

THE LAKE BOGORIA EXTREMOPHILE: A CASE STUDY

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Background:

In the early 1990s, a PhD student from the University of Leicester studied the organisms in Kenya's Lake Bogoria and classified and named the ones she found. Sometime after she had collected them, a biotechnology firm called Genencor International sold an enzyme it had extracted from one of the organisms found in Lake Bogoria—a special type called an “extremophile”—to its business partner, Procter & Gamble. Procter & Gamble ultimately used this enzyme to develop an extremely successful line of Tide bleach that was used to stonewash denim.

While Genencor adamantly defends its “biodiversity expeditions”, critics of its actions are concerned about the effect that these projects have on the autonomy of indigenous peoples and governments. In 2004, the Kenyan Wildlife Society (KWS) in conjunction with the International Centre for Insect Physiology and Ecology (ICIPE) announced their intention to bring an international lawsuit against Genencor for its violation of intellectual property rights. The lawsuit never came to fruition and the issue remains an unresolved and debated topic to this day.

Activity:

This activity is a role-playing exercise which will attempt to simulate the proceedings of the international court case of the Kenyan Wildlife Service versus Genencor International had it come to realization. The class has been broken into four groups and you have been assigned to one of the following. The four groups will represent interest groups; the first two are the parties directly involved and the other two have relevant interest in the outcome of the case.

Activity Schedule:

Step One: Students should begin by individually reading Christine Gichure's article entitled "[Who Benefits From African Research?](#)" in order to gain a background understanding of the details and terms of this case.

Step Two: Students should study the readings for the group to which they have been assigned. It is only necessary to read the assignment from the group to which they belong. Students should write down what they believe are the main points in support of their group's argument, also noting some of the weaknesses of the position so that as a group students can plan how to best defend these points.

Step Three: Students should gather together with the other members of their assigned group to discuss the main points that each noted as well as the potential weaknesses in the case. Together the group should develop a short (5 to 10 minute) presentation that will demonstrate its position and interests (according to the position they have been assigned; personal viewpoints can be discussed later). The presentation should be formatted as if students are testifying before the international court. Ultimately this presentation should include whether or not the group believes that the court should find Genencor liable.

Step Four: Each interest group will present its case. After all the presentations each group will have a brief chance to respond to the claims made by opposing interest groups and to pose questions to one another or raise objections. (This is where it will be important to have anticipated for and prepared responses to the potential weaknesses in a group's position.) They will each then make a very brief closing argument.

Step Five: After receiving questions and objections, each group will reconvene and discuss any alterations to their position that might be necessary to strengthen it in light of the comments. Then the group will work together to quickly draft a one page brief summarizing their official petition to the court. Each group only needs to turn in one brief.

Step Six: Once this has been completed, there will be time to discuss the proceedings and outcome of the activity; only now may students express their own opinions and viewpoints.

The four interest groups will be:

1. [Genencor International](#)
2. [Kenyan Wildlife Service](#)
3. [The Kenyan People](#)
4. [Mascoma Corporation](#)

*** A word to students about their interest groups:**

You should do the best to present your group's argument in the strongest way possible, even if you do not personally agree with the viewpoint that is being presented.

Why the KWS and the Kenyan People separately?: As will be shown in the following readings, the government of Kenya is most concerned with charging fees for permits and scientific exploration but it seems like it might be in the best interest of the people if the technology remained in the country of its origin, especially in the hands of the residents of the area. Additionally, it is possible that if the Kenyan government was able to charge and retain a fee that it would have different priorities for spending than would the people and that the latter's interests might not be adequately served by the government's use of the money.

The research student: The research student herself has not been included as an interest group. She did not identify the potential uses of the organism; she merely categorized it. The alleged wrong in her case is an issue of research ethics, not intellectual property (the latter being the focus of this case study).

Procter & Gamble: Procter & Gamble is not included as an interest group because it legally purchased the technology from Genencor so if there is an issue of moral responsibility it seems to be more on the shoulders of Genencor. For the purposes of this case study, Procter & Gamble's interest can be considered mostly identical to Genencor's.

