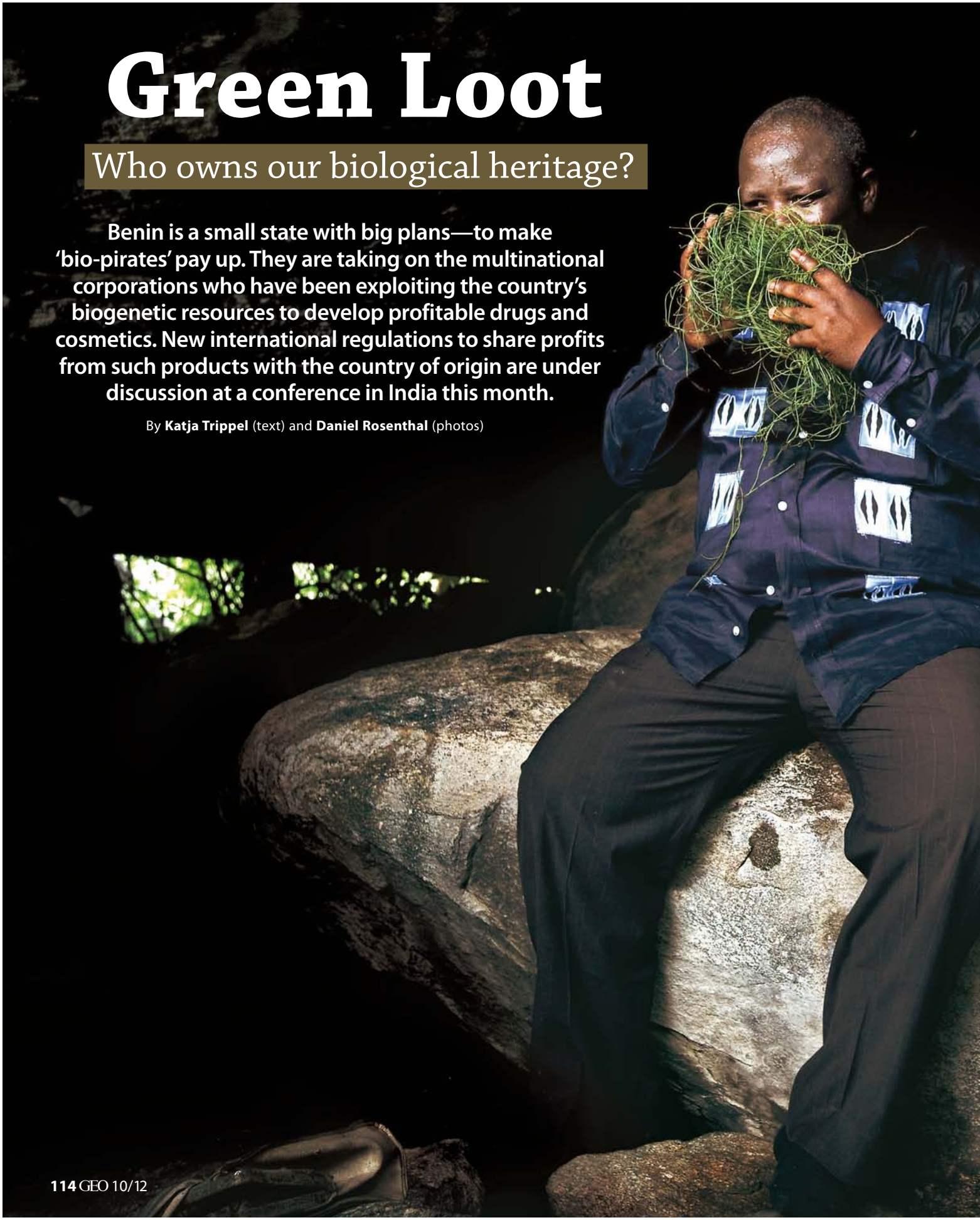
