

6 Forgotten Parts

Pirated Diversity in the Seas, Soils, and in Ourselves

Whatever its shortcomings, the Biodiversity Convention changed our concept of biological diversity. The connections between flora and fauna, between ecosystems and indigenous knowledge, came home to CSOs and policy-makers. If we struggled to look beyond plant genetic resources to grasp agricultural biodiversity, the Convention forced us to look wider still. RAFI began to deal with the livestock breeds that depend upon crops and forages. We also looked beyond food crops to medicinal plants. As some of our colleagues looked on in amusement, we dug into microbial resources in the soil and oceans. Then, one day, we came face-to-face with ourselves—the piracy of human genetic material. As with crop germplasm, there are issues of erosion and of ownership. Despite the South's faith in 'sovereignty' as protected under the Convention, the signing of the 1992 treaty, in fact, opened up a whole new world of biopiracy.

In March, 1997, the RAFI Board held its annual meeting on the island of Bohol in the Philippines. Rene Salazar could point from the board table across a small bay to the still smaller island of Siquitor. Siquitor had made headlines short days before when US cancer researchers reported that a tiny cave-dwelling relation to the sea squirt, something called *diazonomide A*, has a molecule that combats colon cancer in humans. The problem is that the little critter—first pulled from an island cavern 80 metres beneath the sea in 1991—has not been seen since. Repeated expeditions to find it have all failed and some fear the animal is extinct. With Siquitor in the background, we debated the wider elements of genetic erosion and of biopiracy.

As surely as *P. infestans* struck northward from the highlands of Mexico, a day-flying moth, *Urania fulgens*, ranges from the same highlands venturing southward as far as Brazil. Although it may not seem like it, *U. fulgens* ('wild' though it may be) plays a role in both agriculture and medicine. The moth has co-evolved with *Omphalea*—the sometimes vine, sometimes 25-metre tree—whose derivatives span the moth's own terrain. The moth coordinates its flight plan with *Omphalea*'s production cycle of DMDP (naturally produced chemical compound). DMDP renders the leaves of *Omphalea* inedible to almost all herbivores except *U. fulgens*. The arrival of the moths signifies harvest time for local communities. *Omphalea diandra*, the Panamanian vine, gives up its DMDP (non-toxic to humans) to protect the Guaymi people's bean harvest. Beyond its agricultural use, *O. diandra* leaves are warmed and the DMDP is secreted on wasp stings and infected wounds. A decoction is made for treating skin ulcers and sores. The stem sap soothes headaches and the fruit oils are employed as an oral anthelmintic.

Based on the indigenous knowledge of the Guaymi, and others, the British Technology Group (BTG), in August 1993 (barely a year after the signing of the Biodiversity Convention), applied for what was to become US Patent 5,376,675 for the control of parasitic nematodes. A year after that, Shaman Pharmaceuticals placed *O. diandra* on its hit list for possible use against everything from AIDS to diabetes. Also, in August 1993, we learned that the Guaymi themselves were on somebody's hit list.

Biopiracy in plants and soils

The new search for biological wealth

You can extract DMDP from *O. diandra*'s leaves—or you can take it in concentrated form from the belly of the moth, perhaps scraped off the forest floor as part of a soil sample. In 1983, en route to release *The Law of the Seed* at the FAO biennial conference in Rome, I stopped at Cornell University in New York State to fight with the local breeders over the pirating of Farmers' Varieties. On the way to the lecture hall, Jack Kloppenburg walked me past a large windowless building which, he told me, was filled with soils from different parts of the world. While the soils were primarily used in the study of agricultural productivity, their secondary value was in any bacteria, fungi or microscopic 'left-overs' contained in them that could prove interesting to the pharmaceutical or cosmetic industries. Microbial resources had interested me for years—ever since I heard about a kind of microbial gene bank in Rockville, Maryland, known as the American Type Culture Collection (ATCC). If the US crop gene bank at Fort Collins in Colorado was the 'Fort Knox' of seeds, the ATCC was, apparently, the Fort Knox of the creepy-crawlies that contribute enormously to everything from food-processing and biocides to human health care and finishing waxes. Most of this minutia is in the soil. It can have staggering monetary value and its removal creates the kind of socioeconomic loss that plant genetic erosion does. It's a new kind of soil erosion. It raises all the old issues of who owns it, who controls it, and who benefits from it.

When, finally, ten years later, I was able to pursue my curiosity, I found that the data at ATCC was a mess. Going back well over half a century, the ATCC only rarely offered the name of a collection site and was inclined to use colonial names like Rhodesia, Borneo or Malaya rather than any standardised United Nations designation. Patent references, too, were far from complete. As it was with crop gene banks, so it was with microbial tissue culture collections.

In the end, it was easier—that very long weekend—to search for information by company name. For someone used to dealing with plants and having nothing more disagreeable to manage than leaf blight, the sojourn through

the ATCC databases was a grisly affair. Aside from a certain sense of revulsion over some of the materials collected, the overwhelming conclusion was that both medicinal plants and medicinal soils have enormous social and commercial value. Some examples:

Mighty Mucky Merck. The company is on record as having dug up soil samples in at least nine countries from Canada to Namibia. Merck scooped up soil bacteria from a heather forest on the slopes of Mount Kilimanjaro (located in Kenya, according to the ATCC!) found a soil fungus in Mexico for the making of the infamous male hormone, testosterone, used by Merck to, among other things, treat acne;¹ and, at Bosna's Pass, Namibia, dug in the dirt for a lowly fungus, now elevated to a treatment for manic depression.² While Merck has been sifting through the soil, it has not neglected the plants. In 1991, it contracted with a non-profit research foundation in Costa Rica to win access to the biodiversity of that country's national parks (see box).

Miner-Miser Pfizer. Merck isn't in the trenches alone. Pfizer, another giant pharmaceutical concern not likely to let the grass grow under its feet, has been dredging the fungi and bacteria of at least 15 countries. At least 22 ATCC samples—most of them the ubiquitous soil accessions but also canvas leggings and a cotton duck—have resulted in patent claims back in the United States. The soils have come from as far afield as China, Egypt and Jamaica while Papua New Guinea and Panama have volunteered fungi for the production of steroids. All under US patent and all beyond the reach of the Biodiversity Convention.

Lilly of the Field. Another company, Eli Lilly, began sending medical researchers out grubbing in the grime back in 1948. A year later, a young Filipino doctor named Abelardo Aguilar turned in a sample he had already evaluated. In the American Type Culture Collection, the sample is merely identified as soil from the Philippines. But by 1952, the world knew it as *Ilosone* or *Ilotycin* and doctors called it Erythromycin. Although Eli Lilly grandly named its new antibiotic after the island from which it came, the company refused to share its profits with either the local doctor or the Philippines. Erythromycin is one of the most commercially lucrative drugs the world has ever seen.⁸ A year after Abelardo Aguilar's death, traditional medical practitioners, the Philippine Government and Aguilar's surviving family demanded that Eli Lilly return at least USD 500 million in royalties that would go to provide medical services in rural areas. So far, no luck.

Absentee landlord. Bristol-Myers Squibb (BMS) has 38 foreign accessions

Can the South benefit from its own biodiversity? The Case of Costa Rica

Costa Rica's rainforests are estimated to hold 5–7 per cent of the world's remaining species diversity.³ If the much-applauded 1991 Merck-INBio deal were widely replicated, the South's biodiversity could be auctioned off for about USD 10 million per annum. Merck's sales in 1991 were USD 8.6 billion, while Costa Rica's entire GNP that year was USD 5.2 billion.⁴ Merck's research budget in 1991 was roughly USD 1 billion; the company also has three drugs with sales in excess of USD 1 billion each. Given that pharmaceutical companies invest an average of USD 200–300 million on research for each new drug, the discovery charge for one single new drug arising from the deal is barely loose change.⁵ The 1991 deal required Costa Rica to provide Merck with samples in exchange for an average payment of USD 113 per sample.⁶ Non-commercial plant collection costs often run to USD 400 per accession.

For Merck, the Costa Rica contract was 'cheap labour'—a money-saving exercise, and useful propaganda. If, 20 years from now, Merck disputes the origin of a plant-derived compound, Costa Rica's capacity to appeal to the international courts is mostly theoretical. Merck has access to more patent lawyers than can be unearthed in all of Costa Rica.