Suggested Discussion Questions:

1. Who owns the extremophiles found in Lake Bogoria? How come?
2. Are the residents of the Lake Bogoria area owed some portion of the revenues from the sale of the Tide detergent?
3. Was it illegal for the extremophiles to be taken out of Kenya?
4. Was it immoral for the extremophiles to be taken out of Kenya?
5. Assuming some Kenyans are owed compensation, is there any reason why the interests of the Kenyan Government might not be the same as the Kenyan people? If this is the case, what steps should be done to ensure that the people of the Lake Bogoria area receive the compensation they are due?

Genencor



From Genencor's website:

BIODIVERSITY

Extreme environments provide microbes containing robust enzymes. Using this approach, Genencor has commercialized two new industrial enzymes originating from extreme environments.

Extreme environments yield novel Genencor products

In 1998, we commercialized an extremophile enzyme. Puradax cellulase enzyme was derived from a new *Bacillus* species found in the Rift Valley soda lake of East Africa during an expedition in 1992. In 1999, Genencor introduced IndiAge Neutra, a cellulase derived from a new species of strictly alkaliphilic *Streptomyces*. The bacterium was isolated from the soda mud flats on the shores of the highly alkaline Lake Nakuru in Kenya. For economic production, the endocellulase gene was cloned and expressed in *Streptomyces lividans*. This innovative, easy-to-use enzyme product, can treat denim to create the popular stonewashed look. We continue to produce new products by accessing the microbial gene pool.

Our Expeditions

In our search for enzyme candidates we collaborate with a network of internationally-respected scientists to gather and preserve soil and water samples from diverse environments around the world: from frigid Antarctica to the hydrothermal vents of undersea volcanoes, from arid deserts to high-alkaline soda lakes. Together with our collaborators, we have published extensively on sites in Europe, the Antarctic and East Africa amongst others, including both culture-based and molecular analyses of biodiversity, plus the biotechnological exploitation of these extreme biotopes.

Our scientists have participated in a number of expeditions to extreme environments in Europe, Asia and Africa for field studies. We have also participated in many European Union projects on extremophile microbes and Antarctica biodiversity and have been pioneers in developing the technology for commercial application. In October 2002, we announced that we will participate in a collaboration for microbial biotechnology

between the EU and the People's Republic of China. The three-year €1 million euro project funded by the European Commission Fifth Framework Program strives to identify metabolic and genetic diversity as a source of new and valuable products. In accessing natural resources from all over the world, Genencor strives to protect biodiversity.

A typical Biodiversity Expedition

A typical biodiversity expedition, which may lead to new products on the market, includes sampling of the extreme environment site, on site nucleic acid extraction, isolation of DNA and RNA leading to development of DNA and cDNA libraries. In addition, culturing of the samples can lead to isolation of novel extremophiles from specific sites. We apply high throughput screening technologies to libraries and organisms for cloning and expression of target genes. Using robotics, we apply our customer-specific predictive tests to eliminate false leads and narrow the field of candidates to those genes we are confident can produce the desired protein when transferred into our host microorganisms.

Our Culture Collection

From our large collection of preserved ecosystem samples, each of which includes thousands of different microorganisms, we have the potential to evaluate billions of genes for product candidates. The Genencor culture collection with over 15,000 strains is located in our Leiden, the Netherlands and the Palo Alto, CA facilities, where we maintain many microorganisms including, anaerobes, extreme thermophiles and obligate alkaliphiles.

Article from LiveScience.com by Paul Elias, August 2, 2004:

Biotechs Mine Bacteria for Industrial Use

PALO ALTO, Calif. (AP) -- The creatures are known as "extremophiles," and they earn the name: They live in toxic Superfund cleanup sites, boiling deep-sea rift vents, volcanic craters and polar glaciers -- some of the planet's harshest environments.

These single-celled creatures owe their hardiness to genes, and that has drawn the attention of a few biotech companies. The companies train the genes to mass produce industrial-strength enzymes for such products as better detergents, cleaner chemicals and more effective DNA fingerprints.

Such "bio-prospecting" efforts have huge potential for good. They just might make hazardous waste cleanup more affordable, reduce pollution and make better medicines if the microbes' genetic durability can be exploited and controlled.

But tough questions are being raised as well -- about the morality of allowing private companies to patent and profit from Mother Nature.

The extremophile candidates are numerous. There's *Deinococcus radiodurans*, dubbed Conan the Bacterium by its legions of fans because it withstands 10,000 times the amount of radiation that would kill a human. Found on radiated food, it has a unique ability to repair broken DNA.