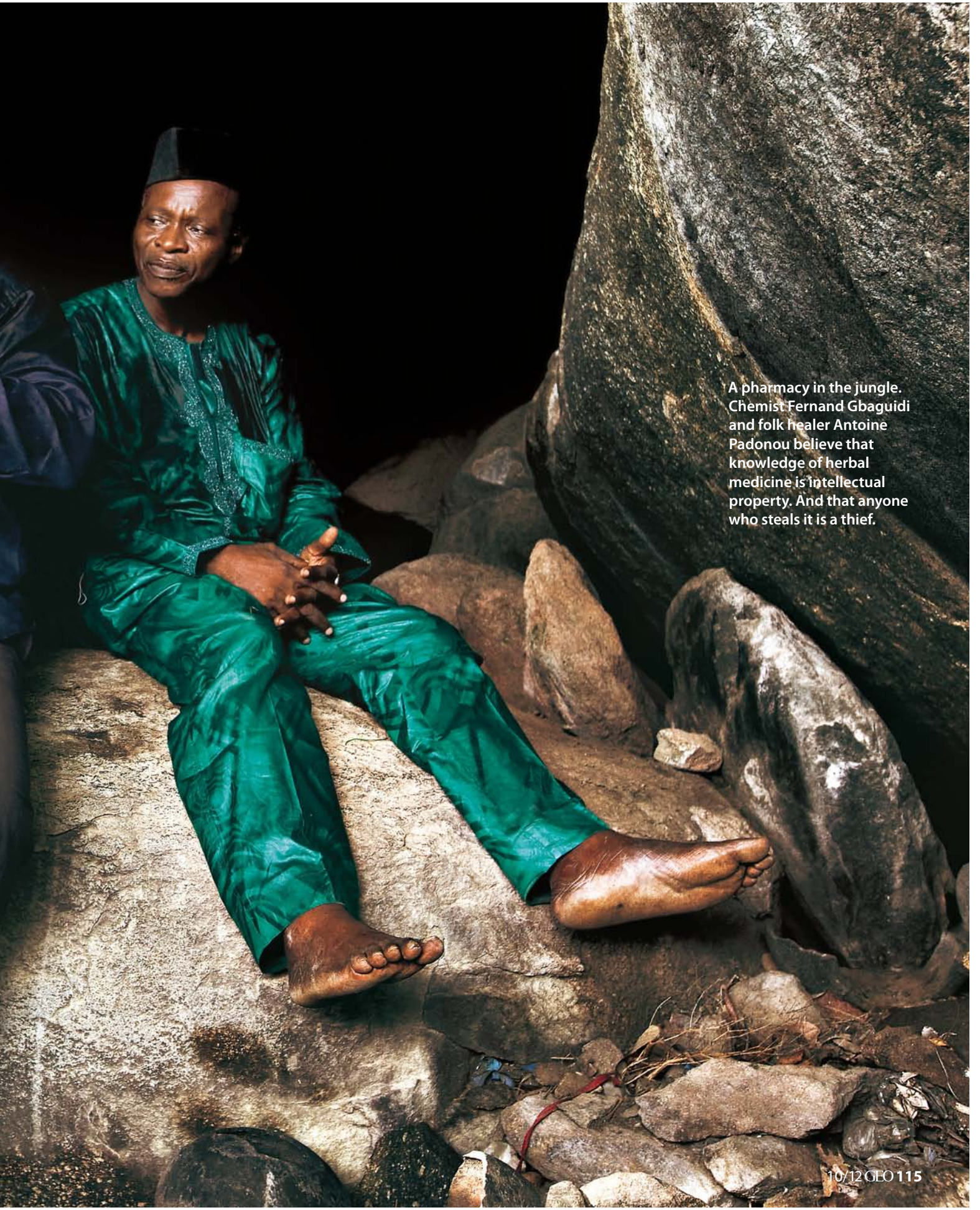
Green Loot