Are the origins likely to be contested? *Beta selinene*, for example, can be extracted from tree leaves in Costa Rica, but biopirates know from published literature that the same material is available in Venezuela, Mexico, Brazil, Honduras—and the home turf of many pharmaceutical transnationals—US-controlled Puerto Rico. Pharmacologically interesting *Isertia* compounds appear to be in abundance in Costa Rica where high percentages of the active material have been recorded. Other samples, however, have been extracted from Colombia and Brazil, and Shaman Pharmaceuticals notes six samples where the origin is simply 'not given'.

Costa Rica's attractiveness for Merck, of course, is not merely its impressive, if non-exclusive, diversity, but also its political uniformity and the low visibility of complicating indigenous communities in that country—communities that could prove much more difficult in other parts of tropical America.

Merck certainly got a good deal out of Costa Rica but other pharmaceutical companies have dirty hands too. Ortho Diagnostics, for example, managed to scrape enough bacteria off a sick dog's eyeball to make a patented product.⁷ In all, the country has surrendered at least 97 accessions to the American Type Culture Collection. The sources of material are impressive ... beach mud and a range of soils, lily ponds, 'Cathedral' pools, hot springs and maize plants. How much of the material is involved in patent claims is uncertain.

Pharmaceutical houses are not just sniffing around Costa Rica's medicinal plants and soil organisms. Some—like Hoffmann-La Roche—are after the country's very essence—its smells. Givaudan-Roure, one of the world's largest flavour and fragrance companies (and a subsidiary of Roche) has contracted with INBio in Costa Rica so that it can use its Scent-Trek technology to capture every odour from a single orchid to an entire tropical beech. Trying to prove the origin of a smell—especially a decade or two after it is collected—should prove an interesting legal challenge.

deposited with the American Type Culture Collection and each comes with at least one patent claim. In all, 15 countries have made soil bacteria and fungi available to the company. BMS (Buy-My-Soil?) seems to have made soil mining in India a major preoccupation. The company and its subsidiaries have scraped together enough soil to either secede or to become India's largest absentee landlord with absentee land. All patented.

Diggers and Diggings. Sifting through the ATCC's half-hearted documentation is not easy but even a crude survey of a few countries indicates the extent of the piracy. India has been a popular sandbox for the corporate set. The diggers include Bristol-Myers, Pfizer, Groupe Lepetit, Lederle Labs, and the ever-present Merck. The ATCC notes a total of 35 bacterial accessions with patent claims. All 35 are assigned to only these five companies.

Beyond India, the ATCC records 258 accessions from Brazil. Two patented products are taken from a member of the pea family found in Brazilian soil and 'invented' by the General Hospital Corporation in the USA. The material is useful as a renin inhibitor. Bristol-Myers has taken Brazilian soil bacteria for the production of *hedamycin*,⁹ while Warner-Lambert has taken bacteria from another soil sample to produce an antibiotic.¹⁰ Lepetit Labs has used a soil accession in the production of *selenomycin*.¹¹ From Japan, Kaken Pharmaceuticals has found Brazilian microbials useful in the production of anti-tumour agents.¹²

Brazil's contribution to the North is clearly underestimated. The University of Florida, for example, patented a Brazilian fungus known to be lethal to fire ants that can cause a billion dollars in damage to US crops.¹³ Neither the patent application nor the ATCC registration mentioned that the fungus was given to Florida researchers by Brazilians. Only anecdotal accounts in biotechnology industry journals made the connection.¹⁴

When the Convention on Biological Diversity convened for its second COP in Jakarta late in 1995, delegates were confronted with an infuriating local example of biopiracy. The family of a Novo Nordisk employee holidaying in Indonesia had used a company-provided sample kit to scoop up soil from a local monkey temple. Subsequent research showed that an enzyme extracted from that sample could be widely used in soft-drink manufacture to convert starch to sugar.¹⁵ The advice for temple guardians in Indonesia? Have tourists wipe their feet *after* they leave.

Dirt cheap. So what if companies profit from medicinal plants or soil bacteria found in the South? Whose skill and knowledge identified the value of

otherwise ‘worthless’ germplasm? Two points need to be emphasised. First, this is an issue of national sovereignty. Governments must determine policy for land and resources. The removal of resources from national territory is a violation of the rights of people through their governments. The United States did not surrender Texas oil to the British merely because British petroleum technology was superior. The Canadian uranium industry would not exist without American technology. The same can be said for the coal industry of Russia or even the pulp mills of Norway. No country in possession of a valuable raw material has ever, intentionally, given it away.

Every year the US National Cancer Institute sifts through more than a tonne of soil material (more than 1,000 individual samples) seeking valuable germplasm. According to microbe-hunters at the University of California (San Diego), the drug industry spends a sizeable fortune every year screening more soil organisms.¹⁶ Why shouldn’t the South benefit?

Second, to a degree that would be astonishing to many scientists, the particular properties of certain soils have long been recognised and valued by indigenous peoples. They may not be aware of the exact chemical compound resident in the plant or soil, but the anti-tumour, antibiotic or steroid characteristics of certain soils are known and valued. Community healers customarily apply both plant remedies and soil samples to wounds and diseases. Competent biopirates make use of this community knowledge when they go off ‘inventing’ in the Andes.

African-Americans in Stokes County, North Carolina—not far from RAFI’s offices there—have long prescribed a soil ‘sandwich’ rich in iron and iodine for children and young women. A fine yellowish soil from China’s Hunan province has long been used as a famine food. Researchers have discovered that the soil was literally stuffed with micro-nutrients desperately needed in times of drought. Perhaps the classic example is from Zimbabwe where people with upset stomachs in one region have used a red soil found in termite mounds. The *New Scientist* reports that the soil contains kaolinite—the key compound found in kaopectate, the commercial anti-diarrhoeic.¹⁷

While corporate pressure to ‘get down and dirty’ may be on the rise, a Brown Revolution is hardly in the offing for the South. That which has not yet been patented in the ATCC could still be patented in our post-UNCED world. Bristol-Myers’ cosmetics and facial creams may have been gouged out of Guatemala and the company’s clients may go forth into Agenda 21 unblemished—but not unsoiled. The company got something for nothing—and that isn’t right. In the summer of 1993, as Americans watched their own

top soil wash into the Gulf of Mexico, Bristol-Myers introduced its new deodorant, 'BAN Clear' offering to do for its customers what the South would like corporate diggers to do for them—adopt a germplasm collection policy that doesn't stink, and is transparent.

Transfer-sourcing. Back in the 1970s, UNCTAD traced the profit trail of transnational drug companies across Latin America, Asia and Europe. UN officials documented case after case of companies arbitrarily declaring their profits in whatever country they found most useful for tax or political purposes. As pharmaceutical companies traded within their own subsidiaries (about 30 per cent of all international trade in the 1970s was between subsidiaries of the same parent, and the proportion is thought to have increased substantially since then), concepts such as cost, price and profit were largely theoretical. Extractive mining companies operated in the same way. Whether it was Orinoco ores or Andean tin, the mining company proclaimed its profits either in Latin America or in the USA or elsewhere, as convenient.

The new extractive industry is biomaterials, and accompanying indigenous knowledge about them. As well as transfer-pricing, however, biopirates can now use transfer-sourcing. They can claim the source of the biomaterials to be the country and community from which they extract the best deal—or they may be able to get away without acknowledging any specific source at all. Sound market economics, perhaps? But what about the principles of benefit-sharing and respect for indigenous knowledge and Farmers' Rights?

Pharmaceutical enterprises have wooed traditional healers and ethnobotanists, seeking their advice on the pharmacological merits of more than 150 plant species and soil organisms. Almost 1,000 indigenous medical uses are under investigation. The Indigenous Peoples' Biodiversity Network (IPBN) and RAFI have compiled obtainable corporate lists in order to assess the scope of the industry's interest. The substantial majority of species used medicinally by one indigenous community are also used, often for the same purpose, by another community and, for 35 per cent of the plants, in at least one other country. Despite the much-hyped commitment of some drug companies to recognition of—and compensation for—indigenous knowledge, barely 6 per cent of the uses studied are ascribed to a named community. Often, the community is identified only as 'Amerindian' or 'Creole'. In almost 20 per cent of the cases, the origin of the technology is given neither as an indigenous community nor even as a country, but simply as 'multiple sources' or 'elsewhere'. When the time comes to commercialise a new plant or soil-based pharmaceutical, it will be entirely up to corporate good will whether a company credits an indigenous community's contribution.