In Chile's moonlike Atacama desert -- one of Earth's driest spots -- lives another extremophile scientists say could give them clues to what life might look like on Mars.

And the Pentagon's research arm, the Defense Advanced Research Projects Agency, is sponsoring experiments on genetically engineering extremophiles to extend the shelf life of blood-clotting platelets in extreme conditions. The idea is to help treat battlefield wounds.

Objections to such work often come from activists who complain that Third World countries aren't properly compensated for microbes extracted from their deserts, mountains and sea shores.

"The concern with bio-prospecting is that the people who consider themselves to be the stewards of the biodiversity in a region often aren't consulted or are ignored," said Beth Burrows of the Edmonds Institute, a environmental nonprofit based in Edmonds, Wash.

Native Hawaiians are angry over a deal between the University of Hawaii and a biotechnology company to share in potential profits gleaned from lava sludge. Now the Hawaiian Legislature is considering a moratorium on the transfer or sale of extremophiles found on public lands so environmental and profit-sharing issues can be worked out.

Antarctica is governed by an international treaty that vows to keep the continent open and free to scientists dedicated to peaceful pursuits. But some 92 patents have been filed in the United States and another 62 in Europe that claim ownership of biological property found there.

While such patent applications appear to be legal, "some scientists active in Antarctica worry about whether outright commercial exploitation and patents are within the spirit of the treaty," said Sam Johnston, who co-wrote a report on the subject for the United Nations this year.

The Edmonds Institute sued the National Park Service in 1997 after it gave San Diego-based Diversa Corp. commercial rights to prospect for extremophiles in the fabled hot springs of Yellowstone National Park. The prospecting, involving fees and royalties paid to the government, was ultimately approved by a judge on the condition that an extensive environmental review be completed.

The park service has defended the deal "which remains on hold pending the review" as a way for it to profit on scientific research without disrupting the park's environment. Four decades ago, the park service wasn't so financially savvy when a University of Wisconsin researcher discovered the extremophile *Thermus aquaticus* in a Yellowstone hot spring.

Today, that bacterium provides a key enzyme -- polymerase -- used for polymerase chain reaction, better known as PCR, a Noble Prize-winning DNA fingerprinting technique used widely by crime labs, hospitals and university researchers.

Yellowstone doesn't receive any income from sales of the PCR enzyme, now a key tool in the \$300 million-a-year DNA fingerprinting business.

The companies involved say that without the ability to patent extremophiles, they can't make good on the many promises of this area of biotechnology.

David Estell, a researcher at Genencor International Inc., said bio-prospecting requires the collecting of just a few samples, which hardly disturbs the environment.

Genencor is one of the few profitable biotechnology companies in existence, earning \$13 million in the first quarter of 2004 on \$94 million in revenue.

Genencor has the genetic material of 15,000 strains of microbes stored in deep-freeze in Palo Alto and the Netherlands. It already has 11 industrial products on the market, and is using living material -- enzymes and proteins, rather than fossil fuels -- to develop cleaner and cheaper ways of making industrial chemicals.

For instance, Genencor takes a gene that gives a microbe alkaline resistance and uses it to create enzymes for laundry detergent. One enzyme is used in Tide detergent, another is used to give jeans a faded look.

Both are produced by extremophiles found thriving in highly alkaline lakes in East Africa and Kenya. The extremophile genes responsible for making these enzymes are genetically engineered into commonplace bacteria, which are then coaxed to grow by the trillions in giant brewers' vats at Genencor's nine factories around the world.

"The goal," Estell said, "is make proteins do something they've never done before."

The Kenyan Wildlife Service



From the Coalition Against Biopiracy's Captain Hook Awards for Biopiracy:

Nominee: Genencor et al.

