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From market to market: Bioprospecting's idioms of inclusion

ABSTRACT
In this article I explore how "community" and its foil, the (urban) market, provide competing models for the market-mediated modes of inclusion and exclusion on offer through bioprospecting agreements. Focusing on the collecting strategies of Mexican scientists implementing one such agreement, I show how community and market inform prospecting participants' ideas not just about (re)distributing benefits but also about managing the political liabilities now haunting corporate resource extraction in the South *[bioprospecting, anthropology of science, Mexico, Latin America, globalization, intellectual property, indigenous rights]*

Bioprospecting is the new name for an old, though arguably ambivalent, legacy: pharmaceutical companies' use of plants and "traditional knowledge" as leads for developing new drugs. Following roughly fifty years of qualified reticence on this front (despite a few high-profile successes based on such leads, industry priorities largely rested in synthetic chemistry), the late 1980s saw many life sciences firms in the United States and Europe renew an interest in nature—and, in some cases, traditional knowledge—as a valuable shortcut for finding new leads. The drug industry's much-hyped "return to nature" took visible form in a number of high-profile prospecting arrangements, in which multinational companies joined partnerships with indigenous organizations and newly formed research institutes in biodiversity-rich climes.[1]

The novelty of these partnerships did not lie only in corporations' (renewed) interest in nature. In line with the 1992 UN Convention on Biological Diversity (CBD)—and a growing body of supporting legislation in signatory nations—these Northern "takings" now come with some form of "giving" built in.[2] In the name of sustainable development as well as redistributive justice, the CBD mandated that drug and biotechnology companies share economic benefits with source nations and communities if they desire continued access to Southern resources. It is in many ways a fragile mandate, running up against, for example, contravening WTO and other trade accords and concerted opposition from the U.S. biotechnology and pharmaceutical lobbies. Nonetheless, the CBD has produced both an idiom and an institutional framework that together have had noteworthy effects on the collection of and traffic in biological resources. Chief among these are the benefit-sharing arrangements that have proliferated across the world, in which resource collection—whether undertaken by corporate entities or academic scientists—is paired up with measures to return benefits to indigenous peoples, rural communities, or national institutes in exchange for their stewardship and provision of potentially valuable raw material.

The generativity of these agreements does not, I argue, lie in their ability to deliver on their promises: To date, no major prospecting initiative has produced any patented products.[3] Yet these promises have indeed set new relationships in motion. In this article, I draw on ethnographic research in Mexico to explore some of the paradoxical effects of bioprospecting's fragile incitement to share.

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I depart from a particular ethnographic problem and the questions it points up both for prospecting politics and for anthropological engagements with globalization, science, indigenous rights, and intellectual property more broadly. The "problem" comes to me, and to the Mexican scientists with whom I work, in the form of the foundational question that defines and haunts most contemporary bioprospecting endeavors: not just *how much* should corporations pay, but also *who* shall "come with" collected plants these days? In other words, who will be included as benefit-recipients, and on what grounds? In the U.S.–Mexican prospecting collaboration in which my colleagues at Mexico's National Autonomous University (UNAM) are participating, the sponsoring agency, the U.S. National Institutes of Health (NIH), has a fairly specific idea of how to answer this question. Simply stated, participating developing country researchers are supposed to sign contracts with each individual who provides them with plants and information. As the presumptive authors and stewards of resources, these providers—and, by implication, the communities of which they are a part—are the people who are supposed to be future benefit-recipients. As with many 1990s ventures in participatory development, the crucial lubricant here is an appeal to the idea of local or community knowledge, resources, and people—all of which, it is assumed, are to be found together in discrete, identifiable, and thus rewardable packages (see Cooke and Kothari 2001; Zerner 2000).

The Mexican ethnobotanists, for their part, offer an alternative strategy to this view of seamless transactions and neatly bundled community resources. In the first two years of the implementation of this contract, the lead UNAM ethnobotanist, Harvard-trained Robert Bye, chose some different starting points altogether for identifying his plants, his "local participants," and the relations between them. Rather than starting in places marked as "communities," Bye, drawing on a long-standing and well-established research method, culled most of his initial plant samples from urban marketplaces. The UNAM researchers' strategy of prospecting in markets has created a vivid breach in the bioprospecting imaginary, both disrupting and reinscribing some of the fundamental assumptions shaping this kind of enterprise—most notably, the idea that plants and knowledge "come with" identifiable local authors, claimants, or stewards attached.

This conversation between prospecting strategies invokes and provokes some big questions about the idioms of inclusion and exclusion on offer in a new era of biodiversity entrepreneurialism. "Market" and "community," as Stephen Gudeman (2001) has written recently, are indeed worth thinking about as competing idioms for the redistribution of corporate returns.[4] In fact, the relationship between market and community is, on a grand scale, one of *the* defining questions for many anthropologists writing about globalization, economy, and identity (not to mention for Aristotle and Marx). In these discussions, market often stands for capitalism itself, and community has been its endangered or, alternately, intimate other (see Joseph 2002). Thus, many anthropologists have argued that global capitalism is running roughshod over indigenous communities, thereby endangering ways of life that exist outside of capitalist logics (see Nash 2001); others have argued that the very intensity of contemporary invocations of community or indigeneity as a site of resistance suggests that these concepts actually come built into "capitalist modernity" in the first place (Joseph 2002; Lowe and Lloyd 1997).