Who owns our biological heritage?

Benin is a small state with big plans—to make 'bio-pirates' pay up. They are taking on the multinational corporations who have been exploiting the country's biogenetic resources to develop profitable drugs and cosmetics. New international regulations to share profits from such products with the country of origin are under discussion at a conference in India this month.

By **Katja Trippel** (text) and **Daniel Rosenthal** (photos)





A pharmacy in the jungle. Chemist Fernand Gbaguidi and folk healer Antoine Padonou believe that knowledge of herbal medicine is intellectual property. And that anyone who steals it is a thief.

It's a matter of greed. Or treachery versus trust. And belief in justice.

It's something worth fighting for: to make the world more just and equitable, and, at the same time, to protect its natural heritage. A total of 193 governments are currently participating in a meet to turn this ambitious plan into reality—along with voodoo priests and pharmaceutical scientists, bush hunters and patent lawyers, nature healers and cosmetics multinationals. We're dealing here with secret ingredients, with treachery versus trust, and with humankind's perennial quest for panaceas and for beauty.

And with lots and lots of money.

It all started in the autumn of 2010 at the United Nation's Biodiversity Convention in Japan, where the Nagoya Protocol was formulated. Since then, 92 countries have signed it, though it will come into effect only in 2013 (*see box*). But when it does, what will it achieve? To find out, we travelled to Benin in West Africa, and then onwards to Brussels and Paris. What we learnt on our travels was as exciting as it was nebulous and complicated.

Prologue: Medicine from a Bacterium

In the mid-1960s, scientists collected soil samples from a coffee plantation in Kenya and discovered in them a bacterium with a brilliant metabolite, acarbose, which lowers blood sugar levels in diabetic patients. Developed by the German pharmaceutical giant Bayer and better known by its brand name of Glucobay, the drug has generated an estimated turnover of over 3 billion euros for Bayer since 1990. The Kenyans, the rightful owners of the bacterium by international law, have come away empty-handed.

A similar thing happened to the folk healers of South Africa, who have traditionally treated coughs with a decoction made from geranium roots. And to women in the Sub-Saharan region, who have been using seeds of a plant of the ginger family for centuries. Foreign pharma companies smelled profits, packed the roots and seeds in their bags, and continued research in high-tech labs.

Today, a geranium root extract is marketed by the Schwabe Group under the brand name of Umckaloabo as a cure for bronchitis; it earns this southern German company at least 40 million euros per year. Likewise, cosmetics manufacturer Christian Dior has patented the seed extract from the ginger plant as an anti-ageing serum and sells it at 135 US dollars an ounce (28gm).

Such business practices constitute 'bio-piracy'—the exploitation and even patenting of foreign genetic resources without sharing the benefits with the source. So far, such transactions have gone largely unpunished. But this is set to change with the Nagoya Protocol.

In principle, however, bio-piracy has been illegal since 1993. In 1992, the nations of the world got together for the first big environmental meet of the United Nations, at Rio de Janeiro. This historical Earth Summit reconvened this summer on its 20th anniversary under the banner 'Rio+20.' And the follow-up meet to the Nagoya conference is taking place in Hyderabad, India, this month.

In Rio, member nations agreed that natural resources were to be declared the sovereign property of the individual states. It was meant to end a 100-year-old legal situation in which nature belonged to all the peoples of this world and hence researchers from foreign countries were free to use it for 'inspiration.'

In theory, therefore, ever since this convention came into force in December 1993, each country has had the right to decide for itself who is allowed to use 'its' natural resources and under what conditions. Scientists bio-prospecting on foreign soil must first get permission and agree on 'equitable benefit sharing' with the country of origin, irrespective of whether the ingredients are for an anti-wrinkle cream or an anti-cancer drug.

The crux of the matter, however, is that almost no one has complied with these provisions. No patent laws have been changed since the Rio Summit, nor has anyone defined how and with whom this 'equitable benefit sharing' must be transacted—the government, the tribal groups whose traditional knowledge is being used, or the individual healers who share their know-how?

This ambiguity put the brakes on those pharmaceutical and cosmetic companies that were concerned about the legitimacy of their research. After the Rio Summit, big firms like Bayer and Pfizer declared that the age of the 'green gold' had ended and said that they would replace their research on natural active ingredients with the allegedly more effective synthetic pharmaceuticals. Most other firms simply carried on as before

A powerful medicinal herb is growing in this field. But exactly which plant is it? Pharmaceutical companies exploit the know-how of traditional healers who, more often than not, come away from the process empty-handed.

Dry treatment: leaves and roots being prepared in a lab in Porto Novo, the capital of Benin.

Bienvenu Bossou, Benin's only 'bio-pirate hunter', says, "We must add value to our natural wealth."

Bossou had to familiarise himself with international diplomatic protocol and with the legal rights of Benin in order to make his voice heard at the United Nation's Biodiversity Conference at Nagoya in Japan.

A noble pact among nations. Its objective is clear-cut rules, but the reality is more complex.

since no one stopped them.

So the freebooting continued. In 2006 and 2009, the African Centre for Biosafety investigated 42 cases from its own continent alone, cases involving the marketing and even patenting of products and processes based on tropical resources like herbal remedies, marine substances and microorganisms. These included, for instance, a patent for a compound from a marine sponge caught in the Indian Ocean off the coast of Mozambique, believed to have anti-carcinogenic properties; or one for a vaccine based on human viruses taken from the blood samples of the indigenous people of Cameroon. And experts believe that hundreds of thousands of plant samples have been illegally collected by bio-prospectors. It was only at the conference in Japan that the United Nations formulated legally binding rules against bio-piracy—namely, the Nagoya Protocol. Its guiding principle was 'Access and Benefit Sharing' (ABS).