Category: Murkiest Case of Biopiracy

For taking, patenting, cloning and selling “extremophile” microorganisms collected from lakes in Kenya. In the late 1980s, scientists connected to Leicester University (UK) collected microorganisms living in the hot geysers of two of Kenya's lakes. The organisms produce enzymes that were found to be great fabric softeners and “faders” – giving fabrics a stone-washed appearance popular with consumers. By 1995, the microorganisms were in the hands of Dutch company Royal Gist-Brocades, and were passed on to US company Genencor when it bought the Dutch company in 1995. Genencor patented them and then began producing them (through cloning) on an industrial scale. Genencor, since bought by Denmark-based Danisco (2005), sells them to detergent manufacturers and textile companies. The Kenyan Wildlife Service maintains that the collectors never had the proper permits to take the microorganisms for commercial use in the first place. To make matters murkier, the Kenyan researcher who proposed the original bioprospecting expedition so that she could write a dissertation on the topic of extremophiles living in Kenya's lakes – she was a Ph.D. student at the time and is now a professor of Botany in Kenya – suspects that her supervisors at Leicester University took the samples without her knowledge. She cannot recall anyone asking her permission to use them. It seems that her UK supervisors conducted clandestine research on the samples, discovered their commercially useful properties and then sold them.

Article from *The EastAfrican* by John Mbaria, August 23, 2004:

KWS Seeks Millions From Procter & Gamble

The action could put a halt to illegal extraction of Kenya's biological resources, particularly those with huge industrial potential

The Kenya Wildlife Service (KWS) is seeking a share of the hundreds of millions of dollars generated from the sales of a popular detergent and a bleaching agent manufactured in the US whose active ingredients were acquired in Kenya illegally.

With assistance from scientists at the International Centre of Insect Physiology and Ecology (Icipe), KWS has launched a claim for a share of the proceeds accruing to the US multinational giant Procter & Gamble and to Genencor International BV of the Netherlands with respect to the sales of Tide Alternative Bleach Detergent and "stonewashing" material.

According to information made available to *The EastAfrican*, Genencor was the company that discovered "extremophiles" (tiny organisms that are able to survive and thrive in extreme environmental conditions) in Kenya, cloned and later sold them to Procter & Gamble, which used them as critical ingredients in the manufacture of the detergent.

With research and genetic manipulation, scientists have not only isolated extremophiles in such extreme environments as hot springs and geysers, but have also reproduced billions of their clones in laboratories (see separate story).

The claim by KWS is significant for Kenya not only because of the sheer amount of money involved, but also because it could put a halt to the illegal extraction of the country's biological resources, particularly the illegal traffic in tiny organisms with huge industrial potential.

According to the Deputy Director in-charge of Research and Development, Dr Richard Bagine, KWS has officially written to lawyers working for Public Interest Intellectual Property Advisors (PIIPA) in the US to handle the matter on its behalf.

However, Dr Bagine said that at this early stage, KWS had not worked out what amount of royalties it will be asking for from the two companies.

"We hope to be guided by PIIPA lawyers, who are able to trace the accounts of these two companies ever since they put up the relevant products in the international market."

In a letter to the founder of PIIPA, Michael Govin, the head of Bioprospecting and Molecular Biology at Icipe, Dr Wilber Lwande, wrote, "PIIPA could first pursue Genencor International and Procter & Gamble for royalties from this discovery and (later) from any other possible discoveries associated with (the) Kenyan samples."

PIIPA is an international not-for-profit organisation whose lawyer-members offer free legal advice to disadvantaged indigenous communities on matters related to the protection of intellectual property rights.

The EastAfrican has also established that KWS is partly banking on the provisions of the Convention on Biological Diversity (CBD), which not only affirms the sovereign rights of signatories over the biological resources found within their territories, but also commits parties to "fair, equitable sharing of the benefits accruing from the utilisation of genetic resources."

Following extensive investigation and interviews with scientists working for the World Wide Fund for Nature (WWF), ICIPE and KWS and with members of the Kalenjin community living around Lake Bogoria, *The EastAfrican* has obtained details of how the samples were collected and shipped out of Kenya.

According to Dr Lwande, the samples were initially collected from a number of alkaline lakes located on the bed of the Great Rift Valley – Bogoria, Magadi, Nakuru, Elementaita and Solai in Kenya, and Natron in Tanzania, in 1998. However, the only samples that yielded positive results were from the hot geysers of Lake Bogoria and along the shores of Lake Nakuru.

The research expedition, which surprisingly seemed to have escaped KWS's attention then, involved scientists from Leicester University in Britain.

"We have evidence to indicate that the samples from which the discovery was made were obtained by Dr William E. Grant of the Department of Microbiology and Immunology at the University of Leicester in the UK," Dr Lwande said.