Inevitably running through these discussions and their many permutations are the lines that (readings of) Marx and Mauss have so enduringly carved into the world: market as the site of abstraction, commodity transactions, rational actors, and disembedded and disentangled relations; community as bearer of the gift, home to barter, shared values, and embedded relations. A great deal of worthy anthropological work has, to be sure, gone into unraveling these stark binaries and the assumptions that underpin them (see Carrier 1997; Gregory 1982; Gudeman 2001; Strathern 1988; Thomas 1991). At the same time, it must be said that some of this work has arguably resedimented those categories precisely in the attempt to mix them up (I would place Gudeman's *The Anthropology of Economy* [2001] in this category) or fully naturalized some of the fundamental characteristics of market-mediated man—most notably, the calculating, rational actor—even as they attempt to track, sociologically, how market and nonmarket entanglements get made (I think here especially of Michel Callon's *The Laws of the Markets* [1998]). In this article, I aim to embark on a different kind of project, an ethnographically grounded one in a particular sense. The schema of market and community will, in fact, permeate this account; but, I do not have any particular commitments to adhering to them myself, nor do I endeavor explicitly to debunk them. My analytical point of departure is slightly off to the side: I am interested precisely in how these well-rehearsed binaries, and, indeed, even the challenges that anthropologists and sociologists have leveled at them, permeate practices of bioprospecting and, in the process, lead us to different questions altogether.

With these issues in mind, I set out to do two things. First, I explore *how* the notion of community and its classic foil, the market, fare in some slightly unexpected ways as idioms for structuring bioprospecting's modes of taking as giving. What are the presumed efficacies, contents, and boundaries of these concrete "places" and abstract "forces?" What, in fact, *do* market and community stand for? This entails asking not just about the redistribution of corporate rewards but also, by implication, about idioms for "placing" traditional knowledge and medicinal plants in particular kinds of domains—compensable or not.

My second agenda, somewhat submerged, but crucially present in the framing of my analysis, is to think about these

highly charged articulations through the lens of the anthropology of science.[5] For the notions of market and community that I explore arise directly through the encounter between fascinating, long-standing scientific collecting methods and the new mandates and accountabilities that prospecting contracts bring to scientific research itself. Thus, my intention is not to deconstruct "the market" and its foils. Rather, I explore how these ideas are explicitly animated, short-circuited, and redeployed in the world of bioprospecting, particularly in the hands of one team of scientists who, through their collecting strategies, propose provocative models of their own about prospecting as a mode of inclusion and exclusion.

Market mediations and the contours of community

The prospecting initiative on which I focus in this essay is part of an international collaboration based at the University of Arizona and is funded by the U.S. government's International Cooperative Biodiversity Groups (ICBG) program. The Arizona-based "Latin America ICBG" involves researchers not just from Mexico but also from Chile and Argentina; it counts the U.S. conglomerate American Home Products (which owns the drug company Wyeth-Ayerst and, until recently, the agrochemical company American Cyanamid as well) as its "industrial outlet." In return for sending extracts of medicinal plants to the University of Arizona and American Home Products, the source country researchers receive minimal research funds each year, and promises of a percentage of royalties ten to 20 years in the future, should those companies develop a drug or pesticide based on these collections.[6] The project is also designed to collect "ethnobotanical knowledge" about plant uses and to direct royalties back to the people or communities from which these resources have been culled.

As this combination of agendas might suggest, the ICBG program is in many ways calibrated directly to the terms set by the UN Convention on Biological Diversity. (Notably, despite the fact that the U.S. Congress has not ratified the convention and trade representatives continue to militate strongly against it [because of industry objections to its benefit-sharing measures], this government initiative has been one of the world's primary engines of benefit-sharing contracts.) Funded by the National Institutes of Health, the National Science Foundation, and, initially, the U.S. Agency for International Development, the ICBG program took off in 1993 and has funded eight projects, all linking U.S. academic researchers to, on the one hand, developing country collaborators, primarily in Latin America and Africa, and on the other hand, drug or biotechnology companies.[7]

In many ways, this initiative is an amplified version of the NIH's long-standing support for plant and microbe screening carried out under the auspices of the National Cancer Institute (see Goodman and Walsh 2001; Laird et al. 2000). With this new program, the NIH infuses a long-standing tradition of plant-based drug discovery with the language and mechanisms of sustainable development, hoping to link profits from pharmaceutical development to conservation and rural economic development (Schweitzer et al. 1991). The ICBG, then, like the CBD itself, belongs to the well-populated annals of "market-mediated" conservation and development initiatives that took root in the late 1980s and early 1990s. Here, biodiversity-derived drugs promise not only corporate wealth, but, if harnessed and redirected through the proper redistribution mechanisms, they might well generate more biodiversity *and* economic prosperity in the South to boot (Eisner and Beiring 1994; World Resources Institute et al. 1993; World Resources Institute et al. 1992; see also Orlove and Brush 1996).[8]

Central to prospecting's ostensible transformation from simply a drug discovery initiative to a new form of market-mediated sustainable development is the redistribution of biodiversity-derived profits. I noted above that the ICBG's preferred destination for these benefits is something called "community." But how do they arrive at this vivid abstraction? In many prospecting initiatives forged in the early 1990s, including the ICBG, benefits are often described as both reward and incentive. The slippage, I would argue, matters a great deal. To invoke reward or even compensation is, in the context of the history of colonial resource extraction that so powerfully marks biodiversity politics, to invite the calibration of future exchanges to some egregious histories of violence and extraction. It is also, of course, to imply that indigenous peoples and other benefit-sharers have a legitimate property right in both knowledge and plants. This proposition is a highly contentious one in the world of prospecting.