Benefit-sharing
*One law for the
 stone, another for
 the seed*

In 1296, Edward I of England pirated the Stone of Scone from Scotland. The seat of Scottish kings since 840 AD, the stone was to spend the next 700 years holding up the backsides of English monarchs, until John Major, in a desperate bid to win Scottish votes, repatriated the stone at the end of 1996. The case of the Stone of Scone poses many of the issues raised by the Biodiversity Convention regarding the status of *ex situ* collections of biomaterials gathered prior to the coming into force of the Convention. It also poses the problem of identifying the origin of biomaterials. After all, the Scottish stone had been taken from Ireland in around 600 AD.

According to the Biodiversity Convention, ‘sovereignty’ over biomaterials dates from the time when a country joins the Convention. Anything in the possession of a country—be it in a forest or a gene bank—is regarded as the property of the country. Anything acquired by a country after joining the Convention must be obtained with the permission of the country that makes it available. When the final negotiations for the Convention ground to a close in May of 1992, however, governments recognised that the status of *ex situ* collections such as gene banks—obviously containing large quantities of potentially commercial germplasm gathered (for the most part) over the previous couple of decades—was a bone of unresolved contention.

Industrialised countries uniformly argued that it would be improper to make the Convention retroactive. The South argued that it would be unfair to do otherwise, since the vast majority of the South’s biomaterials that have been catalogued and studied are in collections held by the North.

In the case of non-living cultural artefacts, the notion of repatriation and retroactivity, seems to be North-centric. For example, German and Italian art treasures heisted by Napoleon’s armies have usually, when requested, been restored to their countries. Germany repatriated art treasures taken during World War II to France, and Russia has similarly returned treasures to Germany. The British have been a little less enthusiastic about returning Greek art treasures ... seeming to feel that the Rolling Stones are a fair exchange for the Elgin Marbles. Neither have they been keen to restore the Benin Bronzes to Nigeria or the treasures of ancient Egypt to that country. Repatriation seems much more a matter of politics than justice.

It was during the Leipzig Conference on Plant Genetic Resources that Christine von Weizsäcker of ECOROPA told us about an initiative by Phytera Corporation to ‘buy’ tropical plant collections held by the North’s botanical gardens and arborariums. The US-based biotech boutique had already approached both the Frankfurt and Berlin gardens, offering them

The Aksum Hope: 1897–1997

The North finds the South's sense of injury and passion for justice in the negotiations surrounding genetic resources and Farmers' Rights difficult to understand. The delegates need only look out of the window of their FAO meeting rooms. In front of the FAO buildings, intended to have been Mussolini's Colonial Ministry, stands the imposing Obelisk of Aksum. Almost two millennia old, the Ethiopian Obelisk was pirated from the ancient capital in 1937—sixty years ago. As delegations debate a new legally-binding 'treaty' on the exchange of crop germplasm, Ethiopians mark the 50th anniversary of Italy's contractual commitment to repatriate the Obelisk. Recently, the Italian government reiterated its intention to restore this sovereign treasure to the people of Aksum and Ethiopia. The Obelisk has come to represent the failures of the System of Greed—and of its broken promises—that have plagued South-North relations from the founding of the United Nations.

As luck would have it, 1997 also marks the 100-year anniversary of the ransacking of the Palace at Benin by British troops and the pirating of the famous Benin bronzes—a fabulous collection of several thousand religious and artistic pieces that symbolise—with the Obelisk—the thwarted history of Africa. Following the theft in 1897, the British auctioned off most of the collection to the Berlin Museum. During the chaos of World War II, the treasure disappeared. Another example of the System of Greed.

But there is hope in the Aksum Obelisk—battered as it is by the traffic of Rome. History—and food security—make clear that the System of Greed overlooked the real treasure of Aksum. Every year, on the Feast of Tsion Mariam (which, coincidentally, fell as governments convened in Rome for the December session of the FAO Commission) the people of Aksum gather at the church near where the Obelisk once stood to exchange seeds. From far and wide—from the vast diversity of plateaus and valleys of Ethiopia, those who have given freely and without question to those who have not. The poor are restored and the diversity is reinvigorated. This is the System of Generosity. This is Farmers' Rights. Nicolay Ivanovich Vavilov would have appreciated the connection. Seventy years ago—in 1927—Vavilov visited Aksum and wrote admiringly of the Obelisk. Local farmers gave him an awnless hard wheat—a characteristic Northern breeders had only dreamed about for years—and one which Vavilov regarded as among his most important samples. Awnless hard wheats can still be found at Aksum but they have also been shared with the world.

There is hope, too, in the Benin bronzes. Lost for almost half a century, the Berlin collection reappeared mysteriously with the fall of the Berlin Wall. Africa's heritage was rediscovered—not in Berlin—but in Leipzig. For the diplomats at FAO—in the shadow of the Aksum Obelisk and of Vavilov—the message should be clear.

USD 15 for every specimen, plus a fraction of 1 per cent of any royalties that might be earned through the commercialisation of compounds extracted from the plants. Cooperating with ECOROPA and with the Indian environmental activist, Vandana Shiva, RAFI convened a news conference attacking the initiative. Short days later, *New Scientist* reported that Phytera had managed to strike deals with at least seven European gardens. By the end of the summer, RAFI's Edward Hammond was in touch with the five major botanical gardens in Hawaii and learned that all had been approached with roughly similar propositions by the New York Botanical Garden, acting on behalf of Pfizer.

Meanwhile, Pepe Esquinas at FAO had commissioned a paper on the plant

wealth of the world's botanical gardens. The preliminary survey indicated that between a third and a half of all the world's flowering plants could be found in the North's gardens—all collected well before the coming into force of the Biodiversity Convention. All part of the national sovereignty of industrialised countries. Phytera was quite open about it. John McBride of its British operations told *New Scientist* that the Convention had made negotiating with the South's governments difficult and that new assay technologies made it possible to screen and study plant compounds from single specimens. Forget the rainforest, take the tube to Kew. Pfizer was hardly less self-serving. Through the New York Botanical Garden, it warned the Hawaiian Gardens that it was solely interested in US plant species—thus including the vast collection of Pacific, Latin American and Asian species all gathered up before the 1992 Convention.

Rural societies, indigenous peoples, the South—will not find it easy to benefit from the biological resources that have been nurtured and developed through their care and genius. Not only must they overcome longstanding Western scientific prejudice; they must also rectify recent intergovernmental agreements and defend the origins of living resources. This is possible. On the basis of South–North; on the basis of what Nyerere used to call the Trade Union of the Third World, there can be benefit-sharing. If, however, the North can divide the South and force it to negotiate country by country and specimen by specimen, then the South will gain nothing.

The extreme parts
Searching for hidden treasures

Although the utility of marine micro-organisms in drugs is not well known, the pharmaceutical industry—aided by new biotechnologies and computerised screening methods—is now looking at our oceans and estuaries with considerable interest. Marine organisms often withstand intense heat, cold and atmospheric pressures. In transitional zones such as the Grand Banks or the Humboldt current off Peru, these pressures are exacerbated by the shock of sudden changes. Microbes and molecules that can withstand these pressures can offer characteristics important to industrial manufacture and medical research.

For example, Kainic (amino) acid has been isolated in Japan from a red alga traditionally employed against intestinal parasites.¹⁸ In 1991, Kainic was catalogued in Taiwan, by Sigma Chemicals, at USD 19 per 100 mg.¹⁹ Another marine microbe, Okadaic acid, is isolated from Gulf of Mexico sponges. The organism is useful in cases of shellfish poisonings. The sponge's compound is in demand for drug research at a cost of USD 100 for minute doses.²⁰

Some of the most recent medical research into marine life is well founded on indigenous knowledge. The classic example, of course, is cod liver oil, much used as a food supplement and medicine because of its high Vitamin A and D content. Based on this historic experience, marine scientists are now looking at other fish oils that appear to have a positive effect on human cardiovascular ailments.