It is also clear that Dr Grant did not work alone but was in a group of scientists who, though they went ahead to publish their results in the *Extremophile Journal* of the UK in 1998, did not have any authorisation from KWS.

"We do not have records showing that the scientists had notified KWS nor any indication that they had acquired a research permit from the Ministry of Education before embarking on the sampling," said Dr Bagine, who added that although the Education Ministry is normally mandated to issue such permits, KWS is empowered to vet proposals made by researchers working in Kenya's protected areas.

It has also emerged that the group of Leicester University scientists was accompanied by an employee of Genencor, Brian Jones.

"After samples were collected from Lake Bogoria, Brian Jones of Genencor International purchased the samples from Dr Grant and made an enzyme discovery that Genencor later sold to Procter & Gamble," Dr Lwande said. He added that the particular enzyme was then used as a critical ingredient in the (manufacture) of Tide Alternative Bleach detergent."

What remains mysterious, though, is who, probably within KWS or the Baringo County Council – which manages the Lake Bogoria National Reserve together with the Koibatek County Council – had given the researchers protection. Attempts by *The EastAfrican* to get the names of the local officials involved did not yield results.

Dr Lwande said that he alerted members of the former KWS board close to three years ago over the matter, "but for whatever reason the board did not take any action."

The KWS board was then headed by a former attorney general, Charles Njonjo, who was deputised by Dr Richard Leakey.

Procter & Gamble was established as a soap and candle company by the Americans William Procter and James Gamble in 1837. Though the two started it as a family business after being prompted by their common father-in law – they had married sisters, Olivia and Elizabeth Norris – it has grown over the past 167 years to become a \$38 billion outfit as of March 31 this year. Its more than 300 products have a consumer base of about five billion people worldwide and are on sale in 140 countries.

And although the company launched the original Tide detergent in 1946, it has over the years come up with a host of brands bearing the name Tide. A statement posted on its website, www.Pg.com, says that Tide has remained its flagship, retaining its popularity because of its "superior" washing quality and "innovations" that have helped it to remain the company's single largest brand.

For its part, Genencor International Inc is a biotechnology company with an annual turnover of \$380 million. It has offices in California and New York in the US and in the town of Leiden in the Netherlands.

In a number of annual reports, Genencor has stated that its scientists discovered the extremophile from which they developed an easy-to-use enzyme that can treat denim (jeans) to create the popular "stonewash" look, in Kenya.

A message posted on its website, www.genencor.com, reads, "In 1998, we commercialised an extremophile enzyme, *Puradax cellulase*, derived from a new *Bacillus* species found in the Rift Valley soda lakes of East Africa." It adds that Genencor had also introduced *Indiagen neutra*, an enzyme derived from a bacterium that was isolated from the soda mud flats on the shores of the highly alkaline Lake Nakuru in Kenya.

In addition, its 2000 Annual Report says, "To find the enzymes that flourish in alkaline environments, like your Saturday wash water, and enzymes that give your jeans a softer feel and a stonewashed look, we looked for them, that's right, in the soda lakes of Kenya."

The two companies have a long-standing commercial relationship that was strengthened after signing a \$600 million five-year supply contract.

According to a statement he made during the launch of Genencor's 2000 Annual Report, the vice president in charge of research and development at Procter, Dr Nahil Sakkah, said this relationship had resulted in "Genencor delivering innovative biotechnology-based solutions to Procter & Gamble for over 18 years."

But although the two multibillion dollar companies have been patting each other on the shoulder over this evidently mutually-beneficial partnership, the people of Kenya – and

particularly the community living around Lake Bogoria – have not seen a single cent from the millions of dollar generated from the sales of these products.

During a visit to Lake Bogoria last week, a former councillor for Kipkuikui Ward, Samuel Kipket, told *The EastAfrican* that as true owners of Lake Bogoria, the local community has never benefited from the many researches going on there: "We are not even told of the nature of the researches conducted by foreigners."

The manager of the WWF-Lake Bogoria Community Based Wetlands Project, Fabian Musila, said, "A lot of research activities have taken place here but apart from reading the findings in international journals, none of the findings are ever communicated to authorities in Kenya."

He however blames this on lack of an effective research policy that would allow for the monitoring and assessment of the importance such research has to the country and its people.