Securing recognition of intellectual property rights (IPR) (or various proxies) for indigenous peoples is a battle that many engaged anthropologists, ethnobiologists, legal scholars, and indigenous activists have been fighting since the mid-1980s. Through professional codes of conduct, proposals for developing copyright for indigenous knowledge, the development of "traditional resource rights," and other ever-evolving mechanisms, researchers and the indigenous coalitions with which they work have made the question of compensating indigenous peoples for their resources a powerful aspect of contemporary ethnoscientific research and of indigenous and biodiversity politics more widely (see Brown 1998; Brush 1994; Brush and Stabinsksy 1996; Coombe 1998; Greaves 1994; Posey 1996). Here, too, the question of competing market and community principles looms large. In discussions leading up to the 2000 Conference of Parties to the UN Convention on Biological Diversity, members of the International Indigenous Forum on Biodiversity wrote that

> indigenous peoples have a legitimate right . . . to deny access to our knowledge and to say NO to bioprospecting, exploration, or the application of intellectual property rights when these procedures are contrary to the principles and collective rights of our peoples. [In Muelas Hurtado 2000:3, emphasis added]

Recognizing that rights to intellectual property can be a highly problematic form of empowerment, researcher-activists such as Darrell Posey have been working for years to develop alternate mechanisms, such as traditional resource rights, that would forge new bases for rights without reproducing the view of the world required by IPR (Posey 1996). These movements and efforts have indisputably gone a long way toward shaping the contemporary politics of corporate resource extraction, academic research, and various combinations thereof. Nonetheless, in most prospecting contracts, benefits-shared usually stop far short of actually granting intellectual property rights or similar alternatives for "local people."[9]

Wary of entering into the kinds of negotiations that property claims and their proxies would entail, corporate and academic participants often prefer other idioms of return altogether: "donation," technology transfer, or the future-looking neoliberal tropes of incentive-building and stakeholding. In this vein, many prospecting initiatives (most notoriously, perhaps, those emanating from Costa Rica's National Biodiversity Institute [INBio]), describe their ideal participants as people who might be enticed, through the promise of future returns, to be stewards of endangered biodiversity (see Reid et al. 1993). In such a view, incentive building rather than intellectual property looms large as the idiom through which participants are to be brought into the prospecting fold.

And yet for all this, "property" is not so easily excised from the mix. In the ICBG, for example, the definition of *benefit-recipients* takes root in the decidedly Lockean idea that proper benefit-recipients are those people who can be rewarded for their identifiable input of labor and innovation into, and stewardship of, nature. It is in this spirit that the U.S. National Institutes of Health, the primary funding body of the ICBG program, enjoins participating Latin American researchers to sign contracts with each individual who provides them with plants and information. The idea is that granting people financial stakes in their resources will encourage them to conserve these resources; to borrow an apt phrase from Marilyn Strathern's (2000) analysis of British "audit culture," local participants are being encouraged here very explicitly to "value their values." And in turn, this logic of incentives and valuation comes with a fairly powerful set of assumptions about the relation among plants, people, and knowledge: They must be found together—localized and localizable—in one discrete package. (That is, it does not make sense to send benefits back to people who aren't managing the resources from whence the lead came). An emphasis on incentive, filtered through the idiom (but not the fact) of intellectual property, thus requires the territorialized local community as the bundled-together source of (semi-)raw material and destination for future benefits.

I would follow Miranda Joseph's lead here, not to mention that of a host of anthropological critics of sustainable development in particular, and suggest that *this* notion of (modified, green) capitalism requires—or at least strongly requests—community (Joseph 2002).[10] And community, in this instance, is a curious and uneasy mix, animated by a host of sometimes competing notions: incentive, locality, IPR, reward, territoriality. But there is another element that might be added to this list of the projected efficacies of (green) capitalism's intimate other: legitimacy, both political and juridical.

In Mexico, as in many places, prospecting has become embroiled in historically charged struggles over sovereignties and rights. The Convention on Biological Diversity has redrawn jurisdiction over "genetic resources" and "traditional knowledge" by taking them out of the global commons and placing them squarely within the sovereignty of nation-states—a victory, of sorts, for Southern nation-states. It also recognizes community rights over traditional knowledge. This dual move has, in effect, provided fuel for reinvigorating competing sovereignty claims by indigenous peoples and nation-states. With Mexico's entry into NAFTA in 1994, these long-sensitive questions flared up dramatically. The day the accord was to take effect, the Zapatista army declared war on the Mexican government and its neoliberal "reforms"—including the end of land reform, withdrawal of rural subsidies, and privatization of various forms of "national patrimony" (Nash 2001; see also Ferry 2002; Gledhill 2001; Stephen 1998).[11] Alongside and intertwined with these concerns, the question of indigenous sovereignty and rights to resources nationwide has been a powerful and contentious rallying cry.

Prospecting has, not surprisingly, pushed some fairly sensitive buttons on these fronts (Hayden 2003). Indeed, in part because of the political sensitivity of matters of indigenous rights to land and natural resources, the Mexican government, both under former President Ernesto Zedillo and now under Vicente Fox, has pointedly shied away from drafting any binding regulatory measures for prospecting activities, even though Mexico is a signatory nation of the CBD and draft legislation on "access to genetic resources" has been "in process" since 1997. Thus, although the secretariat of the environment (now, Semarnat) has been approving prospecting projects and granting permits under previous protocols for "scientific" collections, there is no clear-cut juridical framework established for prospecting activities in Mexico—a point to which many activists and prospecting critics repeatedly turn in denouncing these contracts as illegitimate by definition (see Nadal 2000).

In these circumstances, NIH project managers have placed a premium on the benefit-sharing contract as a mode of informed consent (an arguably overloaded and underqualified one at that): a hoped-for guarantee that collections are proceeding with the proper authorizations from both individuals and communities. And here, too, or perhaps especially, plants, (sovereign, authorized) people, and knowledge *must* cohere. It has proven a difficult and contentious request to fulfil. Several ICBG projects in which researchers have sought to put this notion of community-based prospecting in motion have run into serious difficulties (see Greene 2002; Hayden 2003). Perhaps the most notorious example is that of the Maya ICBG project, sited in Chiapas and run by University of Georgia researchers Brent Berlin and Elois Ann Berlin. This program ran aground quite spectacularly shortly after it was funded in 1998, in large part because of powerful opposition from a coalition of Chiapan healers and midwives (along with some very vocal North American nongovernmental organizations, or NGOs), who argued that the collecting and negotiating processes undertaken in the area were illegitimate.[12]

As I have noted, prospecting "in communities" is not the only model that has been mobilized in Mexico under the (sometimes unapproving) mantle of the ICBG initiative. In fact, in the Latin America ICBG project, based at the University of Arizona and funded five years before the Maya ICBG, none of the researchers from the participating source countries are going directly to "community" as their first (or only) access point for finding plants and the people that come with them. In Argentina, researchers have been collecting plants on large, privately held ranches; in Chile, participating researchers have been working on government lands and cultivating some of their compounds in petri dishes in their labs (Gloria Montenegro, personal communication June 1997). And, as I noted above, the participating Mexican researchers in this project have mobilized their long-standing interest in urban markets to craft an alternate strategy of their own for linking plants-collected to benefits-returned. This is not, as we might surmise, the kind of "market-mediated participation" that ICBG architects had in mind.