To support marine biotech research, the US Department of Commerce has established the Sea Grant Program to discover new drugs and chemicals. A still more ambitious effort is underway in Japan where the Marine Biotechnology Institute (MBI) has brought together 24 major companies with an initial budget of USD 6 million and their own research vessel. Led by international giants like Suntory, Nippon Steel and the Kupwa Hakko Pharmaceutical company, MBI's ship is trawling Micronesia in search of profitable microbes.²¹

Ninety per cent of all living organisms are found in the ocean. Yet, only 10 per cent of the ocean has undergone even cursory exploration and some biologists estimate that at least 10 million marine species remain to be discovered.²² One third of identified phyla are exclusively marine.²³ Few have been investigated for their medical or commercial merits. Thermal vents in under-sea ridges hold the greatest diversity of marine life. Despite the enormous diversity of the Grand Banks, marine species diversity is greatest at the equator and tapers off towards the polar regions.²⁴ RAFI research has revealed that, in the US alone, at least 80 companies are actively engaged in marine biotechnology, and many of these are seeking new organisms that may yield promising drugs.

The most powerful indicator of the unique importance of deep sea organisms came in August 1996 when researchers announced the discovery of a new type of life near an antarctic vent. The micro-organism differs substantially from the two known forms of life on earth—protozoa and the group encompassing bacteria, plants and people. The new organism appears to exist without solar support at temperatures and pressures that could make it an industrial eldorado. RAFI has learned that Craig Ventner, the ubiquitous former gene sequencer for the National Institutes of Health, has already sequenced 60 per cent of the new life form's DNA.

Unattributable parts Industry's most recent moves have been yet more exotic. Australian scientists have cut a deal with US companies to collect soil and marine samples in the Aussie zone in Antarctica. Microbial materials that survive under such severe conditions—temperature and atmospheric pressure among them—

Grand Banks Robbers

In March 1995 a row flared up between Canada and Spain ostensibly over international fishing rights on the North Atlantic's Grand Banks. But below the surface the issue also involved the biopiracy of marine micro-organisms. The world's oceans are a commercially bountiful source of ingredients for the pharmaceuticals, chemicals, cosmetics and food industries. The pirating of marine micro-organisms found within sovereign waters violates the Biodiversity Convention. The expropriation of marine resources outside national boundaries represents another grey area in need of Convention resolution. Spain's largest fishing fleet operating on the Grand Banks was working with Spain's leading biotechnology company to collect invaluable marine organisms in its fishing nets. Here's what's at stake.

Among the most biologically productive marine environments in the world, the Grand Banks lie at the crossroads of the warm Gulf Stream coming up from the Caribbean and the arctic Labrador currents whose icy waters merge with the freshwater from the St. Lawrence/Great Lakes system. The result is a biological 'soup' of vast diversity in everything from fish to fungi. In a recent survey covering a piece of the North Atlantic ocean floor no larger than a small room, 898 marine species representing a dozen phyla were identified—more than half of these had never been seen before. This gives the Grand Banks the kind of biodiversity we normally associate with the Amazon rainforest.²⁵

The fisticuffs engaged in by Canada and Spain in March of 1995 drew world attention to the problem of 'straddling stocks' (fish stocks that are only partly in national waters). Spanish and Canadian gunboats were on the verge of confrontation and the European Union was straddling internal fishing disputes between the British (who were pro-Canadian) and the Spanish (who were pro-Spanish). While fisherfolk and environmentalists are properly exercised over the pillaging of fish stocks wherever this occurs, gone unnoticed is the poaching of other, generally microbial, marine treasures at least as economically valuable and almost as endangered.

And, as in the case of the Grand Banks robbers, the biopirates of marine organisms may also be Spanish. The Estai, the Spanish fishing trawler arrested by Canadian officials on the open seas, hailed from Vigo, an old port on the northwest coast above Portugal.²⁶ Four centuries ago, Vigo was the repeated target of Sir Francis Drake's privateers. Now, Vigo may be home port to the 20th century's biotechnology pirates.

One of the world's leading marine biotech companies is PharmaMar, headquartered (like the Estai and the Pescamaro Uno whose nets were cut by the Canadian coastguard) in Vigo. The plot thickens. PharmaMar is 72 per cent owned by Zeltia (one of Spain's largest chemical companies) but 7 per cent of the biotech enterprise's shares are held by Pescanova—one of the world's largest fishing fleets²⁷—and a further 12 per cent of shares are controlled by Euroventures España (a venture capital firm involving both Zeltia and Pescanova).²⁸ Pescanova, too, is based in Vigo. Whether it directly owns or controls the Estai and the Pescamaro Uno could not be confirmed. Canadian fisheries officials were unable to unravel the Byzantine tangle of shipping contracts and ownership systems that make the industry one of the most secretive in the world.

According to Spanish industry sources, PharmaMar specialises in developing molecules from marine species captured in the nets of its shareholder, Pescanova. Finely-meshed nets—the kind brandished by the Canadian fisheries Minister at the UN—are illegal under international and Canadian rules, but are of the greatest value to any biotech concern interested in sampling the *fruits de la mer*. The micro-organisms they seek could be in the intestines of a turbot or attached to the shell of a minuscule crustacean.

The company's hitchhiking strategy is serving PharmaMar well. At present, PharmaMar claims 13 marine organisms whose anti-tumour compounds are in trials with the US National Cancer Institute.²⁹ Among them are a microbe from the Caribbean that may prove useful in treating non-Hodgkin lymphomas, and other marine samples for breast and lung cancers.³⁰ According to the Spanish financial newspaper, *Cinco Días*, the company has established a marine gene bank with 20,000 accessions and has identified at least 250 active ingredients that have culminated in 30 patents.³¹ PharmaMar also has agreements to sell marine organisms to pharmaceutical giants such as Glaxo, Pfizer, Bayer, Sandoz and Boots.³²

PharmaMar's partner and part-owner, Pescanova, has been carrying PharmaMar scientists far and wide as the fishing corporation conducts its operations in 20 countries. Recently, Skeleton Coast Trawling, Pescanova's African subsidiary, became 'the prime beneficiary' of a World Bank Group move to enhance fisheries in Namibia. Pescanova itself is 20 per cent owned by Imperial Cold Storage of South Africa.³³ The World Bank is providing USD 6.5 million to the Spanish company.³⁴ Such deals couldn't serve PharmaMar's interests better. Africa's southwest coast borders the Benguela Current, arguably (with Peru's Humboldt Current) among the most biologically rich waters in the world.³⁵

In 1990, Pescanova bought two French fishing enterprises, Interpeche and La Miquelonnais, operating within the Grand Banks area. Industry observers, at the time of the acquisition, reported that the move was expected to lead to an expansion of Pescanova's business in Canada.³⁶ National fishing authorities around the world, however, continue to assume that Pescanova is after fish. They are uniformly unaware that its PharmaMar subsidiary is also trawling for pharmacologically important microbes.

could prove uniquely valuable to the pharmaceutical and chemical industries. Not to be outdone by the Aussies, British biologists prowling the dry valleys of the eastern Antarctic have found sandstone rocks with layers of black lichens, white fungi and green algae eking out a dark existence between the grains of rock several millimetres inside the stone. The ability of these tiny life forms to survive—if not thrive—in the cold and dark makes them automatically interesting to industry.

Antarctica is not unique for life in dark places. Under a maize field in southern Romania lie the Movile Caves. Opened in 1986 after 5.5 million years, the caves are a series of subterranean chambers often separated by lakes and rivers whose source is not above—but further below. Some estimates place the water at 25,000 years old. Living along the underground shorelines are a wide range of insects and micro-organisms that can be found nowhere else in the world. Their ability to sustain themselves without light makes them, once again, attractive to industry. Aside from the Romanian cave, some of the incredibly deep caves of France (many more than a kilometre below ground) are also drawing commercial interest. With similar enthusiasm, researchers are exploring the cold depths of Siberia's Lake Baikal (at 1940 metres, the deepest lake in the world); the dense biomass of swamps along the Zaire river; and the saline and soda lakes of East Africa. While industry investigations in these locales are rarely supported by indigenous knowledge, the extreme nature of the sites makes them worthy of study. In fact, in the politicised world of genetic resources, the absence of human involvement is probably an attraction for some companies.

From flora to fauna
*Loss of diversity
 among livestock
 breeds*

FAO argues that close to two billion people rely on livestock for some—or most—of their livelihood. In a sense, this underestimates the importance of domesticated animals for world food security. Excepting Texas cowboys and Pampas ranchers, those who tend livestock rank among the poorest in the world. They are the nomads and foragers clinging to the edge of deserts or arid mountainsides. They are also the women and children who feed and shepherd the chickens and pigs that forage in the farmyard or around the urban compost. Perhaps as little as 15 per cent of our food security rests on meat and dairy products but livestock's contribution to the most food-vulnerable peoples is much greater.

