availability of inexpensive refined rice.[152] Increasing the mass-yield of crops may increase their caloric content, but at what cost to their content of essential nutrients? That is, if a genetic alteration increases the amount of carbohydrate per grain of rice, it doesn't automatically follow that all the numerous other essential nutrients found in rice will also be increased. In terms of patent rights, should we be content with simplistic views of what is a "useful" improvement? These cautions form a backdrop to examine IP rights for biology-based inventions under U.S. law.

1. U.S. Protections for Plant Breeders

Plant patents raise a couple of relevant issues for this discussion.[153] First, since plants are certainly products of nature, they arguably fall outside the scope of patent protections by definition.[154] Another issue concerns a requirement of patent law not discussed above, that of adequate disclosure. To be patentable, an invention must be described adequately to enable someone with expertise in the field to reproduce it from reading the patent.[155] Since no one can "build" a functioning plant from a description (yet) this might seem insurmountable. Finally, the processes of sexual reproduction and evolution cause plants to continuously change with each generation, raising the question of whether the "invention" might be ephemeral.[156] Two U.S. statutes address these concerns, for better or worse.

First, the Plant Patent Act, enacted in 1930, covers new varieties that are asexually reproduced, for example, by budding or grafting, but not a plant discovered in an uncultivated state.[157] This overcomes the instability-

151 SCOTT, *supra* note 55, at 20.

152 *See, e.g.*, Arthur W. Galston & Ethan Signer, *Education and Science in North Vietnam*, 174 SCI. 349, 381 (1971) (explaining that there is little beriberi in North Vietnam because the government controls the degree to which rice is polished); WILLIAM DUFTY, SUGAR BLUES 121–23 (2d ed. 1993) (1976) (describing the story of how the cause of beriberi was identified).

153 SCHECHTER & THOMAS, *supra* note 4, at 55–56.

154 *Id.* at 55; *see* 35 U.S.C. § 101 (2000) (defining patentable inventions as "any new and useful process, machine, manufacture, or composition of matter").

155 35 U.S.C. § 112 (2000).

156 *See* SCHECHTER & THOMAS, *supra* note 4, at 56.

157 35 U.S.C. § 161 (2000) (tuber-propagated plants are also excluded).

of-life problem since asexual reproduction produces near-exact genetic replicas. Further, plant patents under the Act are explicitly excused from compliance with the "how-to-make" requirement of section 112 of the Patent Act.[158] Instead, the plant must be "shown and described" in the specification, and the disclosure is considered adequate so long as the description of the distinct new feature(s) of the variety "is as complete as is reasonably possible."[159] The drawback for holders of plant patents under this statute is that most major food crops, including grains and fruit, are sexually reproduced.

Plant breeders' rights in sexually-reproduced plants are protected under the Plant Variety Protection Act (PVPA), enacted in 1970.[160] This is not part of the patent system, but rather it is certification-based. To be eligible, the plant must be new, distinct, uniform, and stable.[161] Each of these requirements is further defined in the statute, but the relevant requirement here is stability. The novel feature(s) of the plant is that it must be genetically stable across generations; in common parlance, it must "breed true."[162] The PVPA allows two exceptions. First, protected plants may be used by other breeders to perform "research," for example, to breed their own novel varieties.[163] Second, it allows farmers who purchase the seeds of protected varieties to save and sell seeds they produce, with some limitations.[164] Since utility patents contain no such protections for farmers, breeders usually prefer them to PVPA certification.[165]

But are sexually reproduced plants eligible for utility patents? This question was settled in 2001 in the landmark case, *J.E.M. AG Supply, Inc. v. Pioneer Hi-Bred International, Inc.*[166] Justice Thomas, writing for the Court, rejected the obvious argument that Congress must have intended the PVPA to be the sole protection for sexually-reproduced plants, since the PVPA would be unnecessary if patents were available.[167] Justice Breyer took the opposite view in a vigorous dissent, but the six-two opinion was not a close one.[168] Of course, Congress could amend the Patent Act to exclude sexually-reproduced plants. This brings us to the question of what specific rights can be obtained using utility patents on living things and the products derived from them.

158 *Id.* § 162.

159 35 U.S.C. § 162 (2000); SCHECHTER & THOMAS, *supra* note 4, at 57.

160 7 U.S.C. §§ 2321–2582 (2000).

161 *Id.* § 2402(a) (2000).

162 *See id.* (stating "the variety, when reproduced, will remain unchanged with regard to the essential and distinctive characteristics of the variety with a reasonable degree of reliability commensurate with that of varieties of the same category in which the same breeding method is employed").

163 7 U.S.C. § 2544 (2000).

164 7 U.S.C. § 2543 (2000).

165 SCHECHTER & THOMAS, *supra* note 4, at 57. "Utility patents" are the type of patents referred to herein. There are also "design patents," which are not relevant to plant protection—at least, not yet!

166 534 U.S. 124 (2001).

167 *Id.* at 145–46.

168 *Id.* at 147.

2. Utility Patents on Products of Nature Under U.S. Law

In theory at least, "laws of nature, natural phenomena, and abstract ideas" cannot be patented.[169] The foundational case for biological products, *Parke-Davis & Co. v. H.K. Mulford Co.*,[170] decided in 1911, provides the basis for patenting purified, naturally occurring substances, and hence for medicinal extracts of plants. *Parke-Davis* involved a new form of purified human adrenalin that was therapeutically useful in a way that previous purified forms were not. Judge Learned Hand reasoned that being the "first to make it available for . . . use" rendered the adrenaline "for every practical purpose a new thing commercially and therapeutically."[171] This holding is not a conceptual reach. Since adrenalin is a hormone that naturally circulates in the blood, a form that can be safely injected into a patient who suffers from impaired adrenal function is therapeutically useful.

Seven decades after *Park-Davis*, the Supreme Court for the first time upheld a patent on an intact living organism, in *Diamond v. Chakrabarty*.[172] A genetically engineered bacterium with the novel ability to degrade components of crude oil was held to fit within two patentable categories, "manufacture" and "composition of matter."[173] The PTO had predictably denied the patent, so this case opened the doors to bioengineering patents generally. Another leap forward was secured in 1988 by the grant of a patent on a mouse strain.[174] The mouse in question is genetically engineered such that females have a fifty-fifty chance of getting cancer, so its usefulness is purely as a research tool for studying cancer treatments rather than having any non-research utility.[175]

As the law stands today, apparently only patents on actual human beings are off limits. Such patents have been deemed unconstitutional per a 1987 PTO Notice by the Patent Commissioner, which the authors of the West Concise Hornbook on patent law speculate must be based on the 13th Amendment's slavery prohibition.[176]

At the outer limits of patents on nature are two developments. First, in 2001, isolated genes were declared patentable by the PTO, so long as the inventor "discloses how to use the purified gene isolated from its natural state . . . ."[177] Note that this goes far beyond the original *Park-Davis* rationale, because while purified adrenalin can be used as a drug, there really is no direct medicinal or other use for a purified single gene.[178] DNA is a code for

169 *See* Diamond v. Diehr, 450 U.S. 175, 185, 188 (1981) (holding that a method for curing rubber that used a mathematical formula was a patentable process when taken as a whole, even though the formula itself was not patentable).

170 189 F. 95 (S.D.N.Y. 1911).

171 *Id.* at 103.

172 447 U.S. 303 (1980).

173 *Id.* at 308–09.