Mr Musila further said that, in the past two years, Lake Bogoria has hosted numerous researchers from Ruetigart University in the US, the Darwin Initiative, Earthwatch International, University of Japan, University of Arizona and Leicester University.

From the Public Interest Intellectual Property Advisors' website, www.piipa.org:

PIIPA (Public Interest Intellectual Property Advisors, Inc.) is an international non-profit organization that makes intellectual property counsel available for developing countries and public interest organizations who seek to promote health, agriculture, biodiversity, science, culture, and the environment. PIIPA has three main activities:

1. expanding a worldwide network of IP professional volunteers (the IP Corps);
2. operating a processing center where assistance seekers can apply to find individual volunteers or teams who can provide advice and representation as a public service (free or pro bono); and
3. building a resource center with information for professionals and those seeking assistance.

What we do

What can PIIPA's IP Corps do to help?

PIIPA is building a network linking people who need help with IP professionals who can represent them. This establishes a framework for action. PIIPA's global approach can be scaled up as needed and ensures that IP professional resources are the right size, available at the right time, and in the right place

PIIPA's IP Corps can take the following specific types of actions for developing country organizations:

- file patent applications
- file trademark application
- attack and invalidate patents
- attack and invalidate trademark registrations
- search and analyze patent portfolios to determine freedom to operate
- negotiate bioprospecting access and benefit sharing agreements
- negotiate agreements providing access to medicine
- counsel governments on legislative initiatives involving IP protection, e.g. genetic resources, traditional knowledge, and access to medicine
- help governments and NGOs involved in treaty negotiation
- litigate patent and trademark infringement and compulsory license cases

These are unique services not provided by other organizations working on capacity building and training.

Sectors

Biodiversity

In 1992, the United Nations Conference on Environment and Development convened in Rio de Janeiro and created two international agreements -- the climate change framework, and the Convention on Biological Diversity. Generally, the CBD “established sovereign national rights over biological resources and committed member countries to conserve them, develop them sustainably, and share the benefits resulting from their use.” Although the CBD has now been signed by at least 168 countries, significant debate surrounded its passage and still plagues the implementation of the CBD today.

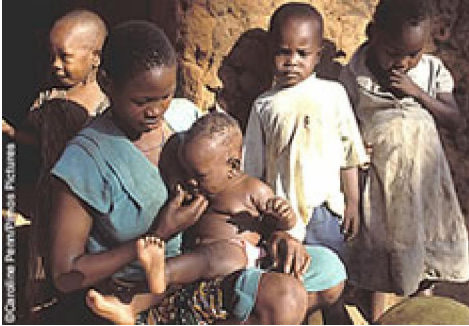
Over the centuries, many samples of unique genetic resources have been taken from their original country of origin to collections in industrialized nations. Many unique biological resources have yet to be catalogued or even discovered. These resources, which are concentrated in developing countries of high biodiversity, remain in demand as sources of leads for new products, or for scientific collections. This demand has led many biodiversity-rich developing countries to exercise their rights over biological resources established by the CBD by enacting national laws and rules to protect their resources. The extension of developing country national laws to require informed consent and benefit sharing as preconditions to access to biological resources has resulted in contractual arrangements between biodiversity source countries and biotechnology and pharmaceutical corporations seeking access to the biological resources. These agreements are variously referred to as either biodiversity prospecting agreements or access and benefit sharing agreements.

While this national legislation relating to biological resources and biodiversity prospecting agreements is intended to protect these countries’ rights to their biological resources, it has also added new legal complexities with which developing countries must cope. Intellectual property experts have not been extensively involved in the establishment of such rules, with the result that they are of limited practicality.

Developing countries, therefore, have a need for professional legal advice regarding the passage and implementation of effective laws, the formation and execution of appropriate biodiversity prospecting agreements, and also their enforcement in the event of a breach. Countries may also require assistance to enforce permitting laws in the event that a company engages in biopiracy – the taking of biological resources without the requisite permissions and agreements.