According to FAO studies, 5 per cent of the breeds of major livestock species are vanishing every year. This can't last for long. If action isn't taken very soon, no action will be needed. Today, in India, 80 per cent of poultry production is based upon exotic introductions and 50 per cent of India's goat

Indigenous knowledge and micro-organisms

Precautions must also be taken in the neighbourhood of swamps because there are bred certain minute creatures which cannot be seen by the eyes, which float in the air and enter the body through the mouth and nose and there cause serious diseases.

Varro (Roman scientist and physician, 116-27 BC)

The Laws of Life (Development Dialogue 1988:1-2) began with the story of Anton van Loeuwenhoek—the Caretaker of Delft—and the inventor of the microscope. Loeuwenhoek's 17th century invention, we wrote, exposed a world beyond our sight and opened the sequence of doors to current-time biotechnology. Not quite. If our earliest record of the use of medicinal plants dates back 60,000 years to northern Iraq, our first indication that ancient societies could magnify and study the world's smaller forms of life also comes from northern Iraq at least 4,000 years before the Dutch inventor made his discovery. Lens found in Crete dating from the fifth century can magnify perfectly up to seven times and, with distance distortion, up to 20 times.³⁷ Were ancient physicians aware of microbial life as well? Varro's warning from first century Rome suggests that knowledge of micro-organisms is far from recent. Indigenous peoples the world over know how to use certain soils for wounds or tumours. Traditional medical practitioners talk knowingly of the 'living soil'. When pharmaceutical companies go searching for soil, the smart researchers talk with local people before reaching for a shovel.

breeds are threatened by extinction. Across the Kaber Pass in Pakistan, the Pak-Angora goat is down to its last herd of 380 animals. The goat is both heat-tolerant and disease resistant. Meanwhile, the Yakut cattle of Siberia, which can withstand temperatures of -60°C and boast a highly-concentrated and nutritious milk, count no more than 900 living animals. In the Philippines, fewer than a thousand of the country's hardy Banabo chickens survive even though they are resistant to most pests and predators. One of the most hardy and best milk-yielding dromedaries in the world, the Arvana-Kazakh (of Kazakhstan), is also on FAO's endangered list. China, the home of the pig, is losing its breeds to North American and European imports at a terrifying rate.

What's being lost—as always—is the diversity that, today, keeps the poor alive and, tomorrow, could be vital to us all. What's being done about it is almost nothing. At FAO, an energetic Aussie named Keith Hammond is working night and day to win the attention of governments for DADS—FAO's Domestic Animal Diversity programme. While Hammond has managed to piece together a network of about 70 national contact points and about USD 2.5 million in core support, he is left to work almost single-handedly with a couple of civil society organisations—to maintain the endangered breeds.

Goodbye Dolly?

I was en route to the Philippines when the news that Scottish scientists had succeeded in cloning an adult sheep first broke in the *New York Times*. When I disembarked from a small prop plane in the provincial capital of Bohol,

Rene Salazar of SEARICE handed me the local paper—headlining the cloning story.

The news about Dolly, of course, rang around the world. Except for that initial story in the *New York Times*, however, nobody talked about the potential impact livestock cloning might have on animal genetic diversity. In theory, the cloning technique—when perfected—could allow us to multiply individuals from rare breeds to improve their survival odds. Since it took Dolly’s ‘inventors’ 177 false starts, however, the prospects of Keith Hammond’s endangered breeds being salvaged by cloning seem slim. It is far more likely that the perfected technique—by being able to mass-produce elite individuals—will add to the extinction pressure.

When I saw Keith Hammond in Rome about three months after Dolly made her debut, the FAO geneticist added another dimension to the story. As much as the media have ignored the potential impact on diversity, they have also overlooked the underlying scientific breakthrough that Dolly represents. About eight months before the *New York Times* account, the Roslin Institute published its development of ‘reverse DNA quiescence’—the ability to walk inside an adult cell and switch on all the lights, to take a mature cell that is busy growing hair and restore all the dormant genes inside so that cell could become part of your liver or brain ... or a whole new cloned sheep. Hammond theorises (but does not confirm) that reverse DNA quiescence might allow impoverished national governments—solely as a back-up to the ongoing use of rare breeds—to maintain an *ex situ* stock of endangered animals at extremely low cost. If the technique works, Hammond reasons, then the current expensive, complex, and unreliable system of nitrogen storage of sperm and eggs could be replaced by a few tufts of hair preserved under very low-tech conditions. Conservationists would need only to walk up to a herd of animals and pluck a few hairs from each in order to replicate the entire herd should the need arise.

That’s the theory ... Meanwhile, the poor and powerless have learned not to count their chickens before they hatch.

Parts-mortem

There’s an old axiom in law that anything found in the soil is the property of the finder—or of the state—if there is no clear land title. This holds true for nature’s creepy-crawlies and for people too. It was with this presumption of law on his side that Ales Hrdlicka opened the graves and removed the bodies of 756 Alutiiq people of Larsen Bay, Alaska, in the 1920s and 1930s. According to elders, some of the bodies were only ten years buried. The biopirate shipped the remains to the Smithsonian in Washington DC where they were crammed, pel-

vic bone to pelvic bone, with almost 18,000 other indigenous cadavers owned by the museum. Some threatened human communities have more dead members in the Smithsonian than live members in their traditional territories.

A 1986 Louisiana court decision (Charrier versus Bell) is changing all this. The Tunica-Biloxi community won back the graves of several indigenous members even though the land was not titled to them. Partly as a result of the law suit, the US government enacted the Native Graves Protection and Repatriation Act and the Alutiiq were free to rebury their ancestors in 1991. Many other aboriginal communities are forcing museums to surrender their grisly displays and return the bodies for traditional burial.

Most notable in these efforts is the global struggle waged by the Hui Malama i na Kupuna o Hawai'i'i Nei (Group Caring for the Ancestors of Hawaii), organised in 1989, to block the destruction of 1,100 graves on the island of Maui. Ultimately, a Ritz-Carlton Hotel had to give way and turn the land over to the State of Hawaii. The Hui Malama have since campaigned successfully to recover human remains from 18 museums in the USA, Australia, Canada and Switzerland.³⁸ The task that awaits, of course, is to achieve as much for the living.

Soon we will have all the instructions on how to make a human being—what thinking means and what memory means—it will totally transform how we view ourselves...

Alan Bernstein, Director, Samuel Lunenfeld Research Institute, Mount Sinai Hospital, speaking at the University of Toronto, 12 June 1996

Human bio-diversity: What would Abraham Lincoln do?

Early in 1993, RAFI followed up scattered rumours about something called the Human Genome Diversity Project (HGDP) by contacting scientists who appeared to be attending its meetings and asking them to send us information. En route to Rome, I picked up a large stack of papers sent to us from California and read them on the plane. Normally, I am asleep before the plane takes off and only wake up when the jet is bouncing down the tarmac at the other end. This was a sleepless flight.

'Isolates of historic interest'

The HGDP is an informal consortium of individual scientists—molecular anthropologists, population geneticists, etc.—and their academic institutions, whose stated interest is in mapping the ebb and flow of humanity's journey around the world and throughout recorded and unrecorded history. According to the correspondence and papers, members of the HGDP have a thirst to know who crossed the Red Sea first and when and where 'who' in

the human family first made it to the Western hemisphere.³⁹ They want to know whether it was the ‘idea’ of agriculture that travelled from ancient Anatolia (modern Turkey) or the farmers themselves. (It was the farmers.⁴⁰ Europeans seem to be notoriously slow learners!)

To solve these unsolved mysteries of the human pilgrimage, the stack of papers told me, the Project was debating whether to grid the planet in 50-kilometre squares and sample people in every block—or to track down the many thousands of distinct human communities scattered about the globe. Either way, molecular geneticists would use the genetic information in siphoned blood samples to build a retrospective map of our past meanderings. The physical task of obtaining living DNA samples seemed a titch ghoulish—researchers would draw blood and take hair roots and cheek scrapings from, optimally, 50 people in each sample group and then ‘immortalise’ human cell lines (the entire DNA of a human being), via liquid nitrogen, in a tissue culture bank.