174 U.S. Patent No. 4,736,866 (filed Apr. 12, 1988).

175 *Id.*

176 SCHECHTER & THOMAS, *supra* note 4, at 37.

177 Utility Examination Guidelines, 66 Fed. Reg. 1092, 1093 (Jan. 5, 2001).

178 *See, e.g.*, Karjala, *supra* note 93, at 507 (criticizing this decision).

the manufacture of proteins that will do nothing on their own, outside of a chromosome in a functioning cell. By contrast, a hormone, such as the purified adrenalin patented in *Parke-Davis*, is biologically active while it is carried around in the bloodstream.[179]

The second example is a rather infamous recent patent that claims to cover the act of making a diagnostic "correlation" between a metabolic assay and a vitamin deficiency.[180] This patent was upheld by the Federal Circuit in 2004.[181] The specific claim at issue covers every potential method for measuring total homocysteine levels in any bodily fluid, whether that method is patented or not, in combination with "correlating an elevated level of total homocysteine . . . with a deficiency of cobalamin or folate."[182] By "correlating" what is meant is simply knowing that elevated homocysteine tends to be related to suboptimal status of either of the two vitamins. In other words, the "process instructs the user to (1) obtain test results and (2) think about them."[183] In fact, these are the words of Justice Breyer in his opinion dissenting from the Supreme Court's dismissal of cert in the case.[184]

The Court dismissed cert "as improvidently granted" in a one-sentence opinion, perhaps because the specific arguments being made on appeal were not fully briefed at trial.[185] The defendant corporation was found guilty of actively inducing infringing acts by doctors, which consisted of diagnosing patients using the correlation. This inducement took the form of advertising homocysteine assays and educating doctors on their use, i.e., teaching doctors about the correlation.

I agree with the dissent that this was not a close case,[186] and that there was a compelling public interest in having the Court weigh in on this topic "sooner rather than later."[187] Indeed, the claimed fenced-off region of mental

---

179 *See, e.g.*, WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 1091 (Philip Babcock Gove, Ph.D. ed., 1971) (defining a hormone as "a specific organic product of living cells that, transported by body fluids or sap, produces a specific effect on the activity of cells remote from its point of origin").

180 U.S. Patent No. 4,940,658 claim 13 (filed July 10, 1990).

181 Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings, 370 F.3d 1354 (Fed. Cir. 2004), *cert. granted*, 126 S. Ct. 543 (2005), *cert. dismissed as improvidently granted*, 126 S. Ct. 2921 (2006). The Federal Circuit has jurisdiction over all patent appeals.

182 Cobalamin and folate are essential nutrients involved in "one-carbon metabolism" pathways. When these pathways are impaired for any reason, including suboptimal dietary intake of either of these nutrients, the conversion of the amino acid homocysteine to other substances is impaired, and homocysteine tends to be elevated in the bloodstream. FRANCES J. ZEMAN, CLINICAL NUTRITION AND DIETETICS 691 (2d ed. 1991) (illustrated in figure 18-6).

183 Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc. 126 S. Ct. 2921, 2927 (2006). Justice Breyer was joined by Justices Stevens and Souter in the dissent. *Id.* at 2921.

184 Chief Justice Rehnquist did not participate in the decision. *Id.* at 2921.

185 *Id. See id.* at 2925 (saying "[t]here is a technical procedural reason for not [hearing the case], namely, that LabCorp did not refer in the lower courts to § 101 of the Patent Act, which sets forth subject matter that is patentable, and within the bounds of which the 'law of nature' principle most comfortably fits").

186 See *id.* at 2927 (saying "[b]ut this case is not at the boundary. It does not require us to consider the precise scope of the 'natural phenomenon' doctrine or any other difficult issue. In my view, claim 13 is invalid no matter how narrowly one reasonably interprets that doctrine.").

187 *Id.* at 2926.

activity by doctors, not to mention doctor-patient communication, is so broad here that there is a First Amendment free speech argument for striking down the claim.[188] It also effectively covers all diagnostic use of a natural phenomenon, which should be prohibited subject matter. The assay does not directly detect a "deficiency" in dietary consumption of either of the two nutrients, since there could be other causes for elevated homocysteine.[189] The only way to positively diagnose the cause is to give the patient supplements of the nutrients and see if the elevated homocysteine goes away or not.

Nor is this situation a "deficiency disease" as such are defined in nutrition science.[190] Rather, it is an indication that your diet may be suboptimal. As such, this correlation falls into a very basic category of tools—the category that contains the relationship between blood cholesterol and heart disease risk. Such broad coverage of fundamental tools of medical and nutritional research is bound to chill innovation in further refinements of this relationship, as well as creating an incentive for a "gold rush" of similar claims. As Justice Breyer points out, "the reason for the exclusion [of laws of nature] is that sometimes *too much* patent protection can impede rather than 'promote the Progress of Science and the useful Arts,' the constitutional objective of patent and copyright protection."[191]

Some evidence for potential self-correction of the bioscience anti-commons emerged in the 2005 case of *In re Fisher*.[192] There, a split panel of the Federal Circuit upheld a decision by the PTO rejecting a patent claim covering five express sequence tags (ESTs) for maize genes. EST's are useful solely as basic research tools, not for any potential therapeutic use. The patent was rejected for lack of utility of the ESTs because all seven of the claimed uses were generically applicable to all ESTs,[193] and all were purely research uses rather than any use having "significant and presently available benefit to the public."[194] ESTs are used as probes to detect gene expression, so they are potentially useful in studying how specific underlying genes get turned on and off. But there can be multiple ESTs for a single gene, and the functions of these particular genes were not yet known. Such patents have a real potential to choke off research into the covered genes while having minimal individual research utility. In any case, this decision shows that

188 There is a parallel to the landmark case Griswold v. Connecticut. 381 U.S. 479 (1965), where the defendants were a doctor and a director of Planned Parenthood that were convicted of aiding and abetting a married couple's illegal contraceptive use. A peripheral constitutional right to free speech was implicated by the restriction on doctor-patient communication.

189 *See* ZEMAN, *supra* note 182, at 652–53 (discussing inborn errors of metabolism of homocysteine that lead to elevated blood levels but are treated by reducing dietary cysteine).

190 To be considered an essential nutrient, removing it from the diet must cause an identifiable symptom or set of symptoms that eventually are fatal. The deficiency disease caused by an actual folate or cobalamin deficiency is anemia. *Id.* at 693.

191 Lab. Corp. v. Metabolite Labs, 126 S. Ct. 2921, 2922 (2006).

192 421 F.3d 1365 (Fed. Cir. 2005). *See generally* SCHECHTER & THOMAS, *supra* note 4, at 187–88.

193 *In re Fisher*, 421 F.3d at 1374.

194 *Id.* at 1371. This may seem hard to reconcile with the mouse patent discussed *supra* text accompanying notes 174–76, but that patent never came before the Federal Circuit Court.

there is some limit to what will be deemed sufficiently useful under §101 in the field of genetic research, but whether even this limitation will stand is anyone's guess. After all, the dissenting justice on the panel would have held such research uses adequate.[195]

The interesting twist on this case is found in the filing of an amicus brief on the part of various biotechnology and pharmaceutical companies and academic institutions which joined the U.S. government in arguing *against* patentability of the ESTs.[196] The amici went beyond simply arguing against holding that the utility of ESTs as research tools is adequate for patentability. They also argued that as a policy matter such research tools should not be patentable because they "would result in an unnecessarily convoluted licensing environment for those interested in researching that gene and/or protein [identified by the EST]."[197] Unfortunately, the court firmly rejected this as a basis for striking down a patent claim, flatly stating that such concerns "are public policy considerations which are more appropriately directed to Congress . . . ." What is remarkable is that these amici were arguing to strike down a large number of patents held by *themselves*, apparently precisely to curtail the anticommons problem they pose in the field of genetic research. However, they will have to band together in an appeal to Congress to achieve their aim with finality.

The foregoing discussion illustrates the recent trend toward ever-increasing scope of patents derived from living things and the controversies they entail. Not all of these patents are directly relevant to the patents implicated in biopiracy, but together they illustrate what many view as an alarming trend towards willy-nilly expansion of IP rights without any meaningful balance of the public's interest in a healthy intellectual public domain. Of course, there are national differences in the rules for what can be patented. In addition, there are several international legal instruments which embody mechanisms for international cooperation in IP rights and together form an emerging body of international IP law.