While some biodiversity prospecting agreements may be fairly straightforward contracts, many provide negotiated royalty payments in exchange for access and sample collection, and other agreements involve complex negotiations regarding the sharing and value of locally-acquired and/or pre-existing indigenous knowledge regarding a developing country's biological resources. Source countries may place a high value on these contracts in monetary, environmental, and political terms. Thus, ensuring that such countries have legal representation that can adequately and appropriately handle the intellectual property issues that arise in the context of biodiversity prospecting agreements, such as licenses for patent, trademark, and trade secret/ know-how rights, and material transfer agreements, is crucial.

The Kenyan People



Article from the International Weekly Journal of Science by David Cyranoski, November 14, 2002:

Microbe hunt raises doubts over local benefits of bioprospecting

Controversy is likely to follow an international consortium of scientists — including researchers from the Chinese Academy of Sciences — as it embarks on a search for commercially useful microbes in the politically contested areas of Tibet and Inner Mongolia.

The scientists will be on the lookout for previously unknown extremophiles — microorganisms that live in inhospitable environments such as salt lakes and hot springs. But it is unclear if the two regions involved will benefit from any discoveries that are made.

The project is being led by microbiologist Bill Grant from the University of Leicester, UK, and includes scientists from the University of Seville in Spain, and the Netherlands branch of the US genomics company Genencor. Its main sponsor is the European Commission, which has donated 1 million euros (US\$1 million). The University of the Western Cape in Cape Town, South Africa, will bring its own funding to the consortium.

The researchers will isolate microbial DNA on site directly from the soil. They will sequence the DNA and search DNA databases for sequences encoding enzymes that give the microbes their special characteristics.

Grant and Genencor have already shown that the strategy can be commercially successful. A collaborative expedition to Kenya in 1992 found an extremophile in a soda lake that has an enzyme that breaks down cellulose over an unusually wide range of temperatures. In 1998, Genencor exploited this property in a process for stonewashing jeans.

China hopes to gain commercially from the project. Its science ministry has negotiated with the consortium to retain "sovereign rights" to biological resources found and a share in any commercialization, says Yanhe Ma of the Chinese Academy of Sciences Institute

of Microbiology in Beijing, a member of the consortium. But there is no indication so far that a fair share of the benefits will filter back to Tibet and Inner Mongolia — contentious "autonomous regions" of China — or even that the issue has been discussed. China's autonomous regions are supposed to retain a degree of control over local economic interests, but many commentators argue that Beijing has neglected these rights.

The United Nations' Convention on Biological Diversity, which the European Commission and China signed in 1992, aims to ensure that countries, particularly indigenous and local communities, benefit fairly if their biodiversity proves to be commercially valuable. Ma says that local governments will be helping them with the project, but he gives no details of any plans to bring work or other benefits to the local people.

Huanming Yang, director of the Beijing Genomics Institute and an advocate of the protection of China's genetic resources, says that scientists from local communities should be involved. Chinese researchers should be sensitive to such issues, he says, but foreign researchers should also bear responsibility. John Ackerly, president of the Washington-based human-rights group International Campaign for Tibet, agrees. "It's the responsibility of the European researchers to make sure that Tibetans are engaged and given benefits, because Beijing won't do it," he says.

But this is not an easy task. "How could an outsider possibly go about pushing the issue of regional recognition?" asks consortium member Don Cowan of the University of the Western Cape.

Mascoma Corporation



Article from the BIOconversion Blog by C. Scott Miller, December 12th, 2006:

New York is starting to put some teeth into its plans to position the state as a leader in cellulosic ethanol development. It has agreed to help finance the establishment of a biomass-to-ethanol demonstration facility in Rochester, New York with the collaborative support of [Mascoma Corporation](#) and [Genencor](#), a leading industrial biotechnology company that develops innovative enzymes.

Most interesting to me is the range of feedstock that will be demonstrated - "The facility is expected to operate using a number of New York State agricultural and/or forest products as biomass, including paper sludge, wood chips, switch grass and corn stover." Demonstrating proficiency and high yield from any of these feedstocks would enhance further investment and development for not only these collaborators but also other developers in allied technologies.

This announcement is significant for a number of other reasons - the bioconversion process to be demonstrated (enzymatic hydrolysis); the location (near chilly, urban Rochester, New York); the investment structure (\$14.8 million state support, \$5.2 million from the developer); the industry/education involvement of International Paper/Cornell University/Clarkson U.; and the endorsement by the National Resources Defense Council (NRDC) - which in my state of California has been equivocal in its support of similar waste-to-energy initiatives.