Market research

For the ethnobotanists with whom I work, as for many of their colleagues in Mexico and elsewhere, the iconic twin images of plant-based drug discovery—the intrepid explorer crashing through virgin jungle and the ethnobotanist as shaman's apprentice—fall far from the realities of everyday research. So does the vision of "traditional knowledge" as an objectlike thing, fixed in place, isomorphic with easily identified and bounded communities. Since the early 1980s, Mexican researchers such as anthropologist Carlos Zolla, chemist Xavier Lozoya, and ethnobotanists Robert Bye and Edelmira Linares (among many others) have demonstrated through their research and writing that medicinal plants are also well traveled, cosmopolitan, dynamic, even urban phenomena (Bye and Linares 1983; Lozoya and Zolla 1984). Anthropologist Valentina Napolitano reminds us that "traditional" Mexican herbal medicine "has always been strongly linked to popular medicine as it is practiced in low-income [urban] neighborhoods" (Napolitano and Mora in press:4). Urban plant markets are a crucial locus for the study (not to mention the practice) of herbal therapeutics. Robert Bye has been studying the plants circulating through these markets for well over 15 years. Market plants are particularly rich research objects, full of some intriguingly specific material, biochemical, and, it would seem, *social* properties.

Whether dedicated entirely to medicinal plants or offering dried herbs alongside piñatas and fresh vegetables, bustling markets such as La Lagunilla in Mexico City or the central city market in Chihuahua were considered promising venues by researchers long before the advent of prospecting contracts. From an ethnobotanical standpoint, there is a great deal to learn from even a quick pass through these sites: Popular plant names and uses, for example, are on vivid display, alongside other key dimensions of ethnobotanical inquiry such as which part of a given plant people consider most useful. (Since vendors sell plants in the forms in which people use them, a cursory look around any given market will indicate, for example, that *matarique's* efficacy rests in its roots, *gordolobo's* healing properties lie in its flowers, and *copalquín's* curative powers are found in its bark.)

Although this much information is on ready display, a great deal of additional work is required if markets are to become points of departure for more detailed studies. Most pointedly, buying plants in these sites becomes an entry point for more extended conversations with vendors about how a plant-based remedy is prepared, where the plant is collected, and, with luck, how to locate the collectors who have brought particular specimens in from afar. For the most part, the people who sell plants in urban markets are, indeed, not the people who collect them. The vendors I know in mid-to-large cities buy their merchandise from a heterogeneous array of suppliers. Sometimes these are wholesalers; but, in the northern state of Chihuahua, where Bye has long conducted research, suppliers are just as likely to be Tarahumara men, women, and girls who come in from the mountains several hours' bus ride away; local miners who pick up plants in their spare time, hoping to make some extra money (prospecting in double time, we might say); or farmers who, every two weeks, gather the "weeds" that grow on the edges of their corn and bean fields and bring them to the city.

A number of Mexican researchers have placed such collectors at the very center of their studies of plants and their uses. Thus, anthropologist and medical doctor Paul Hersch Martínez has investigated the fragile livelihoods of plant

collectors in the southeastern state of Puebla (Hersch Martínez 1996), and ethnobotanist Myrna Mendoza Cruz (personal communication 1997) tracks the creative substitutions (which often become the basis of new popular classifications) that rural collectors finesse when wholesalers push them to bring in specific plants that are simply not in season. Bye, for his part, has been interested in the relationship between commercial demand and biological distributions: Do popular plants become more scarce in the field, and if so, does this scarcity prompt shifts in therapeutic practices and plant uses (Robert Bye, personal communication, 1996)? These are consequential questions that require an understanding of plants (and "biodiversity") as always already shot through with entanglements: with commerce, human traffic, management, and, indeed, creativity.

But market plants prove interesting in many other terms as well. For ethnobotanists who are also interested in economic botany—a field that focuses not on "local" or "popular" uses but, rather, on the industrial potential of plant life—such specimens certainly hold distinctive appeal. Bye works in and across these two subfields of botany, and market research is indeed an important trading zone between them. Market plants, he seeks to demonstrate in his research, are promising leads in the search for "bioactivity" (the potential of plant chemical compounds to show some kind of biological efficacy). Bye argues that these plants have been used and tested by generations of consumers and, thus, can be counted on to work—for something, and, perhaps, even for the purposes commonly attributed them. In a preliminary progress report for the ICBG prospecting program, the UNAM team wrote,

> [Market] plants have been tested empirically by generations of Mexicans, and, as a consequence, their demand is constant, there are established routes of supply and processing, and it is possible that they have been subject to processes of selection by man, improving their therapeutic activity. [Bye et al. n.d.:3]

Bye and his partners in the ICBG prospecting agreement, UNAM chemists Rachel Mata and Rogelio Pereda, have worked together for years on precisely this kind of corroborative–collaborative project. The ICBG project is in many ways just another source of funding for these scientists to continue their work together, analyzing the chemical activities of the compounds hiding in plants both picked and purchased.

If markets serve as excellent first-tier bioassays (see Bye and Linares 1986), they also hold other kinds of appeal for plant researchers. In logistical terms, of course, market studies are a notably quick and efficient way to acquire plants. In the context of the ICBG project, with its quota of 100 extracts per year that the Mexican researchers must meet to continue receiving funds, such efficiency has been especially attractive—even more so, given that the Mexican team began two years behind schedule because of an extra round of institutional negotiations and thus spent the first year and a half catching up on their missed collections. Of equal significance for the viability of the team's collections, the plants purchased in markets are, most often, already dried and so are relatively resistant to mold in the VW bus *(combi)* during a several-weeks-long collecting trip. Mold is often a danger with freshly collected plants, and it ruins them as candidates for future chemical analysis.