B. International IP Law

Patent law is an exercise of national sovereignty, and it grows out of a nation's desire to promote innovation by granting rights to its citizens to intellectual innovations that otherwise belong in the public domain. Nations with little industry and low education levels have better things to spend their limited resources on than developing and enforcing expensive patent registration systems. Further, the nature of patent law is to deal with constant change, so diverging views on what should be patentable are

195 *Id.* at 1380.

196 Brief for Amici Curiae Eli Lilly and Co. et al. in Support of the United States Patent and Trademark Office in Support of Affirmance at 1, In re Fisher, 421 F.3d 1365 (Fed. Cir. 2005), 2004 WL 4996616 (amici included Eli Lilly and Company, the Association of American Medical Colleges, Baxter Healthcare Corporation, The National Academy of Sciences, Dow AgroSciences LLC, and the American College of Medical Genetics).

197 *In re Fisher*, 421 F.3d at 1378.

inevitable as science and technology probe the gray area between life and invention. It is no surprise, then, that considerable national variation in patent law exists nor that the developing and developed countries should favor different approaches to joint efforts at regulating patent protection internationally.

1. National Variation

U.S. patent law is quite liberal in granting protections, even among the developed nations of the Northern Hemisphere.[198] For example, in 2002, Canada's high court denied recognition of the mouse patent already discussed.[199] This was despite the fact that Canada's statutory definition of patentable subject matter is nearly identical to that of the U.S., covering "any new and useful improvement in any art, process, machine, manufacture or composition of matter[.]"[200] The European Union's Patent Convention excludes from patentability any "plant or animal varieties or essentially biological processes for the production of plants or animals."[201] This was clarified in 1998 by the European Biotechnology Directive, to permit patents on "biological material" that has been "isolated from its natural environment or produced by means of a technical process . . . . "[202] On the other hand, plant varieties cannot be patented under EU law, even if they are genetically engineered.[203] At the opposite end of the spectrum, India has had one of the more restrictive regimes regarding protection of biological information.[204] This is not surprising, considering that India has been home to numerous biopiracy stories. The most notable biopiracy story is that of the neem patents.[205]

Of course, many developing countries have no patent law at all, since they have had little history of technological innovation. This fact goes to the crux of the divide between North and South; undeveloped countries are poor because they are undeveloped, and they are also relatively rich in biological resources for the very same reason. It is no coincidence. Two international agreements have sought to address this disparity from differing viewpoints, in order to inject some equity into the flow of valuable information from poor to rich nations.

198 Chen, *supra* note 76, at 15–16.

199 *See* Harvard Coll. v. Canada, [2002] 4 S.C.R. 45 (Can.).

200 Patent Act, 1993 S.C., ch. P-4 § 2 (Can.).

201 Convention on the Grant of European Patents art. 53(b), Oct. 5, 1973, 1065 U.N.T.S. 255, 13 I.L.M. 270.

202 *See* Council Directive 98/44, art. 3.2, 1998 O.J. (L 213) 13 (EC) (on the Legal Protection of Biotechnological Inventions).

203 *See* Chen, *supra* note 76, at 17 (citing European Patent Office, Enlarged Bd. of Appeal, Transgenic plant/NOVARTIS II, G0001/98 EBA 38 (Dec. 20, 1999), *available at* http://legal.european-patent-office.org/dg3/pdf/g980001ex1.pdf).

204 Chen, *supra* note 76, at 16.

205 *See supra* Part III.A.1.

2. Indigenous Rights Under The Convention on Biological Diversity

As its name suggests, a major goal of the Convention on Biological Diversity (CBD) is protection of biodiversity in developing nations. [206] Its theoretical underpinnings are economic; it is designed to encourage appropriate valuation of depletable bio-resources using market-based strategies.[207] While no one would argue against these goals, the CBD also promotes a more controversial objective, that of "fair and equitable sharing of the benefits" flowing from the use of such resources.[208] To achieve this, Article 15 of the CBD specifies that States "have sovereign rights over" and a responsibility to conserve their biodiversity resources.[209] Members who use resources from other nations are required to obtain informed consent first. Thus, members are given considerable leeway to control access to their physical resources but in the context of a duty to protect them not as a pure unconstrained property right. In addition, the CBD grants rights in biological resources to indigenous communities, and contains provisions concerning how states should treat their indigenous communities.[210] These provisions encourage co-operation, equitable benefit-sharing, and respect for indigenous lifestyles that promote sustainable use.[211] The CBD thus emphasizes *in situ* preservation of both biodiversity and the traditional knowledge systems and cultures associated with undeveloped, biologically rich areas of the earth.

On the other hand, to promote equitable sharing, Article 16 requires those who wish to exploit genetic resources to provide "access to and transfer of technology" to developing countries on mutually agreed terms.[212] That is, developed countries are expected to help developing ones gain the technological infrastructure and know-how to exploit their own resources. Naturally, large biotechnology companies are reluctant to agree to help create their competition, and the developed nations' governments are similarly reluctant to impair their control over IP rights. Nevertheless, a compromise was reached in balancing the two views, one which "arguably fell short of meeting the expectations of both developed and developing countries because of its compromised and often ambiguous language."[213] In any case, the CBD has no enforcement mechanisms other than public opinion.

---

206 Convention on Biological Diversity, June 5, 1992, 31 I.L.M. 818. For an in-depth discussion of the Convention, see June Starr & Kenneth C. Hardy, *Not by Seeds Alone: The Biodiversity Treaty and the Role for Native Agriculture*, 12 STAN. ENVTL. L.J. 85, 106–10 (1993).

207 Greg K. Venbrux, *When Two Worlds Collide: Ownership of Genetic Resources Under the Convention on Biological Diversity and the Agreement on Trade-Related Aspects of Intellectual Property Rights*, 9 U. PITT. J. TECH. L. & POL'Y 5, 5 (2005) (citing W. LESSER, SUSTAINABLE USE OF GENETIC RESOURCES UNDER THE CONVENTION ON BIOLOGICAL DIVERSITY 4–5 (1998)).

208 Convention on Biological Diversity, *supra* note 206, at 823.

209 *Id.* at 822.

210 *Id.* at 826, 829–30.

211 *Id.* at 826, 830.

212 *Id.* at 829.

213 Venbrux, *supra* note 207, at 13.

The CBD was first opened for signatures in June, 1992. Every industrial country except the United States quickly signed on to it.[214] The reluctance of the United States is striking in the face of the lack of any sanctions attached to the agreement, but consistent with the unrelentingly pro-free-trade policies that have dominated U.S. politics since 1992.[215] The Clinton administration did sign the CBD, but it has never been ratified by Congress.[216] On the other hand, the United States has been fully on board with the far more powerful Trade-Related Aspects of Intellectual Property Rights (TRIPS).[217]

3. The Empire Strikes Back: WTO/TRIPS

The TRIPS Agreement came into being shortly after the CBD, and it is a part of the larger international agreement which forms the World Trade Organization (WTO).[218] TRIPS is specifically concerned with protecting the IP rights of developed nations, and it is quite powerful because all WTO members are obliged to comply. It is also "the most detailed and comprehensive multilateral agreement on intellectual property yet achieved."[219] In general, TRIPS offers trade-status incentives to developing countries in exchange for extending IP protections, a quid pro quo which proponents applaud as mutually beneficial, but critics consider potentially coercive.[220] Patentable subject matter under TRIPS includes inventions "in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application."[221] A significant exception exists for plants and animals (other than microorganisms), although its actual effect is not entirely clear. Members are not required to issue patents on these categories, but, if a country opts out, Article 27(3) requires it to provide an "effective sui generis system" for protection of new plant varieties. Also, the least-developed countries have until January 1, 2010 to comply, so the full meaning and effect of this provision remains to be seen.

214 *See* Starr & Hardy, *supra* note 206, at 107.

215 *See* Venbrux, *supra* note 207, at 11-12 (providing history of the CBD in U.S. politics under Presidents Bush Sr. and Clinton).