This deal predates the development agreement made between Mascoma and [Tamarack Energy](#) of Essex, CT who is not likely to be directly involved. However, according to Tamarack Project Manager, Matt Wolfe, "this is right in line with our project development."

Press Release from Genencor's website, December 20th, 2006:

Mascoma Awarded New York State Contract to Build and Operate \$20 Million Cellulosic Ethanol Demonstration Facility

Receives \$14.8 million for project planned for Rochester, NY;
Planning to partner with Genencor to supply advanced enzyme systems

CAMBRIDGE, MA and ROCHESTER, NY, DECEMBER – Mascoma Corporation, a leader in cellulosic biomass-to-ethanol development and production, announced today it has received a \$14.8 million award from the New York State Department of Agriculture

and Markets and the New York State Energy Research and Development Authority to build and operate a biomass-to-ethanol demonstration plant in Rochester, New York, pending local permit approvals and definitive agreements among the relevant parties.

The project will focus on demonstrating “cellulose to ethanol” technology and industrial processes. International Paper Co., Cornell University, Clarkson University and the Natural Resources Defense Council join Mascoma and Genencor as part of a consortium supporting the project.

The facility is expected to operate using a number of New York State agricultural and/or forest products as biomass, including paper sludge, wood chips, switch grass and corn stover. Genencor also plans to add capacity at its existing manufacturing facility to supply enzymes to the demonstration facility. Following completion of design, engineering and site agreements and the required approval process, Mascoma estimates it will take 10-12 months to construct the pilot plant and begin operations.

Mascoma was founded in 2005 by biomass industry pioneers Drs. Lee R. Lynd and Charles Wyman of Dartmouth College. With financial backing of \$39M from a syndicate of leading venture capital firms led by founding investor Khosla Ventures, Mascoma plans to build, operate and manage a 15,000 square foot facility in New York State to complete testing of multiple feedstocks and technologies for biomass ethanol.

“After decades of research and development around the world, cellulosic ethanol technology has reached a point where we are ready to demonstrate the commercial scale production of ethanol from biomass,” said Colin South, president, Mascoma. “We are very excited about the support from New York for our multi-feedstock approach, and we applaud New York and Governor Pataki’s leadership in developing the cellulosic ethanol market. This plant will demonstrate the technologies we expect to rapidly move into commercial application. The continued development of these technologies will require the formation of new partnerships between academics, companies and feedstock producers. To support the development of this facility Mascoma is developing and integrating leading technologies and recruiting experienced personnel in technical and operations areas. We look forward to working with our university and industrial partners on this exciting effort.”

As the enzyme partner for the project, Genencor expects to supply enzymes to the project as well as work with Mascoma to continue to improve its advanced enzyme products. Genencor intends to make further investments in its existing enzyme production facility in Rochester. Mascoma intends to locate the demonstration plant at or near Genencor’s manufacturing site in Rochester.

“Genencor has made substantial progress over the years on advanced enzymes for biomass conversion,” said Jack Huttner, vice president of biorefinery development at Genencor. “Partnering with Mascoma allows us to prove them in a commercial setting. This will bring cellulosic ethanol one significant step closer to reality. It is a great opportunity to help build a promising new sustainable industry, and Genencor thanks Governor Pataki and the State of New York for its support of this project.”

“We see the development and commercialization of cellulosic ethanol as a growth industry for the state of New York. This funding award to Mascoma and the company’s demonstration plant initiative with Genencor are important steps in establishing this industry here,” said New York State Agriculture Commissioner Patrick H. Brennan. “Producing cellulosic ethanol locally is an ideal approach to further capitalize on this state’s agricultural and forestry resources like paper sludge, wood chips, and emerging energy crops. Further, this energy production method can reduce our dependence on foreign sources, while benefiting the environment in a number of ways.”

“Cellulosic ethanol promises to contribute significantly to rural economic development and to a sustainable renewable energy future,” said Nathanael Greene, senior policy analyst at the Natural Resources Defense Council (NRDC). “It is important that this technology is proven in real world settings and in regions where neither corn nor sugar cane predominate the agricultural production system. Developing cellulosic ethanol for New York will have a measurable, positive impact on farmers’ income and greenhouse gas emissions in the state.”