Hair-pulling aside, the difficulties of the task, as perceived by HGDP members, lay in reaching remote ethnic communities in rainforests or on mountain tops and scampering back fast enough to get their grisly cargo into cold storage before it deteriorated. There are between 4,000 and 6,000 distinct languages,⁴¹ and, therefore, at least as many indigenous peoples, to be sampled. Working in geographic task groups, scientific experts concluded that it was possible to put together a priority list of genetically distinct human communities in imminent danger of extinction. At one meeting, the group came up with more than 720 such ‘endangered’ peoples. The threatened indigenous peoples were listed and identified, with awesome scientific insensitivity, as ‘isolates of historic interest’.

*Saving the ‘good’
Samaritans*

The Project’s members were, according to their papers, aware that the collection of human cell lines around the world held a number of worrying implications. There was the issue of obtaining medically approved ‘prior informed consent’ from indigenous peoples, many of whom speak none of the UN’s official languages, and are rightly distrustful of strangers with sharp instruments wanting blood. There was also the problem of racism. The Project’s results could be interpreted as feeding into the twisted analysis of race supremacists willing to manipulate the genetic data to prove their own right to domination. Less grandly—but very realistically—the collected genetic information could facilitate more subtle forms of employment discrimination, or be abused by insurance companies to curtail access to health care.

As legitimate as these concerns were and are, the HGDP missed a few. DNA sampling of indigenous peoples might give governments facing land disputes a means of claiming that the community involved was not wholly ‘indigenous’—or that another group may have settled the area first. An indigenous nation is not a blood type, it is a culture. Then there are questions of life view: some individuals or communities might reject the concept of ‘immortalisation’ even if it only involves a blood sample. Others, with a strong sense of land, might resist the idea of having an ‘immortalised’ part of themselves exported and stored on foreign soil.

But there are still other concerns. Although the viruses and bacteria we found in the American Type Culture Collection were mostly from soils, they were also from the diseased ears of cats and the entrails of insects, and from ‘blood from an American soldier, New Guinea, 1943’ and the ‘stool of an Iowa man’ who had recently been in Bangladesh. We also found that the WRAIR/WHO Leishmania Reference Center (formed by the World Health Organization) sports deposits simply identified as ‘human’. The more we explored these strange-seeming entries in the ATCC catalogue the more we encountered the admonition that the collected sample was part of a US or other patent claim. The ATCC is the world’s premier repository for microorganisms incorporated in patent claims. Not only soil samples, insects, and mammals, but even human biomaterials, were obviously patentable subject matter. Biotechnology—relatively old aspects of it—offers a kind of life-after-death. Bits and pieces of life, including the complete DNA of a human being, can live on—‘pickled’—in a liquid nitrogen cylinder stored at the American Type Culture Collection. Human genetic material—material of the kind that the HGDP proposed to collect—could be commercialised and patented.

We needed to know where the HGDP’s funding was coming from. The US government is not known for its love of history. Yet, the HGDP either had—or was seeking—funding for its history project from the US Department of Energy and the US National Institutes of Health (NIH). At the NIH, medical research was often a shared venture with the private sector. In early 1992, Camila Montecinos and I were in Cartagena, Colombia, at UNCTAD VIII when we saw the headlines in the *Wall Street Journal* reporting that Craig Ventner (then of the NIH) had submitted a patent claim on thousands of DNA fragments and genes that his computers had discovered in the human brain. The NIH defended its patent claim arguing that Ventner’s computer system had found parts of the brain no one had ever found before; that the patent requirement of an inventive step was met by the computer process and that the requirement of inventive utility was met by the mere fact that the

DNA fragments were part of our brains. A year later, as I read the HGDP papers on the plane to Rome, the NIH patent grab was still making headlines. Could the history project of collecting the human cell lines of indigenous peoples lead to NIH patents and commercialisation?

*Patentable people
parts*

That human material is worth patenting might be a surprise to some. Certainly it was to leukaemia patient John Moore. In 1976, Moore had cells from his diseased spleen removed by a University of California medical team who, after some additional research, patented what became known as the ‘Mo’ cell line in 1984.⁴² In time, the university licensed the cell line to the Genetics Institute which, in turn, surrendered rights (for a price) to the Swiss pharmaceutical company, Sandoz. At the beginning of 1996, Sandoz merged with Ciba-Geigy to form Novartis. There, now, lies the legal right to a piece of John Moore’s body. One estimate places the long-term commercial market for the cell line at about USD 1 billion. This being a fighting figure, Moore demanded the return of his spleen cells and rights over his own bodily parts—cancerous or not. In 1990, the California Supreme Court determined that Moore had no direct claim on any parts of his body once they were removed, but that he did have the right to sue his doctors for improperly appropriating his spleen cells. The wise doctors settled out of court.

Ambiguous though the decision was, the door was left ajar for the patenting of human material with or without the consent of the human.

Then, as we were trying to make sense of the HGDP’s well-intentioned effort to fill in the blanks of history, *Genetic Engineering News* reported, also in 1993, that 30 citizens of Limone, an isolated Italian community, have a unique gene that codes against many forms of cardiovascular disease. Pharmacia, a Swedish pharmaceutical company (now merged with Upjohn) working with the University of Milan, swarmed all over the townspeople, taking blood and other samples, and applying for patents. If the genetic trait can be turned into a marketable drug—and this remains a very big ‘if’—the profits will be tremendous. As RAFI dug into the story, we learned with the considerable help of Miges Bauman of Swissaid that researchers had targeted one man who had donated more than 46 litres of blood (over several years) for what he thought was university research. He didn’t know that the University doctor was passing the samples on to Pharmacia in Sweden nor that Pharmacia had acquired a patent related to the research. Could the HGDP result in other such patents?

Everything happens at once. AIDS researchers in Kenya, working through

Canada's International Development Research Centre (IDRC), discovered, also in early 1993, a kind of immunity among some Nairobi prostitutes who would have been expected to contract the fatal disease. Although their good luck is less likely to be due to unique DNA than to the disease's surprisingly low-level infection in these instances, researchers are studying the women in the hope that at least clues if not cures can be gleaned from their germplasm. Not long after, other researchers collaborating with IDRC discovered a similar group in the Gambia.

Back in Ottawa short days before Easter 1993, further RAFI research at the ATCC computer database revealed information on the use of genetic material from a 'six-year-old male human' who appears to have died in Cincinnati in 1939. In 1984 the little boy's immortalised cell line was resurrected by the University of Kansas to become US Patent 4,473,549. The patented material seems to be part of a vaccine for the immunisation of animals (especially birds) and people against *Toxoplasma gondii*—a parasitic disease that can damage the brain, muscles and nervous system. Half a century after his death, the Cincinnati Kid has returned to active service and can now be injected into Colonel Sanders' broilers.

The computer search also turned up the immortal remains drawn from the breast of a cancer victim. The material was patented in 1987 by Tel Aviv University and Teva Pharmaceuticals and the woman's hepatoma cell line is now part of an immuno-assay for breast cancer.⁴³ Another ATCC sample is the cell-line leftovers from 'an eight-year-old Negro male', now also patented.⁴⁴ The incidents became morbidly monotonous.

We regarded our computer screens with very uncertain emotions. With the concurrence of the donors, there was certainly nothing wrong with human genetic material being employed in the service of humanity—be it to safeguard chickens or in the more noble service of combating breast cancer. If the ATCC collection was undeniably ghoulish, it was hardly immoral. Nevertheless, it was difficult to accept that the tenants of the tissue culture repository would have waived their right to secure benefits for their families or communities when their genetic material was commercialised. It seemed even less credible that they would have agreed to have their material patented for the private profit of others. We were absolutely certain that the Human Genome Diversity Project had substantial moral and commercial implications that the HGDP itself seemed reluctant to acknowledge.

On the last working day before the Easter break, we sent out a fax to everyone we could reach among indigenous peoples' organisations and many

governments, outlining our growing alarm over the Project. Along with the retinue of worries described above, we added another: that human biomaterials could be used in biological warfare research. In *The Laws of Life*, Cary Fowler wrote a deeply-disturbing chapter on ‘Mars and Microbes’, examining the potential use of new biotechnologies to develop a much more insidious generation of biological weapons. The compilation of human genetic diversity in tissue culture collections would, we reasoned, facilitate the development of diseases that could target specific age groups, gender groups or ethnic communities—if not today, then in the decades ahead.