216 *See* Charles R. McManis, *The Interface between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, 76 WASH. U. L.Q. 255, 256–57 (1998) (discussing the stance taken by the Clinton Administration towards the treaty).

217 World Trade Organization, *TRIPS: Frequently Asked Questions*, http://www.wto.org/english/tratop_e/trips_e/tripfq_e.htm#who'ssigned (last visited Jan. 27, 2008) (TRIPS applies to all WTO members); World Trade Organization, *Understanding the WTO: Members and Observers*, http://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm (last visited Jan. 27, 2008) (the United States is a WTO member).

218 *See Annex 1C: Agreement on Trade-Related Aspects of Intellectual Property Rights*, 33 I.L.M. 1197 (1994) (hereinafter TRIPS).

219 SCHECHTER & THOMAS, *supra* note 4, at 396–97.

220 Aoki, *supra* note 63, at 20.

221 Agreement on Trade-Related Aspects of Intellectual Property Rights, April 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, art. 27, ¶1, Legal Instruments—Results of the Uruguay Round, 33 I.L.M. 1125 (1994).

TRIPS also contains provisions intended to promote the development of technological infrastructure in developing countries, but these have had mixed success. Under Article 66, developed countries are obliged to create incentives for their own companies to transfer technologies to developing nations. Under Article 67, developed countries must also provide financial and technical help to developing nations. In theory these provisions should help developing nations leapfrog into modern technological competency, but, in reality, developed nations have not always acted in support of this goal.[222] As one commentator put it, "these efforts have largely amounted to nil."[223]

CBD and TRIPS both purport to benefit all sides through an exchange of value. However, their differing approaches vividly illustrate the mismatch in world views between the developed and developing countries in both cultural values and economic goals. Most striking is the differential treatment of traditional knowledge and culture under the two schemes. While traditional knowledge is protected as a central feature of the CBD, it is explicitly not protected under a scheme that protects only what is newly invented. On the other hand, a culture that celebrates and rewards individual authorship and biotechnology research will inevitably clash with one that considers it immoral to privatize living things and commonly useful human knowledge.

This brings us back to the question of a common ground. On one hand, no one disputes that social justice for indigenous people and preservation of biodiversity are important and necessary aims. On the other hand, no one opposes medical progress. That is, there is striking agreement as to the desirable ends; it is the means to those ends that are in dispute, especially the role of IP laws in fostering them. The next section will consider objections that have been raised to the rhetoric of biopiracy as well as some alternatives to the outrage-based approach.

V. RECONSIDERING IP LAW & INDIGENOUS RIGHTS

Throughout much of recorded history, an assertion that adult human beings are entitled to be treated as political equals would have been widely viewed by many as self-evident nonsense . . . .
– Robert Dahl[224]

The "other side" of this argument is not biotechnology companies or wealthy nations. Rather, it is the view that the "piracy" rhetoric is unhelpful at best and is probably counter-productive. A direct confrontation between actors of disparate political power based only on a sense of grievance is unlikely to serve the interests of the underdog. What is needed, rather, is to seek natural alignment of interests, greater transparency, and a shift towards less patent protection rather than expansion by *sui generis* systems or by

222 Venbrux, *supra* note 207, at 7–8.
223 *Id.* at 7.
224 ROBERT DAHL, ON POLITICAL EQUALITY 1 (2006).

imposing uniform patent regimes globally. Such approaches will better serve all sides concerned, especially insofar as they are able to optimize patent rights to achieve measurable global "progress in the useful arts" rather than progressive concentrations of wealth and power.

A. The Rhetoric Problem

In the past several years, legal scholars have begun to point out an underlying problem with arguments that employ "a vocabulary grounded primarily in terms of moral obligation, unjust enrichment, and free-riding."[225] Heald argues that this rhetorical approach is ineffective, concluding that calling for broader *sui generis* IP rights for indigenous populations "is a poor rhetorical strategy for maintaining the world's biodiversity."[226] Heald points out various problems within proposals for expanding IP protection, such as the growing consensus across the political spectrum that "intellectual property rights are too broad,"[227] and the difficulty of justifying protection for existing knowledge under a system designed to spur new creations.[228]

Heald is not opposed to using justice-based or normative arguments. He simply thinks they are more effective to protect bio-prospectors' rights than indigenous rights. He offers two examples of such arguments. First, the interest of the world community is best served by maximizing access to potential life-saving plant resources, not limiting such access.[229] Second, bio-prospectors "are the natural enemies of those who would log the existing primeval forests to extinction."[230] That is, advocates for indigenous rights should be the natural allies of bio-prospecting companies, and should avoid alienating them by calling them "pirates." In addition, the rhetoric of justice does have potential uses for underdogs. For example, it has sometimes been effective to discourage strict enforcement of TRIPS, or to motivate corporations to alter their positions out of shame, such as when the Big Pharma industry altered its policies towards pricing of AIDS drugs in Africa.[231]

Finally, Heald concludes that "imagination is the most critical commodity needed" in the search for a rhetorical strategy that stands a chance of succeeding in protecting biodiversity.[232] He proposes harnessing market forces to bring together the natural allies of Big Pharma and indigenous groups. To this end, he identifies six sources of market failure that have kept them at loggerheads. These include such difficult topics as

225 Heald, *supra* note 2, at 520.

226 *Id.* at 542. As explained in *supra* note 2, Heald does not use "indigenous populations" but instead "long-term occupant communities" because of the difficulties of determining "what sort of group might qualify for protection," and because it "makes inhabitants of rain forests and other bio-rich areas of the world sound less like exotic 'others.'" *Id.* at 519 n.3.

227 *Id.* at 522.

228 *Id.* at 523–24.

229 *Id.* at 531–32.

230 *Id.* at 532.

231 *Id.* at 542.

232 *Id.* at 543.

government corruption and threats to cultural integrity. Heald does not purport to solve them, only to identify them as a first step towards reconciliation. His intent is to draw attention to the need for creative thinking by the two sides and the legal community on how best to overcome them.[233]

In a similar vein, Cynthia Ho argues for abandoning the rhetoric of biopiracy in her thorough exploration of the history and underlying causes of the dispute.[234] Ho believes that "[b]iopiracy is indeed a very real problem for developing countries," but also points out that these claims have had little real effect in protecting the rights of indigenous populations.[235] In examining why, Ho explores three suggestions. First, as a matter of issue framing, crying "piracy" worked well for large Western companies pushing for TRIPS, which created legal rights that did not exist under national IP laws.[236] That is, it just is not illegal for businesses in poor nations to copy what is protected in the United States or other developed nations unless their governments agree to enforce the right. Indeed, why should that be illegal, if the purpose of IP law is to spur innovation for the benefit of the technologically advanced nations, and the residents of poor nations can't afford the monopoly price? Further, "theft" of intangible, infinitely multipliable property does not deprive the original source—supplying affordable drugs to the poor is a far cry from plundering a sailing ship full of gold, or supertankers full of oil. Those same concerns, however, do not play well when made by the powerless in that same forum, consisting as it does of wealthy nations' governments, because "[n]o one is likely to embrace being portrayed as a predator."[237] Thus, Ho concludes that indigenous communities need a new way to frame their concerns.

Second, to this end, Ho suggests assertions of national sovereignty may get more traction with Western countries than accusations of piracy.[238] All nations recognize each others' rights to assert sovereignty. She points out that such an approach has been effective in the arena of national protections for widespread access to generic drugs.[239] In Brazil and South Africa, for example, the United States backed off of aggressive stances favoring enforcement of patents on AIDS drugs, influenced in part by negative public opinion.[240] Sovereignty-based defenses have the advantage of being readily understood by both governments and their populations.