Researchers have to work out with the authorities of a country the access to and goals of a bio-prospecting project, and the criteria by which benefit sharing is to be implemented—as a share in profits or the transfer of know-how. The legal recourse open to countries affected by bio-piracy has also been defined.

Once this Protocol comes into force, it will be one of the most far-reaching international treaties ever passed for the protection of the earth's biodiversity. It obliges all governments to create ABS clearinghouses and to modify their criminal laws. The world over, patents involving natural ingredients are to be granted only on the basis of an ABS certificate.

So much for theory.

Chapter 1: The Hopes of Policy Makers

Benin, West Africa, an office in Cotonou, the country's seat of government. Bienvenu Bossou, 56, rummages frantically through the mountains of paper piled up on his writing table. "*Oof*!" he exclaims. "This Protocol certainly creates a lot of work."

Bossou, a retired forester, is Benin's one and only bio-piracy hunter. Tasked with implementing the Nagoya Protocol, he has set up the Organisation for the Protection of Nature within the Ministry of Environment.

Benin, a small, peaceful and reasonably democratic country on the Gulf of Guinea, is known as the cradle of the voodoo cult. Most of its population, unfortunately, faces a shortage of just about everything: money, education, doctors, work. "Nature is all we have," sighs Bossou. "Our only option is to add value to it." And the Nagoya Protocol will help in this respect.

Anyone who falls ill here, he explains, turns to the products of nature: leaves, roots, seeds and fruits, which traditional healers turn into teas, pastes or extracts. He is certain that some of these formulae, or the ingredients isolated from them, could be of use to the rest of the world in the future, as the bases for new drugs and cosmetics.

As a matter of fact, the World Health Organisation estimates that plants provide a good two-thirds of the base material of pharmaceutical products. And American scientists David Newman and Gordon Cragg have calculated that between 1981 and 2006, 39.3 per cent of all the ingredients that pharma companies developed into drugs traced

Approved, but Pending

The diplomatic battle over biological resources continues—this time in India.

THOUSANDS OF DELEGATES from across the world are meeting in Hyderabad this October for the 11th Conference of the Parties to the UN Convention on Biodiversity. This is the decision-making organ of the Convention and is, as a rule, convened once every 2 years. Delegates from all 193 member states have voting rights and decide by consensus to accept or modify protocols and working programmes.

COP decisions are binding under international law and must be implemented by member states. Representatives of non-governmental organisations and specialised agencies of the UN (like UNESCO) are allowed in as non-voting observers and can actively take part in the negotiations.

One of the main issues at stake is a treaty that was drawn up within the framework of the Biodiversity Convention: the Nagoya Protocol or the "treaty for regulation of access to genetic resources and the fair and equitable sharing of benefits arising from the utilisation of these resources." Since its adoption at COP 10 in Japan, it has been at the stage of 'ratification.' The consent of delegates at a UN conference is not enough; it has to be accepted and approved by governments and parliaments. So far, 92 countries have signed, while another five have indicated consent (as of June 2012). To come into force, the Protocol has to be ratified by 50 countries. Besides, some intricate details have yet to be ironed out. The conference in India will provide new impetus to this process. And it could be well worth it, for according to the EU, the Protocol will control a global market with a turnover of 350 billion euros a year.

Plant samples, teas and genes. And as quid pro quo: know-how, technology or dollars.

their origin to plants. Another 15.3 per cent were derived from molecules found in nature but produced synthetically.

The 10 per cent annual growth rate of the global natural cosmetics industry reinforces Bossou's conviction. Labs across the world are interested in plant ingredients such as aloe vera, argan oil or algae. Though the turnover of these products is less than that of medicines, they reach the market faster, not having to go through clinical trials. "Whatever succeeds elsewhere in the world should be a success in Benin as well, shouldn't it?" Boussou asks.

If he had his way, in future all collaborative projects requiring Benin's participation would need to be registered with a government authority. The latter could then insist on equitable benefit-sharing agreements. Bossou's model is based on examples of bio-prospecting deals that every poor country dreams of. In Gabon, for instance, proprietors of a pharmaceutical lab are believed to have paid about 150,000 euros for permission to isolate molecules from 1,200 plant samples. In Brazil, the firm Natura Cosméticos has given indigenous communities financial assistance to the tune of 5 million US dollars in exchange for access to plant material for its products.

Details of such agreements—who got how much money or know-how, under what conditions and how the patent rights were shared—have, of course, never been made public.