Delivered in our usual modest style, the fax excited considerable reaction. Among the most excited was a Stanford law professor named Henry Grealy who was volunteering his time to the HGDP as the Chair of its North American Ethics Committee. The professor and I spent the spring and early summer of 1993 e-mailing one another about various points in our fax and Communiqué. We were hung up on two points. First and most fundamental was Grealy’s sincere desire to win RAFI over and to make us a go-between for the HGDP and indigenous peoples. I kept sending the professor mailing addresses for indigenous peoples’ organisations and he kept trying to make RAFI ‘middleman’, when no such service was needed.

To be crystal clear—RAFI was not opposing the HGDP in principle. We were saying only that its work had to be negotiated with indigenous peoples in a UN forum. If indigenous peoples supported the HGDP, we would too.

It was both astonishing and telling that the HGDP seemed to have no notion how to reach indigenous peoples. For people—among them anthropologists—so interested in people and history, they displayed a stunning lack of familiarity with the social dynamics of indigenous organisations today. Grealy’s entreaties were so persistent and so oblivious to our insistence that the HGDP ‘dial direct’ to the folks they wanted to sample, that we finally made the unprecedented decision to close the dialogue and force the negotiations to the people most involved.

*‘Human nature’
and monopolies*

In the summer of 1993, I was responding to a request from a civil society organisation in India looking for more information on soil patents involving that country. Once inside the ATCC database, I typed in a query for accessions with the words ‘India or Indian’. Among the ‘hits’ was ATCC CRL-10598, comprising the remnants of ‘a 26-year-old female Guaymi Indian patient in Panama’. The accession contained an entire human cell line established by a Dr Michael Dale Lairmore of Columbus, Ohio. The not-always-accurate notation on the screen indicated that the accession was part of a

patent claim. Further, companies could have their own immortalised Guaymi from the ATCC for USD 127—assuming they could make a deal with Mr Brown.

We hadn't yet broken off contact with the HGDP and I sent a note to Henry Greely noting that the ATCC reference implied that an indigenous person was currently the subject of a patent claim. Henry Greely immediately replied that the woman's cell line was probably an irrelevant part of a larger claim.

The last time I'd felt this way was in 1983 when I received a 'brown envelope' containing a signed memo from the US government to IBPGR advising the institute that the United States regarded any donated germplasm to be US property—and that the USA reserved the right to embargo access to other countries—including the original donors—as it saw fit.

With absolute incredulity, I placed our monthly CD ROM of world patents into the computer drive and called up 'Guaymi'. There was one hit. The patent title read, 'Human t-lymphotropic virus type 2 from Guaymi Indians in Panama'. The world patent claim had been made in 1992 and Michael Lairmore was cited as the woman's 'inventor'. The patent application stated: 'This is the first isolation of HTLV-II from a defined non-intravenous drug using population. The present invention further relates to methods of identifying anti-HTLV-II ... and to a variety of bioassays for the detection and diagnosis of HTLV.' Lairmore's employer—and the holder of the patent claim—was the late Ron Brown, the US Secretary of Commerce and thus responsible for the US Patents and Trademark Office and the signing authority for any US government patent claims made abroad. Appropriately, it was Ron Brown who—with (then) Trade Representative Mickie Cantor—was responsible for GATT negotiations. It was at GATT that Messrs Brown and Cantor were demanding global acquiescence to the patenting of all forms of life. Coincidentally, the world patent application was published exactly one week after the United States succeeded in keeping cell libraries and gene banks outside the final text of the Biodiversity Convention and short days before the Rio Earth Summit adopted the Treaty. While the Summit took every opportunity to extol the virtues of indigenous knowledge, the US was patenting indigenous people.

Over the next few days, I talked to Lairmore and his former employer, the Centre for Disease Control (CDC) in Atlanta. It became clear that the CDC was in search of HTLV viruses around the world and that they had come across one type in the Guaymi cell line. Theoretically, a cell line containing the HTLV virus could prove medically important for developing diagnostic

kits—possibly even cures—for leukaemia. According to the Atlanta office, they were seeking a patent in order to safeguard public sector research interest in the virus. How they obtained the blood sample; the extent to which the woman—or the Guaymi—were informed of the CDC’s interests—remained unclear despite my careful questioning.

I talked with Alejandro Argumedo and Camila Montecinos and a few days after the discovery was on a plane to Colombia. While the meeting in Colombia was to look at our work with partners on crop genetic resources, I took the opportunity to sit down with Camila, Rene Salazar of the Philippines, Regassa of Ethiopia, Andrew Mushita of Zimbabwe, and Henk Hobbelink (GRAIN) to discuss the US patent attempt on the Guaymi. In the end, Camila bought me a plane ticket and Alejandro Argumedo made contact with the Guaymi General Congress—so that I could fly to Panama City and meet with the Guaymi.

At about 11 p.m. one Saturday night, I was drinking beer (they were drinking tea) in a hotel bar with three leaders of the Guaymi General Congress. Through a kind interpreter whose English was worse than my Spanish, I tried to explain to strangers what an HTLV virus was; what a patent was; why GATT was important; and why Ron Brown wanted their blood. By the time the sun was first making itself felt on the Panama Canal, I was back on a plane for Miami hoping the Guaymi General Congress didn’t think I was an idiot.

Two weeks later, two members of the Guaymi Congress and Jean Christie from RAFI, were all in Geneva together challenging the US patent application. The Guaymi won. The media ‘photo-opp’ of Ron Brown faced off against Guaymi people at GATT in Geneva was a little too much for the United States to stomach at a delicate time in the trade negotiations. Before the interminable 1993 rang down its curtains, the patent application was withdrawn.

The victory was shortlived. In 1995, however, Miges Bauman of Swissaid was on the telephone with news of two other patent claims on indigenous peoples. In each case, the claimant was the United States of America. This time, the targets were a 20-year-old Hagahai man from Papua New Guinea and a 57-year-old woman from the Solomon Islands. Both carried HTLV viruses in their cell lines.

Jean Christie flew from Australia to both Papua New Guinea and the Solomon Islands to talk with governments—these meetings setting off a howl of

protest around the Pacific. Meanwhile, I changed my travel plans to detour to the Hague in order to pay a call on the International Court of Justice.

The last time I had been at the Court was in 1970—during the Second World Food Congress—when several hundred ‘youth’ from around the world put on trial the politicians who spoke the same platitudes at the second congress as they had at the first (in 1963). In the grand finale of the mock trial, five of us were to climb the fence surrounding the Court and nail our verdict to the palace’s front door. With typical Dutch organisation and decency, it had been tactfully pre-arranged that the five of us who were to nail the verdict would be arrested after the act and spend a few hours in jail. Unfortunately, under the flickering torchlight, we realised that somebody had forgotten to tell the guard dogs protecting the wide lawns around the building. We decided to mail our verdict instead.

So, a quarter of a century later, I passed through the World Court’s doors for the first time. When I left The Hague three days later, I was convinced that not only the patenting of indigenous peoples’ cell lines by foreign governments—but the wider issue of life patenting—had to be, and could be, raised to the level of the Court.

A few weeks later, Rene Salazar of SEARICE and Alejandro Argumedo of Cultural Survival Canada and IPBN were with Beverly Cross, Edward Hammond and me in Jakarta. It was the second ‘COP’ (Conference of the Parties of the Biodiversity Convention). Together we decided to bring the issue of human cell line patenting before the Convention since, technically, human biodiversity is part of the Convention. It was, by no means, our intent to surrender the panoply of indigenous and other human rights issues to a Convention dominated by park wardens who thought they were dealing with panda bears. The intention was to use the political forum created by the intergovernmental body to point out that human biodiversity and projects such as the HGDP were not being monitored within the UN System.

The Solomon Islands and Papua New Guinea led the plenary hall attack on the US patent claims supported by a surprising range of countries that included Sweden and Canada. Although the US delegation refused to respond—even to direct questioning—in the formal meetings, we had a confrontation in one of the civil society seminars on intellectual property. Much flustered, a US diplomat told an angry gathering that his government had gone ahead with the patent on the Hagahai man only at the request of the Hagahai themselves. Through requests made under the Freedom of Information Act, Edward Hammond had already determined that the US govern-

ment had not a shred of evidence to substantiate this absurd defence. That the US Commerce Department was venturing into a new form of foreign aid by fronting the legal fees for a patent they regarded, now, to be commercially irrelevant, was too much for the audience to believe.