Third, Ho notes that Western nations take the position that TRIPS is sufficiently flexible to accommodate sovereignty concerns.[241] Yet these nations aggressively pursue inflexible "TRIPS-plus" agreements with

233 *Id.* at 535–37.
234 Ho, *supra* note 62, at 433.
235 *Id.* at 438–39.
236 *Id.* at 505–06.
237 *Id.* at 506–07.
238 *Id.* at 507.
239 *Id.* at 508–09.
240 *Id.*
241 *Id.* at 509.

individual developing countries.[242] She suggests that such agreements "present an opportunity to highlight a serious incursion on the national sovereignty of developing countries."[243] While the agreements are technically voluntary, for economic reasons, "developing countries have enormous pressure and incentive to cooperate" in them.[244] TRIPS allowed developing nations to adopt rules tailored to their specific needs, yet powerful trading partners are exerting coercive pressure to wipe out those nations' sovereign rights to serve their own specific needs.

Ho acknowledges that a rhetorical switch from piracy to sovereignty is far from a complete solution to the problem. She thus proposes improving the communication between sides by aligning the objections of developing nations with those in the developed nations who argue that patent rights have gone too far. For example, the clash between access to affordable drugs and patent enforcement is a global one, involving disputes between developed nations as well as the less well-heeled.[245] Second, the runaway trend towards patenting everything that comes out of a research laboratory is in real danger of choking off such research, which used to go into the public domain without delay.[246] Ho points out that "the type of technology patented is increasingly more fundamental," and patenting basic research tools such as gene sequences has great stifling potential because it is so far upstream of useful end applications.[247] A third area of potential confluence is the debate on whether living things should be patentable, since there is so much variation among developed countries on this point.[248] Finally, global uniformity of patent law is not necessarily a good thing. Not only do poor countries get little benefit, but variation creates the potential to learn what works or does not.[249] After all, there is no good data available on exactly what type or level of protection is optimal in the trade-off between stimulating and stifling inventive activity.

Finally, Ho proposes to enhance international conversation and transparency by creating an internet-based commentary system hyperlinked to patents.[250] Such a system, she envisions, would benefit all concerned while leaving extant patent protections untouched. Investigative reporters and bloggers would have better access to accurate information and be less likely to promote baseless rumors and distortions. Patent holders could gauge public opinion before attempting commercialization, and policy makers would likewise benefit from easy access to global feedback on specific patents.[251] It is hard to fault this suggestion, but whether it would benefit indigenous populations is unclear.

242 *Id.* at 510.
243 *Id.* at 511.
244 *Id.*
245 *Id.* at 515–17.
246 *Id.* at 517.
247 *Id.* at 517–18.
248 *Id.* at 519–20.
249 *Id.* at 520–22.
250 *Id.* at 532–33.
251 *Id.* at 534–37.

B. IP Law: Too Hot, Too Cold, or Just Right?

Another scholar who has written prolifically in this area is Jim Chen,[252] who flatly proclaims "[t]here's no such thing as biopiracy."[253] His arguments sometimes tend to the strident, as when he claims that "both sides in this debate fetishize property,"[254] or that "fear that the Grace patent and TRIPS would . . . deprive Indian villagers of the right to continue traditional uses of neem . . . is purely scurrilous"[255] (How, one wonders, can "fear" be abusive and offensive?).[256] Chen is an enthusiastic proponent of treating all ethnobiological knowledge as a global commons,[257] reasoning that collective access to information usually outweighs proprietary incentives as a spur to innovation.[258] Further, Chen concludes "[t]he harsh reality is that there is no economically justifiable reason for protecting ethnobiological knowledge."[259] He concedes that the debate will not go away unless developing countries find a way to be compensated for the contributions of their biodiversity to global technological progress,[260] but he does not believe indigenous communities enjoy any special moral high ground when it comes to ecological preservation and management.[261] It is true that any population (human or other) is capable of wreaking ecological havoc whenever it exceeds the carrying capacity of its environment. However, this is not a reason to dismiss the accumulated knowledge of all indigenous populations as undeserving of respect.

While Chen is not especially sympathetic to "biopiracy" arguments, he does believe biodiversity is both endangered and worth preserving, and, more to the point, that "[t]he contemporary law of intellectual property routinely falls short of its stated ideal of advancing the progress of science and the useful arts."[262] A major reason for this failure, in his view, is courts' excessively broad interpretation of the statutory grant, at the expense of the constitutional limitation of that grant. He agrees with Jessica Litman that "the political economy of innovation policy exerts 'inexorable pressure to recognize as an axiom the principle that if something appears to have substantial value to someone, the law must and should protect it as property.'"[263] Think of it this way, politicians like to reward constituents, and

---

[252] *See, e.g.*, Jim Chen, *Biodiversity and Biotechnology: A Misunderstood Relation*, 2005 MICH. ST. L. REV. 51 (2005) [hereinafter Chen, *A Misunderstood Relation*]; Jim Chen, *The Parable of the Seeds: Interpreting the Plant Variety Protection Act in Furtherance of Innovation Policy*, 81 NOTRE DAME L. REV. 105 (2005) [hereinafter Chen, *Parable of the Seeds*]; Chen, *supra* note 75.

[253] Chen, *supra* note 76, at 26.

[254] Chen, *A Misunderstood Relation*, *supra* note 252, at 102.

[255] *Id.* at 88.

[256] WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 831 (Phillip B. Gove ed., 1986).

[257] Chen, *A Misunderstood Relation*, *supra* note 252, at 83.

[258] *Id.* at 66.

[259] Chen, *supra* note 76, at 22.

[260] *Id.* at 26.

[261] *See* Chen, *A Misunderstood Relation*, *supra* note 252, at 58–60 (describing the destruction of native species in Hawaii).

[262] Chen, *Parable of the Seeds*, *supra* note 252, at 115.

[263] *Id.* (quoting Jessica Litman, *Breakfast with Batman: The Public Interest in the Advertising*

recognizing the economic interest of those who hold copyrights to "Happy Birthday" is more politically beneficial than standing up for the diffuse interest of the rest of us in being entitled to have waiters sing it in a restaurant.

Using the PVPA as an illustration, Chen argues for a constitutional canon of interpretation that would read the grant of monopoly power narrowly, thereby favoring the encouragement of innovation by curbing over-protection.[264] In his view, "a court should be prepared to explain how its preferred construction advances the progress of science and the useful arts."[265] Such an approach "would add another substantive canon to the federal courts' already extensive list of heuristic rules that unapologetically favor some policy-oriented way of reading certain statutes."[266] It seems like a good idea on its face, yet it is unclear to this author how such a case would be made for most individual inventions. The system as it stands is rather a blunt instrument, and a reliable feature of new inventions is how hard it is to predict their eventual success or failure, either in the market place or as a platform for new discoveries.

Chen uses the PVPA because, by contrast with patent and copyright protections, it has produced little innovation. Chen proposes two reasons for this. First, its crop exemptions were, for a time, interpreted so broadly as to render its protections much weaker than they were intended to be, and, thus, less attractive than patent and trade secret laws.[267] Specifically, an exemption intended to permit farmers to replant, for their own use, seeds produced from their personal harvest was read as allowing a farmer to sell up to half his crop to others.[268] Had courts been willing to interpret the law through a filter of its ability to stimulate plant variety innovation, perhaps this would not have been the case. Second, Congress included a research exemption based on the "excessively romantic" premise that breeders would use each other's varieties as raw material for genuine innovation, when in fact they have often employed reverse-engineering techniques to produce "knock-offs of proprietary varieties."[269] Thus, the two exemptions swallowed the protection.

Chen stresses that his proposed interpretive canon would have a corrective effect on both the over-protection of patent law and the under-protection of the PVPA.[270] Yet he also recognizes that "the inventive process is in many respects a random walk."[271] Creativity is impossible to quantify, or to predict, unlike continued royalties on "Happy Birthday." How then shall courts or Congress or anyone ensure that the constitutional purpose is served?

Age, 108 YALE L.J. 1717, 1725 (1999)).

264 Chen, *Parable of the Seeds*, *supra* note 252, at 112.

265 *Id.* at 116.