"The Nagoya Protocol will make everything more transparent now," Bossou believes. "I will open up my country to such collaborations." His problem, however, is that he has no clue about the presence, or otherwise, of bio-prospectors in the country right now. Nor does he know how many researchers and traditional healers are already in touch with foreign collaborators. At any rate, no one has approached him, the official ABS representative, for permission or even just to keep him in the picture.

But there are rumours, and these make him nervous: Americans posing as environmentalists are believed to have got information from farmers on natural pesticides; a Japanese man is alleged to have wormed his way into the health ministry as a trainee and stolen documents on natural medicine; employees of L'Oréal, are said to have carried away sackfuls of leaves to France. Is there any truth to this?

"I don't know," says Bossou unhappily, "not yet."

Chapter 2: The Secrets of the Healers

About 200km inland, on the outskirts of Dassa-Zoumé, Antoine Padonou, president of the National Association of Traditional Healers, stands in the middle of a tropical garden. "Oh yes," he says, "we have made great strides." In view of the dearth of qualified doctors in Benin, about 80 per cent of patients are treated by his healers. Bienvenu Bossou is banking on their competence and partnership, because he is convinced that they are the first to be contacted by bio-prospectors, both legal and pirates, in Benin.

Antoine Padonou, who likes to be called *le président*, spent several years living in Marseilles and Abidjan, and enjoys his rather cosmopolitan reputation. He moonlights as head of a voodoo cult, something that greatly enhances his authority amongst his colleagues: "We follow a holistic approach of body and soul, just like modern Western doctors."

Bossou sees Padonou primarily as a specialist in herbal medicine and admires him for slowly but surely professionalising his community. For instance, it has recently become mandatory for every practising healer to be registered. A database of professional knowledge has been compiled together in a library of sorts, but anyone who leaks trade secrets is ostracised. Further, 60 botanic gardens for medicinal plants have been developed. These will improve the quality of traditional ingredients and, so Bossou hopes, attract foreign ABS partners.

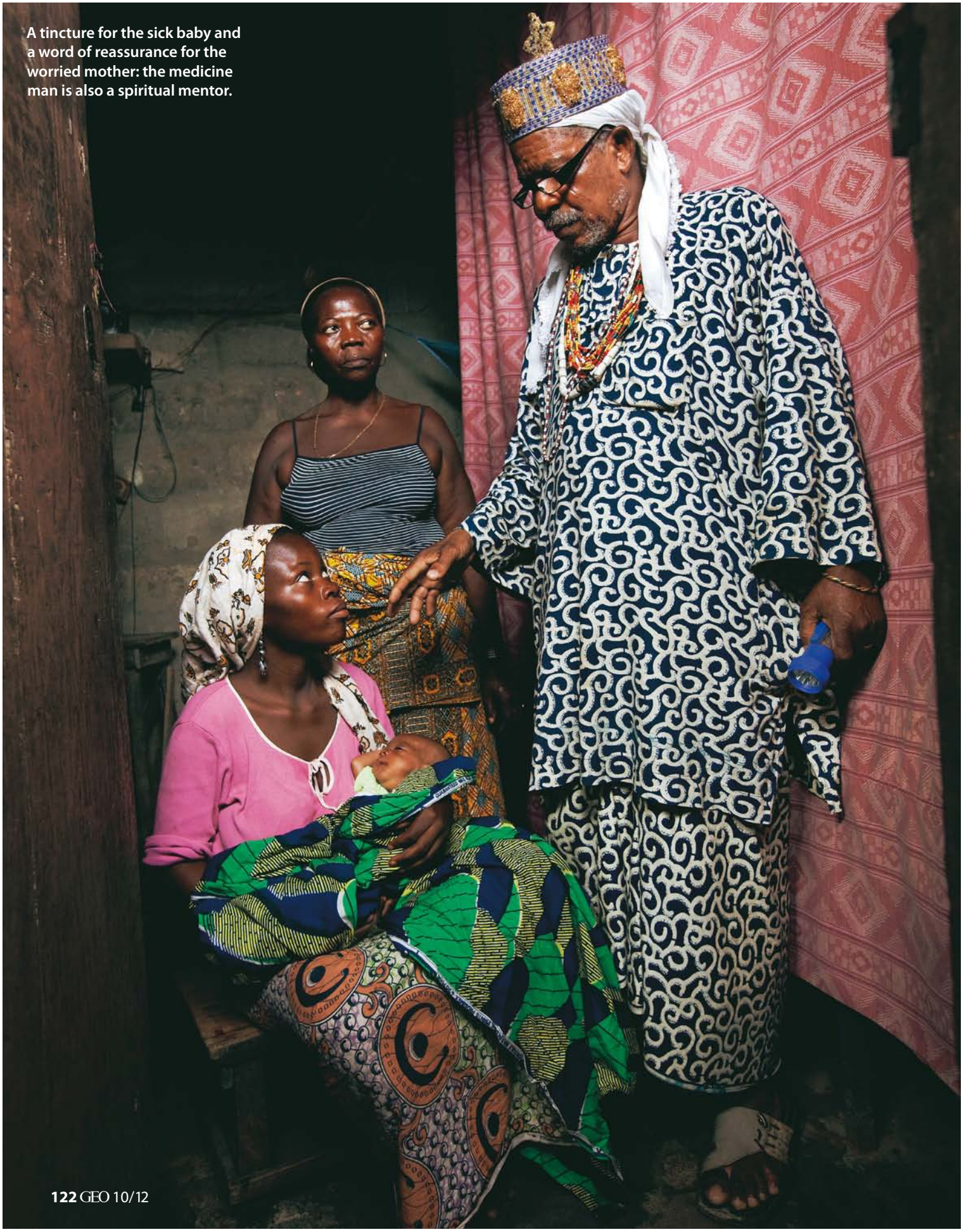
To the uninitiated, Padonou's own garden in Dassa-Zoumé seems like a patch of primeval forest. But each shrub and each tree has been planted with care. He strips a piece of bark from the Néré tree with its bright red flowers. "A powder of its seeds helps in cases of high blood pressure." The olive-green seeds of the Molluca bean, he says, cure umbilical inflammations in infants. And the nondescript grass growing in the shade of the tree there is effective against bacteria, parasites and evil spirits. Padonou smiles: "The efficacy of the first two, at least, has been confirmed by pharmacologists through lab tests."