Thus, the materiality of market plants—the ease with which they may be collected and stored, their heightened (one might say, selected-for) biochemical efficacy, the ways that they "come with" a host of useful information embodied in their form—holds multiple appeal for ethnobotanical studies. For precisely these reasons, market work might seem ideally suited for a project in which collections are directly destined for an "industrial outlet" with drug discovery in mind. But in the view of some NIH program administrators, markets are an unsettling interruption. Market plants may well be shot through with human relations, but, as government officials and concerned observers on both sides of the border have asked, do market-based collections contain the *right* mixtures? Do they produce the right kinds of relationships between communities and biodiversity-derived benefits? When the market meets the NIH's "local community," both end up significantly and interestingly transformed.

Market relations

I have already alluded to what might be found in a market from an ethnobotanical point of view. But when mobilized as a point of entry for prospecting, market research takes on other striking features. First and foremost, Bye and his coworkers very pointedly do not sign benefit-sharing contracts with plant vendors. As one UNAM ethnobotanist who works in markets told me in 1996, "Plant vendors are merely vectors of transmission of information—they're not sources, so they don't merit part of the royalty benefits." Rosemary Coombe (1998) reminds us that such attributions of authorship are significant indeed: The distinction between those who make knowledge and those who merely distribute it is *the* difference that matters where the idiom of intellectual property is concerned (see also Boyle 1996). But it is not just a recourse to authorship that serves as a crucial idiom for determining who shall be "inside" and "outside" the reach of potential benefits-shared. The commodity transaction itself looms large in this context; the very act of a purchase, strictly speaking, sets market collections free of long-term obligations. Bye explained to me that it doesn't make sense to treat vendors as sources of knowledge that deserve compensation: When you buy the plants, you buy the information, and no further obligations are involved.

Like the NIH's invocation of the local community, this invocation of the market—as a site of short-term obligations, of limited entanglements, of the distribution but not the generation of "knowledge"—is a strategic essentialism, one that will sound provocatively familiar to an anthropological or sociological audience (Carrier 1997; Granovetter 1985; Gudeman 2001). And, indeed, Bye himself does not dwell for very long in this idealized world of truncated transactions. Markets, as I suggested above and as I will demonstrate further below, prove to be such rich ethnobotanical sites precisely because of the webs of relations and entanglements that can be traced through them. This emphasis on the "disembedded-ness" of market transactions (see Callon 1998) serves a very particular and, indeed, temporary purpose: It is the first step in Bye's efforts to construct an alternative strategy for relating plants-collected to benefits-redistributed.

If not through market transactions, where, then, are benefit-recipients to be found? In considering this question, I introduce another powerful boundary-making device: not just authorship and the commodity but the nation itself. Medicinal plants, specifically those that travel though markets, hold a privileged place in a powerful ethnobotanical and popular story about Mexico as a mestizo nation. Building on the national origin story promulgated in the aftermath of the Mexican revolution (1910–1917), many people both inside and outside of Mexican public intellectual circuits name medicinal plants a national resource, both a reflection and a result of the hybridization of indigenous cultures and plants with those coming from Europe and Africa. Though having identifiable roots in the indigenous "past," these plants now, this story tells us, belong to a diffuse national culture. (As anthropologist Carlos Zolla phrased the common sentiment to me in a June 1997 interview, "With medicinal plants, as with many other things in Mexico, we are a country of mixtures.")

These stories of mixture have, over the years, been granted extraordinary tangible institutional form. Certainly looming large here is the legacy of *indigenismo,* an official policy in which the assimilation of indigenous peoples into the nation has been a powerful modernizing trope.[13] And where medicinal plants in particular are concerned, I would note efforts in the late 1970s by nationalist–populist President Luís Echeverría to resurrect a 19th-century project to develop a domestic drug industry based on "distinctively Mexican" resources—plants and traditional knowledge (see Sherwood 1991:168–169; Soto Laveaga 2001). The resulting institute, IMEPLAM (the Mexican Institute for the Study of Medicinal Plants), became home to many prominent Mexican chemists, anthropologists, and ethnobotanists (including Xavier Lozoya and Carlos Zolla), and the research generated out of this effort and its subsequent incarnations has helped constitute the Mexican *herbolaria,* or storehouse of medicinal plants, as a distinctly national, hybrid resource (see Hayden 2003; Lozoya 1976).[14] Significantly, many renderings of these centuries of mixture begin precisely with descriptions of the extraordinary market systems through which medicinal plants (among many other things) have traveled since the height of the Aztec empire, and certainly well before.

These market-mediated notions of the nation (or, more specifically, of a Mexican national herbolaria) constitute the second step in the Mexican researchers' efforts to refashion the relation between plants-collected and benefits-redistributed. In a report on the project's progress in Mexico, Bye and his colleagues in the Faculty of Chemistry explain their strategy of working in markets thus:

> Medicinal plants were central to the quotidian life of precolombian Mesoamerica. As such, medicinal plants and knowledge thereof are a national legacy that have been shared by many generations and cultures over several centuries. Given the antiquity and broad diffusion of this Mexican medicinal flora, the ICBG program is concentrating on studies of plants from different regions of the country. To understand the evolution of a "national medicinal flora" that has developed over centuries, this broad sample has also incorporated the contemporary system of commercialization, which conserves many prehispanic characteristics. [Bye et al. n.d.:7]

Arguing that it is impossible to trace this prehispanic–national legacy to particular individuals and communities, they have made a bid for redefining the relationship between resource acquisition and benefit-sharing:

> Market work gives you a bit of flexibility (in terms of sharing benefits) . . . some of the plants have a very wide distribution in terms of their use and to a certain degree, one could say, this is Mexican, this is not from this community . . . remember, the main objective here is to promote conservation and maybe there's a greater need for conservation and social-economic development in another community. And if we stick to this straight definition that the person who gave the information gets all the credit, then there's a problem if we want to help somebody else.[15]

With these broad distributions in mind, the UNAM team has made an explicit case for not going directly to people such as local healers and the communities of which they are a part as their first points of contact for gathering both plants and benefit-recipients. Rather, in the early years of the project, they paired up market collections with a bid for considering nongovernmental organizations, indigenous collectives, and productive organizations as their interlocutors (Bye et al. n.d.:2). In this way, Bye does not seek out authors or owners as his participants but, rather, a diverse array of community enterprises whose goals, or projects, line up with those

that might meet the criteria of the program. Among these are small *artesanía*-production enterprises in Sonora, indigenous collectives in Chihuahua dedicated to cultivating and commercializing medicinal plants for local and regional markets, and a group of traditional healers in Oaxaca, organized through the government's Instituto Nacional Indigenista (INI), with whom Bye has worked to establish an ethnobotanical garden. These forms of alliance follow the traces, then, of neopopulist government development projects formulated to "cushion the blow" of the withdrawal of government subsidies for rural production under NAFTA, or of government-sponsored indigenist initiatives. They are decidedly *not* arrangements forged as acknowledgment of the provision of information and plants. The complex material and ideological legacy of national(ized) medicinal plants is the crucial condition of possibility for this rerouting of benefit-sharing relations away from a direct exchange of resources for (promises of) benefits and toward more diffuse but, in a certain sense, also more targeted relations.

Market interruptions

The Mexican scientists working on this project have been quite explicit about their rationales for collecting in markets. In fact, many of the explanations I have been quoting have been articulated precisely as answers to the objections and unease of ICBG project directors in Washington, D.C. The sponsors of this agreement at the NIH have never been particularly content with market research as a mode of prospecting. Why? Market collections, as one high-level administrator told me in 1998, "break the link" among people, plants, and benefits. And it is precisely this link that projects such as the ICBG are supposed to be both encouraging and recognizing in the first place. Bye's program, one might say, injects *too much market* into the NIH's market-mediated strategy.

One of the many things at stake in this excess is the work that the paired-up idioms of intellectual property and community are meant to do within the ICBG as a "green" drug discovery initiative. This powerful pair is meant precisely to recognize and thus create connections, or links. Many anthropological discussions of intellectual property dwell precisely on the question of connections, though they lean in quite the opposite direction. Marilyn Strathern has shown how intellectual property claims interject in the kinds of connections, flows, and travels that we might identify in processes of knowledge production: "Ownership," she argues, "re-embeds ideas and products in an organism (whether a corporation, culture, or individual author). Ownership gathers things momentarily to a point. . . . [It halts] endless dissemination" (1999:177). Certainly such truncations are precisely what intellectual property claims effect—even as they set new processes in motion.[16]

Both Strathern and Georgina Born (among others) have made powerful cases for thinking not just about the institution and fact of intellectual property but also about the idiom of IPR—or, in Born's terms, the "informal practices and discourses of intellectual property" (1996:102). And in the present case, just as patents themselves generate a multiplicity of effects, the efficacy of IPR (as a legitimating trope for certain practices) takes some interesting turns.

In the "dilemma" that market-based prospecting poses for the NIH, the idiom of intellectual property—the idea that plants and knowledge come with identifiable, remunerable author–owners—is laid bare as a strategy not for severing but for producing long-term chains of connections, legitimacies, and obligations. These connections are supposed to take the form of an "uninterrupted" chain of transactions—starting and ending with resource providers *as* benefit-recipients, and to be guaranteed, as it were, by the benefit-sharing contract. Certainly, this transaction would, even in its idealized form, be marked by a significant interruption: the period of up to 20 years as "resource providers" wait for that other form of intellectual property—a patented drug—to materialize and thus to generate royalty payments. As Shane Greene (2002) has noted in his discussion of an ICBG collaboration between Monsanto-Searle and Aguaruna communities and coalitions in Peru, this delay looms large in the growing discontent of Aguaruna with their coalition leaders and the ICBG itself.

For his part, Robert Bye has identified some additional breaches in the ICBG's notions of a seamless, contractually mediated, and therefore legitimate connection. The "links" produced by this model of compensation seem, in the context of the kind of widely circulating knowledge that interests Bye, unduly limiting, counterintuitive, or just plain wrong. Medicinal plants (or at least the kinds that he has been studying), he argues, *don't work that way in Mexico*. Displacing the curiously twinned idiom of IPR–community as *the* mode of entitlement allows Bye to channel prospecting-derived benefits where he argues they are most appropriate and needed. It is precisely the truncations produced by "the market" that facilitate his efforts to extend the network of ICBG beneficiaries in creative and positive ways.

Bye's benefit-sharing counterproposal to the NIH does not, I hope it is clear, simply dig up the familiar disjuncture between "market" and "community." Nor does it plant us solely in a predictable debate about the difference between talking about *a* (concrete) marketplace and *the* (abstract) market. Rather, at stake in this counterproposal and the NIH's response thereto is an intriguingly vivid clash of abstractions. The NIH, in its attempts to wed drug discovery to the social goods promised by sustainable development, stands as the guardian of a somewhat romanticized local that cannot tolerate the presence of market transactions. The Mexican scientists, the very people in charge of identifying and enrolling these local participants, counter with a

few powerful idealized models of their own—nationalized mixtures and obligation-free, pure market transactions.

Yet as I hinted above, market research has more complex temporal dimensions to it, which make it difficult to dwell for long in this highly charged if not slightly odd topography of long-term, encumbered, IPR-requested community and short-term, truncated, mestizo, market transactions. For the Mexican ethnobotanists, market research is also an ideal prospecting technology precisely because it does, indeed, contain social relationships that may be good candidates for future, long-term cultivation.