266 *Id.* at 117. Chen cites the rule of lenity as an example of a currently used heuristic rule. *Id.*

267 *Id.* at 157.

268 *Id.* at 127–28.

269 *Id.* at 139.

270 *Id.* at 157.

271 *Id.*

C. Creativity and Progress in the Useful Arts

The Constitution explicitly requires that patents are granted for the *purpose* of promoting the Useful Arts, and no one disputes this means to promote robust growth of the intellectual commons. Certainly, the *quid pro quo* of disclosure built into the Patent Act has that growth as its policy goal. Unless genuine balance is maintained between private economic gains and diffuse public externalities, the patent system poses a real threat to the very thing it seeks to nurture: the human creativity which is the source of human cultural expansion in science and technology. Where, then, shall we turn to determine whether our laws are accomplishing their avowed purpose or defeating it? There is, as it happens, a scientific discipline of creativity, which Bradford Simon recently applied inventively to the operations of IP law.[272]

Simon contrasts the underlying assumptions about the nature of creativity embodied within the two paradigms of human knowledge of IP law and traditional knowledge. He argues convincingly that IP's underlying model of the solo creative genius "expresses, at best, an impoverished conception of creativity,"[273] whereas the collective model represented by traditional knowledge more accurately captures the interactive, group nature of the creative process. A major source of mischief is "the fundamental attribution error," which refers to an inborn bias to which our minds are prone when we are attributing causality to individual behavior.[274] That is, in deciding why a person acts in a certain way, we are biased towards overestimating individual dispositions or personality traits, and therefore to underestimating context, or situational factors.[275] This happens, in theory, because we are programmed to pay attention to actions, not backgrounds, which is perfectly logical.

Of course, why it happens is not the point—that it does happen is well-demonstrated, and explains a lot. IP law is focused exclusively on individual actors in the system. Perhaps what is needed is an inverse of the current approach, one focused instead on the system which produces the individual acts. Such a system would be designed to minimize the cost of idea-sharing in order to maximize the velocity of intellectual growth.

Interestingly, while large corporations argue for more and more IP protection on the strength of the "individual inventor/author" concept, they have largely embraced the findings of creativity science when it comes to inspiring actual inventiveness among employees.[276] This shows that corporations are realists, and opportunists. That is, unlike patents, they do not exist to benefit the public at large. Indeed, if they are publicly traded, they are required by law to serve the interests of shareholders first.[277]

---

272 *See* Simon, *supra* note 9.

273 *Id.* at 1666.

274 *Id.* at 1667.

275 *Id.*

276 *Id.* at 1660–65.

277 Dodge v. Ford Motor Co., 170 N.W. 668 (Mich. 1919). In this classic case, Henry Ford lost

Arguing for strong patent protection is good business for those already on top.[278] Internally though, leaders of the same corporations recognize the value of cooperation, synthesis, expertise, and "inner passion to solve the problem at hand."[279] They also recognize the limited value of the very things which are assumed by the patent system to be important, including external rewards such as money, or individual flashes of genius to produce something altogether new.[280] This raises the prospect of whether such corporations might be willing to risk putting what they know about the creative process to work in reforming or supplementing the patent system, not for the benefit of the developing world, or even as responsible global citizens, but for their own collective self-interest.

VI. CONCLUSION

If we accept that we cannot stop science and technology from changing our world, we can at least try to ensure that the changes they make are in the right directions.
– Stephen Hawking[281]

We have seen that critics of biopiracy favor conserving biodiversity, and Big Pharma gets no benefit from destroying rain forests. The disagreements arise over issues of how-to, how much, and in what directions the benefits should flow. The global events which gave birth to accusations of biopiracy have evoked echoes of colonialism, giving rise to deep suspicion and understandable outrage. To reiterate my earlier point though, outrage is not a legally cognizable injury. Scholars who object to "biopiracy" as a rhetorical device do not disagree with the substance of the arguments. Arguably, biotech companies would benefit themselves in the long run by loosening their stranglehold on biological research and resources so that future golden eggs may be laid. At the same time, those who would protect indigenous people and biological resources should get past their hostility to science and new technologies, and embrace the idea that science and innovation can and will help them achieve their goals. All of which is easy to say, but, realistically, can it be achieved?

A. A Teachable Moment?

The drug giant, Pfizer, recently announced it will lay off ten percent of its global workforce, evidently because its business model of an endless

to his minority shareholders because he admitted that his purpose in reducing the price of cars was "to employ still more men; to spread the benefits of this industrial system to the greatest possible number, to help them build up their lives and their homes." *Id.* at 671.

278 *See* Simon, *supra* note 9, at 1661 (citing statistics on the concentration of patents both in the hands of developing countries and large biotechnology companies).

279 *Id.* at 1664.

280 *See id.* at 1663 (quoting several prominent authors in the business field, recognizing that creativity is the product of cross-fertilization among many people).

281 *See* HAWKING, *supra* note 150, at 28.

stream of "blockbuster" drugs has not panned out.[282] Scientific jackpots are rare and not readily obtained using a business model that emphasizes profits above all other considerations. One observer concluded that Big Pharma is so reliant on "blockbuster" patented drugs that it simply ignores any opportunity deemed worth less than one billion dollars.[283] Basic science typically progresses by making a large number of small advances, like most creative endeavors. Perhaps all the "big" drugs have been found,[284] but I think it more likely the low-hanging fruit has been picked by drug companies, cashing in on many decades of research carried out in non-profit institutions. I fear that they care nothing for the "public domain tree." They have no stake in tending innovation in the long term.[285] But perhaps the current crisis in drug companies has produced a "teachable moment."

Within the IP law community there is also a growing consensus that rights are getting out of hand, like Mickey Mouse's enchanted broom in "The Sorcerer's Apprentice."[286] There is a conceptual problem that tends to generate ever-increasing IP rights. While consumable property rights cover a finite, definable thing, IP intangibles are not consumable, and are therefore in a sense semi-infinite; they defy any common sense, concrete way of placing a non-arbitrary limit on the grant of a monopoly. Logically, if you have the legal right to exclude 300 million people from using your idea without your permission, why should over six billion other people get it for free?[287] But on the other hand, does the rationale that you want inventors to be able to make a living from their inventions really require them to prevent *all six and a half billion* inhabitants of earth from using them? U.S. copyrights have been expanding at an alarming rate in the "time" dimension, and patent rights have been expanding in space to cover more and more people.[288] This reflects the psychological fact that, conceptually, we want to give away more and more because the dividing line is necessarily arbitrary.

---

282 *Billion Dollar Pills*, THE ECONOMIST, Jan. 27, 2007, at 69. *See also* MARCIA ANGELL, THE TRUTH ABOUT THE DRUG COMPANIES: HOW THEY DECEIVE US AND WHAT TO DO ABOUT IT, at xv–xix (2004) (describing the lack of real innovation by drug companies and the economic forces behind their practices).

283 THE ECONOMIST, *supra* note 282, at 71.

284 *Id.*

285 *See id.* at 70 (stating that "[t]he tables are turning, but Big Pharma has not given up the fight. Its armies of lawyers aggressively defend patents, even flimsy ones taken out on minor tweaks to existing treatments . . . .But the effort is largely in vain.").

286 Congress's latest extension of copyright duration was dubbed "The Mickey Mouse Protection Act" because Disney, a major proponent, was facing expiration of Mickey's copyright. *See, e.g.*, Peter K. Yu, *Mickey Mouse, Peter Pan, and the Tall Tale of Copyright Harmonization*, IP LAW & BUS., Apr. 2003, at 24, *available at* http://www.peteryu.com/IPLB0403.pdf. *See generally* Keith Aoki et al., Duke Center for the Study of the Public Domain, *Tales from the Public Domain: Bound by Law?*, http://www.law.duke.edu/cspd/comics (last visited Jan. 27, 2008) (describing the clash between documentary filmmaking and copyright law).