The Solomon Island patent claim was dropped before it was granted by the US patent office. The Hagahai patent was granted but continuing opposition from indigenous peoples and from Papua New Guinea led to its cancellation as well. The announcement of the removal of the Hagahai patent came, with a poetic logic wasted on the Commerce Department, on UN Human Rights Day—December 10, 1996.

If RAFI was successful in defeating the foreign claims on human cell lines, we have not been successful in stopping the patenting of human genetic material. Our investigations revealed, in early 1997, that patents are pending on more than one million human genes and human DNA sequences. Several hundred patents on human genes and sequences have already been granted.

Then as the RAFI board and staff gathered for our annual meeting in Bohol, Philippines, late in February 1997, Rene Salazar brought us all news clippings of the successful cloning of an adult sheep ‘Dolly’. By May, RAFI had obtained copies of the two patent applications made through the World Intellectual Property Organization (WIPO) by the Roslin Institute in Scotland. The scope of the patents claims includes the cloning of human beings. Not long after came ‘Polly’—a cloned lamb carrying human genes. Hard on its hooves came news that Japanese researchers could transfer whole human chromosomes into rodents. Then came ‘Gene’ the cloned calf created by a different and more efficient process than Dolly or Polly and bringing us still closer to the cloning of human adults. All disturbing. All under patent claims.

* * *

In October, 1997, a special committee of the US National Research Council, responding to a request from the NIH and National Science Foundation, tabled a report making clear that the Human Genome Diversity Project lacked the international governance structure, ethical guidelines and programme logic necessary to warrant the US government’s financial support. It was a stunning—possibly fatal—setback for the HGDP. At the outset of the Committee’s review process, RAFI and colleagues from Indigenous Peoples’ Organisations in Colombia and the Solomon Islands had testified before it and raised the same concerns. It was the first time that the US sci-

entific establishment had heard directly from indigenous peoples on this issue. The committee, however, did endorse the importance of collecting and analysing human genetic diversity for both medical and historical reasons—under the right international arrangements and with the full participation of indigenous peoples. The committee also expressed its strong disapproval of the patent system. Finally, the committee agreed that those who make their genetic material available never relinquish control over it and have the right to recall the material rather than risk it being used for purposes not previously accepted.

A few days after this victory, RAFI's Edward Hammond, acting on information uncovered by Beverly Cross, discovered that the National Science Foundation—the governmental authority that had requested the evaluation—had continued to fund the HGDP throughout the evaluation process and had, in fact, spent more than USD 2 million on human genetic diversity research from Botswana to Bolivia to Borneo while the study was underway.*

* * *

Outside the main entrance to the Department of Commerce in Washington, DC, stands a plaque with an inscription from Abraham Lincoln, 'The patent system added the fuel of interest to the fire of genius'. One hundred and thirty years later, would Lincoln still be a patent booster—or would he be in Rockville, Maryland, freeing the slaves?

*I do not know whether I was then a man
dreaming I was a butterfly,
or whether I am now a butterfly
dreaming I am a man.*

Chuang Tzu (369-286 B.C.)

Notes

1. US patent 4,814,324.
2. US patent 4,981,980.
3. This estimate is found in Joyce, Christopher, 'Western medicine men return to the field', *BioScience*, Vol. 42, p. 399(5), June 1992, and also in Axt, Josephine R., Corn, M. Lynne, Lee, Margaret, and Ackerman, David M., 'Biotechnology,

* For continuing information on this and other matters addressed in this issue of *Development Dialogue*, readers might wish to access RAFI's Internet home page at <http://www.rafi.ca>

- Indigenous Peoples and Intellectual Property Rights', CRS Report for Congress, April 16, 1993, p. 12.
4. Mussey, Dagmar, 'J&J, Merck Ready First Euro-Brand', *Advertising Age*, October 26, 1992, p. 1. and Costa Rican data from PC-Globe 5.0.
 5. DeMassi, J., Hansan, R.W., Grabowski, H. G., and Lassagna, L., 'Costs of Innovation in the Pharmaceutical Industry', *Journal of Health Economics*, 1992, Vol. 10, p. 107.
 6. Axt, Josephine R., Corn, M. Lynne, Lee, Margaret, and Ackerman, David M., *op. cit.*
 7. US patent 5,215,882.
 8. 'Philippines-Medicines: Who really discovered erythromycin?', Inter Press Service, November 9, 1994.
 9. US patent 3,334,016.
 10. US patent 4,495,286.
 11. US patent 3,683,074.
 12. US patent 5,102,794.
 13. US patent 4,925,663. ATCC registration number 20872.
 14. *AgBiotechnology News*, September/October 1990, p. 22.
 15. *Business Week*, November 14, 1994, p. 72.
 16. Cohen, Tracy, 'Pharmaceuticals from the Sea', *Technology Review*, Vol. 96, No. 3, p. 15(2), April 1993. In the article, an oceanographer engaged in marine soil research at the University of California (San Diego) places the annual corporate expenditure at USD 10 billion. This figure seems unlikely since it would amount to 8 per cent of global drug industry sales.
 17. 'Tuck into a Soil Sandwich', *New Scientist*, 18 October 1997, p. 14
 18. Scheuer, Paul J., 'Drug from the sea', *Chemistry and Industry*, No. 8, p. 276(4), April 15, 1991.
 19. *Ibid.*
 20. *Ibid.*
 21. Reid, Walter V., *et al.* (eds), *Biodiversity Prospecting*, World Resources Institute, Washington DC, 1991, pp. 13–14.
 22. *Global Marine Biological Diversity*, ed. by Elliott A. Norse, Island Press, 1993, p. 6.
 23. Thorne-Miller, Boyce, and Catena, John G., *The Living Ocean: Understanding and Protecting Marine Biodiversity*, Island Press, WA, 1991, p. 28.
 24. *Diversity*, Vol. 9, No. 4, 1993, and Vol. 10, No. 1, 1994 (double issue), p. 83.
 25. Thorne-Miller, Boyce, and Catena, John G., *op. cit.*, pp. 61–62.
 26. 'Spain gives tepid reaction to release of Estai', *European Business Report*, March 15, 1995.
 27. Pescanova, which has annual sales of Pta 60,000mn, with its shares largely controlled within Spain although 20 per cent are held by Imperial Cold Storage (South Africa). The company has 13 per cent of the Spanish frozen food market, and more than 40 per cent of the frozen fish market. Pescanova has 20 per cent of the pizza and prepared food market in Spain as well. Unilever is said to be interested in buying Pescanova which is rumoured to be vulnerable because of its rapid overextension and heavy debt load.

28. 'PharmaMar: Risk capital costs to buy stakes after capital increases by FY92', *Cinco Dias*, August 6, 1990, p.10.
29. 'PharmaMar talking to foreign investors', *Pharmaceutical Business News*, January 24, 1994.
30. McNamee, David, 'Eye of next, toe of frog (many creatures secrete chemicals that have pharmaceutical properties)', *The Lancet*, Vol. 344, No. 8938, p. 1696(2), December 17, 1994.
31. 'Once participates in PharmaMar, *Marketletter*, November 29, 1993.
32. 'PharmaMar talking to foreign investors', *Pharmaceutical Business News*, January 24, 1994.
33. 'Pescanova, atrapada por un endeudamiento de 40.000', *Pais* (Madrid, Spain), January 22, 1995, p. 8.
34. 'IFC approves loan for expansion of Namibian fishing companies first project in Namibia to get World Bank Group financing', *News Release*, June 16, 1994.
35. Hickling, C. F., *Water as a Productive Environment*, Croom Helm, London, 1975, pp. 140–141.
36. 'Interpeche: Fish processing costs is 70 per cent acquired by Pescanova', *Expansion* (Spain), April 25, 1990, p. 40.
37. James, Peter, and Thorpe, Nick, *Ancient Inventions*, Ballantine Books, New York, 1994, pp. 157–161.
38. 'Protection of the Cultural and Intellectual Property of Indigenous Peoples', prepared for the First International Conference on Cultural and Intellectual Property Rights of Indigenous Peoples, New Zealand, June 12–18, 1993.
39. For further information, see *RAFI Communiqué* on the Human Genome Diversity Project published in 1993.
40. Ruhlen, Merritt, *The Origin of Language—Tracing the Evolution of the Mother Tongue*, John Wiley and Sons, New York, 1994, p. 182.
41. Ruhlen, Merritt, *op. cit.*, p. 62.
42. US patent 4,438,032.
43. US patent 4,707,438.
44. US patent 4,393,133.