Market connections

For ethnobotanists working in urban markets, prospecting contracts obviously do not represent the first instance in which science and commerce have mixed. Nor do the collaborations underlying such contracts mark the first time that "reciprocity" figures centrally in the work they do and the collections they undertake. Like many of their colleagues across Mexico and elsewhere, the UNAM ethnobotanists have long made efforts to "give back" to the communities with whom they work. Among their modes of reciprocity have been community education campaigns, in which researchers offer (and often are asked) to teach people about the plants found near to hand. Indeed, many Mexican ethnobotanists have, since the 1970s, considered the project of "returning knowledge" to communities as a political and activist act (Toledo 1995)—one that takes its force and meaning against the backdrop of extended histories of territorial displacement and linguistic assimilation fomented by decades of government *indigenista* policies. These histories—alongside the fact that academic knowledge production is one of the many forces that have helped place "traditional knowledge" into the public domain—conjoin to make ethnobotanists themselves, often, the de facto "guardians" of traditional knowledge (see Brush 1999).

In this prospecting project, the idea of teaching "local people" about their plants makes its way into the UNAM scientists' view of potential benefits they can offer, in several senses. For instance, they have offered to join forces with local schools in areas where they have set up potential benefit-sharing relations—such as Mayo and mixed mestizo and Tarahumara communities—to produce illustrated dictionaries of medicinal plants. But so too do markets themselves play an important role in identifying and producing these kinds of potential relationships. The process of starting in markets actually helps researchers root their traveling plants and knowledges "back" in identifiable (community?) places. Consider this, then, step three in Bye's market-mediated efforts to refashion the relationship between plants acquired and participants-enrolled.

Yerba del conejo is one of these relation-laden market plants.[17] The leaves of this plant were of interest to the Mexican research team as a possible pharmaceutical "hit" that also, Bye hoped, could serve as the basis for a community-level cultivation and commercialization project. After numerous visits to the northern city market where they had spotted this plant in 1997, the researchers managed to track down one of the collectors who brings yerba del conejo to the city. He consented to meet the researchers at his brother's ranch, where the plant grows along the weedy borders of the property. The collector's brother had little use for the weed, much less a name for it, and so was a bit bemused that these *científicos* from Mexico City were curious enough about it to ask his permission to unearth and take with them two or three live plants, roots and all, in plastic bags.

For the researchers, these plants were not, I was told, "community" resources yet. How might they *become* community resources? The plants were taken for replanting in the nursery at UNAM's Botanical Garden; depending on how well they weathered Mexico City's rather distinctive atmospheric conditions, they would then be subject to cultivation and germination studies. If these studies yielded enough information about the optimal conditions for cultivating this plant, then Bye might venture back to the ranch or other sites nearby, to replace yerba del conejo in hospitable soil and, through ICBG-funded workshops and public education projects, to teach people that it is "a valuable plant." Rather than "mining" the knowledge and plants of a particular community, then, ICBG community development and conservation activities are more likely headed in this direction, cultivating people's interest in the plants nearby and creating opportunities for cultivation and commercialization projects.

Optimally, this is how markets function in the service of bioprospecting. Commercial circuits lead researchers first to plants that can be sent off to the participating companies in short order, and then, in the longer term, those plants might lead them to vendors, interlocutors, and even communities who may in turn elect to become local experts—and benefit-recipients—themselves. Market work is, in this sense, not an undoing but, rather, a postponement of prospecting's modes of community gathering.

The NIH's notions of compensation and Bye's are not, in this sense, as distinct as they might have seemed. Both aim to find ways to enroll the proper kinds of subjects into longer-term projects of stewardship and sustainable resource management. Both work with an idea of community as a proper site of these relationships. And for both parties, the market transaction or the commodity relation does not itself a proper participant make. For, in the above example, too, the collector who gathers and sells yerba del conejo does not, by virtue of this activity alone, find himself within reach of benefit-sharing status.

The point where these two models of benefit-sharing diverge is not, then, where they end up but, rather, where they begin.

Research strategies

What is one to make of these two uneasily articulated modes of inclusion and exclusion? Answering this question, I would suggest, entails a point of departure anchored neither in market nor in community. Rather, I would look to the question that has animated both idioms throughout this account: the issue of legitimacy. Borrowing a page from the annals of science studies, I would argue that this is not simply a "political" question. Rather, I think it is worth attending to the ways in which these matters of governance, of political and social relations, are written both large and small in the material worlds of scientific research practice itself. As sociologists and historians of science have shown, the viability of particular research strategies or research objects is inseparable from the social and institutional relations in which they are embedded (see Clarke 1995; Fujimura 1996)—and I might add here, the liabilities that they (ostensibly) help avoid.

Certainly, for my colleagues in Mexico, plant work has always been social work. But the dimensions and shape of this sociality, its renderings of accounts, look different now. For the UNAM ethnobotanists, prospecting contracts are both symptoms of and potential solutions for a relatively novel imperative: to inject the right kind of publics into their collections.[18] This imperative, they worry, comes with its risks as well: accusations of biopiracy, the risk of sullying long-term relations with the highly charged yet elusive promises of benefit-sharing. It is in anticipation of this kind of fallout and those kinds of accusations—and the activist mobilizations that can and will accompany them—that the articulations of market and community outlined in this essay have taken shape.

For the NIH, the viability of resource collection for plant-derived drug discovery starts and stops with community—an idealized and necessary source or site of quasi-sovereignty, collective authorship, and ethical capacity. But for UNAM ethnobotanist Robert Bye, this model is perhaps the *least* promising way to fashion benefit-sharing partnerships in a country in which the politics of indigenous resource rights are extraordinarily sensitive, and in which popular and ethnobotanical notions of a diffuse herbolaria—at once, I argue, "cosmopolitan" and "nationalist"—provide an alternate model of plants and the relations that come with them. Through his use of market research, Bye argues that it is possible to channel socially and biochemically enhanced plants into drug discovery circuits *and* to enroll indigenous and rural communities and organizations as benefit-recipients, without having to link these processes through (slippery or contentious) attributions of authorship and ownership. The "disagreement" over methods here is thus not precisely about *who* to enroll as a benefit-recipient but *how*: In what idiom—territoriality, nationalism, cosmopolitanism, authorship—will biological collections be attached to social relations, interests, and claims? This is a science studies–inflected way of framing *the* major questions haunting both bioprospecting and indigenous rights movements more broadly.