287 *See, e.g.*, U.S. Census Bureau, *U.S. and World Population Clocks–POPClocks*, http://www.census.gov/main/www/popclock.html (last visited Jan. 27, 2008) (showing a current U.S. population of more than 303 million people and a world population of more than 6.646 billion people).

288 Yu, *supra* note 286, at 24; *see supra* Part IV.A.2.

If some is good, more must be better. Arguably, patent law in general is headed for its own "teachable moment."[289]

B. Embracing a Reality-Based View of the Universe

Recently, political debates involving science have been characterized by a kind of willful dementia about scientific realities on subjects ranging from AIDS to global warming. This tendency was most starkly embodied in comments reportedly made by a Bush advisor, who airily dismissed as irrelevant those of us who inhabit "the reality-based community."[290] The underlying belief seems to be that there is no such thing as objectively real consequences to political actions. Those in power can simply stride across the landscape, rearrange reality as they please, and never look back. This perfectly embodies the worldview behind Scott's "thin simplifications."[291] On the other hand, five Western states recently agreed to limit their greenhouse gas emissions, in a deliberate bid to force the federal government to adopt similar measures nationally.[292] Nine Eastern states have a similar agreement.[293] So perhaps the political class, too, is on the brink of embracing scientific reality, at least where global warming is concerned. And if Lee Iacocca and the United States Defense Department can embrace global warming as a serious threat to our future security, there is reason for hope.[294]

Of course, humans have been transforming our physical landscapes for the worse for millennia. Easter Island is the global poster child for how badly humans can serve their own interests in neglecting to act as stewards of the natural system of which we are a part. While there is controversy as to the exact timing and reasons for the collapse of Easter Island's rich biodiversity in its forests, the island is undeniably an impoverished shadow

289 *See, e.g.*, ADAM B. JAFFE & JOSH LERNER, *Preface* to INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT (2004) (making the case that changes to patent law made in the 1980s have so hindered scientific and economic advancement that it may lead to increasing support for positive reform).

290 Ron Suskind, *Faith, Certainty and the Presidency of George W. Bush*, N.Y. TIMES MAGAZINE, Oct. 17, 2004, *available at* http://www.nytimes.com/2004/10/17/magazine/17BUSH.html?_r=1&oref=slogin.

291 *See supra* Part II.C.

292 Michael Milstein, *Oregon Joins 4 States in Greenhouse Battle*, THE OREGONIAN, Feb. 27, 2007, at A1.

293 *Id.*

294 The former head of Ford and Chrysler recognizes the threat of global warming in his new book, *Where Have All the Leaders Gone?*, although he used to think Al Gore was "a little nutty" on the subject. Alex Taylor III, *'They're Throwing Us to the Curb,'* FORTUNE MAG., Apr. 30, 2007, at 132, *available at* http://money.cnn.com/magazines/fortune/fortune_archive/2007/04/30/8405437/index.htm. The U.S. Defense Department has just released a report on the defense threat posed by global warming. Andrew C. Revkin & Timothy Williams, *Global Warming Called Security Threat*, N.Y. TIMES, Apr. 15, 2007, at A25, *available at* http://www.nytimes.com/2007/04/15/us/15warm.html.

of what it was when humans first found it.[295] We have a similar ability to impoverish ourselves on a global scale, through simple unwillingness to cooperate, and to acknowledge reality.

Conversely, where people with power are willing to act, science and technological innovation can be harnessed to reverse and repair some harms. Depletion of the ozone layer is one example. The ozone layer of the atmosphere protects us from ultraviolet radiation, which damages DNA and has the potential to end life as we know it if the ozone layer is destroyed.[296] In the 1970's scientists found that chlorofluorocarbons (CFC's), widely used as aerosols, refrigerants, and industrial solvents, were in fact rising into the atmosphere and destroying about four percent of the ozone per decade.[297] The economic disruption that would be caused by phasing out these uses led to political resistance toward the ban on CFCs, but when an actual hole appeared in the layer in 1985, the political will was summoned to stave off disaster.[298] Replacement products have been developed, and we still have refrigerators, air conditioning, and spray deodorant. CFCs were slated to be phased out in the developed world in 1996, and scientific data shows that the rate of deterioration of the ozone layer is slowing. Thus, it may recover to pre-1980 levels within this century rather than suffer catastrophic destruction within a few decades.[299]

---

[295] *See e.g.*, Bob Holmes, *Did Humans Devastate Easter Island on Arrival?*, NEWSCIENTIST, Mar. 9, 2006, http://www.newscientist.com/channel/being-human/dn8825-did-humans-devastate-easter-island-on-arrival.html (last visited Jan. 27, 2008) (discussing the ongoing controversy among scientists over the causes and timing of environmental degradation of the island). For an even more extreme modern day example, consider the tragedy of the Island of Nauru, which has been entirely gutted by guano mining. *E.g.*, Michael E. Pukrop, TED Case Studies, Phosphate Mining in Nauru (1997), http://www.american.edu/TED/NAURU.htm (last visited Jan. 27, 2008); *Chicago Public Radio, This American Life*, *253: The Middle of Nowhere. Act One, No Island is an Island* (radio broadcast Dec. 5, 2003), *available at* http://www.thislife.org/Radio_Episode.aspx?episode=253.

[296] *See, e.g.*, NOAA, *Science: Ozone Basics*, *available at* http://www.ozonelayer.noaa.gov/science/basics.htm (explaining ozone depletion and describing the history of bans on man-made pollutants that destroy atmospheric ozone). Do not confuse ozone and global warming. Ozone is a harmful pollutant at ground level, when you breathe it, but it is a natural component of the upper atmosphere, not a greenhouse gas.

[297] Edward S. Atkinson Jr., *Chlorofluorocarbons and Stratospheric Ozone: Regulatory Background*, 36 AM. STATISTICIAN 301, 301–02 (1982) (overview of scientific studies of CFCs and ozone in the 1970s).

[298] *See* INST. OF PHYSICS, THE RISE OF OZONE RESEARCH 4 (2005) (noting the 1985 paper that alerted the world to the existence of a "hole" in the ozone over Antarctica and its influence on the signing of the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987); *see also* Philip Shabecoff, *U.S. to Take Steps to Protect Ozone*, N.Y. TIMES, Dec. 1, 1987, at C4 (describing proposed restrictions and rollbacks on CFCs and halons in response to the Montreal Protocol).

[299] *See* SCIENTIFIC ASSESSMENT PANEL OF THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER, EXECUTIVE SUMMARY OF WMO/UNEP SCIENTIFIC ASSESSMENT OF OZONE DEPLETION: 2006, at 21–23 (2006) (estimating dates for the return to pre-1980 levels of ozone in varying scenarios and noting that "[f]ailure to comply with the Montreal Protocol would delay, or even prevent, recovery of the ozone layer"). Of course, the refrigeration and aerosol spray industries did not possess a drop in the bucket of clout which the energy companies of today wield. If they had, would we already be living on a global version of Easter Island?

C. The Creative Animal, IP Incentives, and the Fate of the Planet

Back in the 1780s, the founding fathers could hardly have conceived that a modest clause of "little moment" would one day give rise to a system which funnels enormous wealth into the hands of large corporations. Perhaps because of this history, and in spite of the massive amounts of wealth and power involved, there has been little if any scientific study of how patent systems actually perform. I believe we need a rigorous, science-based study of patent law incentives, creativity, innovation, and economic growth. Scientists should take the lead in this debate for their own self-interest as well as for the common good. Everyone is in favor of the growth of knowledge. However, there is a vast ocean of knowledge to be had; what we currently know is a drop in the ocean of what we might one day know. Policies which distort the direction of research into a corner bring the highest short-term profits for a few corporations but ultimately serve no one in the long run. As the current problems of Big Pharma demonstrate, even shareholders cannot count on an indefinite free ride. Corporations are fairly adept at embracing reality though, so if a scientific rationale for a more nuanced approach to patent law and innovation existed, they would likely give it a hearing.