Coda

While researchers, activists, and funding bodies (who often, of course, occupy quite different positions relative to each other and to the prospecting enterprise) continue their attempts to navigate the post-CBD world of taking and giving, the terrain of bioprospecting continues to shift underfoot. Fully consonant with wider trends in the world of prospecting, it seems that Mexican plants (and their people, whoever they may be) will soon be cut out of the Latin American ICBG project altogether, as the ICBG program in general turns its emphasis to ever more liability-free political and natural environments (Robert Bye, personal communication 2003). Safer and more lucrative shores seem to be in the offing: most prominently, microbes, rich in easily manipulable genetic material and, unlike medicinal plants, ostensibly "free" of thorny "cultural" claims (see Helmreich 2003). Indeed, invoking medicinal plants' unruly mix of enhanced political entanglement and "questionable" biochemical activity, major drug companies seem content to see plant and ethnobotanically derived screening return to the margins of corporate drug discovery (see Parry 2003).

Such attributions of viability matter not just for our understandings of the politics of prospecting but also for the analytic project of the anthropology of science in what are, arguably, rapidly transforming circumstances, both North and South. As the idioms of market and community continue to infuse new and familiar taxonomies of inclusion and exclusion, so too will it be imperative to attend to negotiations of governance, legitimacy, and entanglements through the practice of scientific research itself, and all of its ever-shifting accountabilities.

Notes

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1. See Parry 2000 and Takacs 1996 for accounts of this "return to nature."

2. See Povinelli 2002 for an extended discussion of what she calls "late-liberal" modes of taking-as-giving in the context of the multicultural state.

3. And even this (elusive) promise is a complicated one: Not entirely without merit, many prospecting critics vociferously contest these agreements as dressed-up versions of familiar forms of corporate plunder.

4. Gudeman argues, "Rethinking the distribution of corporate returns lies at the heart of a new political economy" (2001:151).

5. I have written at length elsewhere about the ways in which bioprospecting requires academic plant collecting practices, with their own long-standing complexities, rationales, and socialities, to do new kinds of representational work (Hayden 2003). Scientists involved in bioprospecting contracts must in a sense *do* science studies, and do them one better: Much like classic sociologists of science, my ethnobotanist colleagues are endeavoring to "trace the relations" of people and interests that lie embedded, latent in knowledge and artifacts (see Latour 1987)—and not only that, but to compensate them (Hayden 2003).

6. The exact percentage of royalties to be shared remains confidential, but project administrators in the United States tell me it is somewhere between 2 and 15 percent—this sum would pass through the University of Arizona before heading south. Arizona will then keep 45 percent of that first redistributed sum directing the remaining 55 percent to the country that was the source of the plant material (Timmermann 1997).

7. For information on the ICBG program, see Grifo 1996; Rosenthal 1997; and Timmermann 1997; see also Greene 2002.

8. For critical commentary on these questions, see, among others, Escobar 1995; Foster 1997; Goldman 1997; Hayden 2003; Zerner 2000.

9. See Shane Greene 2002 for an account of an ICBG project in Peru in which, exceptionally, the participating indigenous coalitions were able to negotiate "trade secret" status for their knowledge and, thus, to license its use to the participating company.

10. For critiques of notions of community within development see, among many others, Brosius et al. 1998; Cooke and Kothari 2001; Escobar 1995; Zerner 2000.

11. See, in particular, Ferry 2002 for an insightful analysis of these articulations of national patrimony and neoliberal markets in relation to mining and mineral resources, Stephen 1997 on *ejidal* "reform," and Nash 2001 on the relationship between globalization and neoliberal reforms and indigenous political mobilizations in Chiapas.

12. The demise of the Maya ICBG is a long and complicated story, much of which transpired through Internet exchanges, campaigns, and bulletins. See the websites of the following organizations for an indicative guide to the issues: RAFI (now the ETC group), at www.etcgroup.org; CIEPAC (in Spanish and English), at www.ciepac.org; the University of Georgia, at http://guallart.dac.uga.edu/ICBGreply.html. For continued updates and extended links, see the very useful site maintained by University of Chicago graduate student Michelle Day, at http://home.uchicago.edu/~mmday/Mayanmedicine.html. See also Hayden 2003 for a more extended discussion than I have offered here.

13. Whereas ethnobotany and anthropology in Mexico have certainly been crucial participants in official indigenismo, many practitioners in these fields have also used their research to resist or help protect indigenous peoples from the kinds of cultural assimilation and deterritorialization that various incarnations of indigenismo—not to mention other forms of development—have set in motion (see Alcorn 1984; Caballero and Mapes 1985; Toledo 1996).

14. Echeverría's efforts on this front were part of his wider move to reinvigorate "indigenous" (i.e., national) scientific capacities in the name of Mexico's self-sufficiency (Schoijet and Worthington 1993). Joining a wave of nationalizations throughout Latin America, Echeverría not only attempted to resurrect a domestic, ethnobotanically based drug industry but also effectively nationalized the extant pharmaceutical industry by expropriating foreign companies (see Lozoya 1976).

15. Interview of Robert Bye by Tamara Dionne Stout, July 1997.

16. That is, when a product is patented and marketed, it is thereby launched into the public domain, continuing, we might say, its dissemination. At the same time, the matter of who shall benefit from such commercialization is highly controlled through the patent.

17. A pseudonym.

18. As suggested earlier, this imperative has emerged as much from the terms written into their research grants as from national and international activist sensibilities and multilateral accords.

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