On the other hand, those who cry biopiracy will not readily accept my premise, given their deep suspicion of Western science and its perceived consequences. It is undeniable that scientists can develop tunnel vision about the superiority of their own methods, thereby losing touch with common sense and observation-based expertise. Thin simplifications of reality can be, and have been, catastrophic. We are still seeing the damaging effects of DDT and a host of other mistakes. But, on the other hand, we have replaced CFCs. Nevertheless, demonizing science will get developing nations nowhere. Science is indeed a value-neutral tool which anyone can employ. Those who would defend indigenous people and biological resources should make it their own; science is about creativity, transformation, and the promise of a better human future, and bioscience (including environmental science) is still in its infancy. Profit-based models for its exploitation are not the only ones possible.

D. Asking the Right Questions

If the right questions have not yet been asked by either side of this debate, it remains to explore what approach would serve us all better. This will not be an easy task. Biological sciences are still in their infancy, and we can hardly imagine where they will ultimately take us. We can predict, however, that human creativity will continue to fuel an expanding knowledge of our world and our current direction will have enormous consequences in the long term. We should begin by asking, "where do we want to go? What types of growth and change will get us there?" And finally, "what policies will encourage those changes?"

At the beginning of this Comment, I suggested triangulation to address the disconnect between patent law and indigenous resource protection. I proposed that a useful framework is the division of human knowledge into

the categories of science, technology, and expertise. Technology is the domain of IP law and expertise is the domain of traditional knowledge. The point of treating intangible intellectual creations as property is to encourage innovation and disclosure, so its very foundation makes IP law ill-suited to protect accumulated expertise or to compensate its custodians. Science, at its heart, is a means to discover objective reality and to liberate ourselves from subjective erroneous belief, thereby allowing us to gain control over our collective destiny. As such, it is equally useful to serve the interests of Big Pharma and defenders of indigenous rights but by taking different directions. After all, basic science in climatology is the basis of our knowledge that we are causing global warming by generating greenhouse gases, just as it was the basis for identifying depletion of the ozone layer.

As Jim Chen has pointed out, a few simple changes to patent law will suffice to take it out of the business of supporting the objectionable exploitation of indigenous knowledge and resources.[300] But even effecting a complete disconnect does not address the concerns of those objecting to biopiracy practices. On the other hand, asserting sovereignty, as incorporated in the Convention on Biological Diversity, is a promising approach for protecting the rights, of indigenous people to preserve their environments and lifestyles.[301] But this, too, is only a fragment of a solution to the bigger problem of how we go forward as a species.

One possibility is the scientific study of innovation as distinct from creativity. Creativity is one way to innovate, but there are many paths to innovation. As Justice Kennedy wrote recently, patentable inventions may be produced by "instinct, simple logic, ordinary inferences, extraordinary ideas, and sometimes even genius."[302] Two very recent tools are radically transforming the way people interact and transforming biological science, and they point to a new synergy. First, the Internet allows people to network in ways that were never possible before. Information technology in general also makes the collection, storage, and selective retrieval of vast amounts of data possible in ways that were previously inconceivable. These capabilities are novel in human experience; we have little conception of where they can ultimately take us. Second, genetic sequencing is similarly mind-bending in its implications for bioscience.

The confluence of these tools presents a unique opportunity to both stimulate innovation and study it. Scientists could be invited to cooperate globally in designing a system for information sharing based on placing a direct value on the sharing itself, rather than basing incentives to share on the right to prevent others from using your contributions. At the same time, information technology could be employed to collect data on the process of innovation, with ongoing feedback, in order to "grow" a system that favors

300 Chen, *supra* note 76, at 28.

301 *See* Convention on Biological Diversity, *supra* note 206, at 146 (stating one of the Convention's objectives is the equitable sharing of benefits arising from genetic resources while respecting the rights associated with these benefits); *see also* Ho, *supra* note 62, at 507–11 (advocating sovereignty-based arguments for protection of indigenous rights).

302 KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1728, 1746 (2007).

intellectual growth. Indeed, the scope of the field of genetics virtually necessitates global cooperation to avoid massive duplication of effort. In a similar vein, those who study the biosphere have an opportunity to share their data internationally and create a metascience of living systems. This author has no expertise in the design of such systems, but I believe there are plenty of people who do.

Finally, we should study the ways in which "small is the new big." Ideas such as appropriate technology[303] have been around for decades, but we seem to be entering an age where diffusion of power and knowledge have the potential to displace the ability of big businesses to overshadow the commonsense development of the small. This, too, seems largely a result of the Internet's networking power combined with a generational shift in worldview; ideology-driven divisiveness is being abandoned in favor of pragmatism and cooperation consistent with the "generations" theory of Strauss and Howe.[304] To further this trend, we should focus on the economics of efficiency and individual actions rather than on alternative sources of consumables.

Examples of such technologies are plentiful from light bulbs to cars, and my hometown of Portland, Oregon provides a recent illustration. Portland State University (PSU) just installed a set of small, quiet wind turbines on top of some of its buildings.[305] The turbines are an experimental breed of "urban turbines" mounted on a vertical axis which are better than the traditional propeller-type turbines at capturing variable-direction, low-speed city winds.[306] That is, they do not depend on a vast, vacant, wind-swept landscape to work. PSU staff and students will help the inventor of the forty-inch-high devices test them in the coming months.[307] I offer this example for two reasons. First, it is small, and therefore just a fragment of a complete solution to our energy woes. The point is, though, that a complete solution could be created from thousands of small steps such as this. As Scott describes, governments like big, simple approaches they can understand and control. But complex, organic solutions are more likely to take us into a livable future world. Second, this is the sort of technology that can liberate developing countries from the oppression of adopting the current Western consumptive model and instead allow them to leapfrog into the 21st century with their ecosystems relatively intact.[308] Many small

303 *See, e.g.*, ERNST FRIEDRICH SCHUMACHER, SMALL IS BEAUTIFUL: ECONOMICS AS IF PEOPLE MATTERED 169 (Perennial Library 1989) (1973) (arguing for a new direction in technology that "lead[s] back to the real needs of man, and that also means; *to the actual size of man*. Man is small, and, therefore, small is beautiful. To go for gigantism is to go for self-destruction").

304 *See* WILLIAM STRAUSS & NEIL HOWE, THE FOURTH TURNING 15–20 (1997) (providing a capsule summary of their generational theory); *see also id.* at 265–67 (explaining the current generational constellation). According to these authors, we should be at the cusp of a generational shift away from the divisive "culture wars" toward an era of major crisis met with society-wide cooperation just about now.

305 Patrick O'Neill, *PSU Taking Wind Power for a Whirl*, THE OREGONIAN, Apr. 26, 2007, at A1.

306 *Id.* at A9.

307 *Id.* at A1, A9.

308 I should disclose here that I am no neutral observer of energy technology, either. In 1980,

efficiencies are inefficient for a central government to administer, but they are far more efficient for a coordinated population to employ than reliance on government-provided "big" solutions.

In the first section of this Comment, I quoted a technical definition of science to set the stage for discussion. Let me now offer a more personal, subjective definition. Science is not the only human tool for progress. Science is not the only important or powerful tool possessed by humans. But science is a tool with unique potential to liberate humans from our worst failings of self-serving beliefs. The fruits of science enrich us spiritually and intellectually. Technology enriches us materially. Expertise and cultural traditions enrich us as social animals. The three things are not separable from each other but work best together. A new science of how best to stimulate technological innovation through instruments less blunt than current IP law should be flexible enough to incorporate all three, because all three proceed through collective human creativity.

I was in my senior year of a Bachelor's degree in Energy Systems Engineering when Ronald Reagan was elected. My intention was to go into the then-budding field of energy conservation technology, a field Reagan promptly dismantled. Instead, I entered the fast-growing defense contracting field.