He swings confidently between tradition and science in his clinic as well. Painted a bright blue, it has 12 voodoo deities standing guard on a shelf, along with formulae that he himself has mixed; certificates from the WHO and other institutions grace the walls nearby.

He points proudly to the two certificates from Benin's Ministry of Health, testifying to the 'trustworthiness' of his medicines. This too is a measure initiated by his association, as a first step towards regulation of medicinal products

He even has a cure for syphilis, says the traditional healer. But he keeps his formula secret—for fear of spies.

The doctors at the hospital blundered and then wanted to amputate his leg. So this teacher turned to a traditional healer to save his limb.



A tincture for the sick baby and a word of reassurance for the worried mother: the medicine man is also a spiritual mentor.

Their dream: to explore and research biomedicine in their own labs and to collaborate with pharmaceutical giants.

and ingredients research. The objective is obvious: certified substances for the benefit of patients—and also, of course, for professional parties from the West.

But like Bossou, he is unable to name who these parties may be. He claims he has been contacted by L'Oréal, and yes, he has a good idea of what the French could be interested in…

He calls in a patient, a young man, a welder by profession, who had suffered burn injuries on his arms 7 months ago. Photographs show second-degree burns. "I never thought I would be able to move my arms again," he says and rolls up his sleeves, bends his elbows. The pain is gone, just a few scars remain, and the skin seems to have healed as well.

Padanou treated the burns with a compound from some anti-bacterial leaves; the wound was then dried out with a paste of five plants, which also hastened skin formation. "This is my most popular medicine," says the healer. Only he and his sons are allowed to touch it.

To be on the safe side, however, Padonou is taking additional precautions: a patent application for his paste lies on his desk, ready to be submitted to the African Intellectual Property Organisation in Cameroon. The processing fee cost him the equivalent of 2,500 euros—a fortune in Benin, which only very few can afford.

"Money—that is our main problem," says Padonou. "The government must help our association." But with what?

"With active ingredient research," answers the voodoo priest.

Chapter 3: Of Authority and Centrifuges

Porto Novo, the University of Abomey-Calavi's Laboratory for Pharmaceutical Biology. Fernand Gbaguidi, 39, is a pharmacologist and chemist, his work comprising of two worlds: the chaotic green one outside in the garden, where you stumble over roots as you go about collecting herbs, and the pristine one in the lab, where walls are tiled and everything is in its place. His job requires him to constantly build bridges between the two.

Gbaguidi heads the lab where traditional healers send their pills and potions for testing in order to acquire the health ministry certification. It is one of the most modern pharmaceutical labs in West Africa. And it is Benin's first official ABS project—even though Bossou learnt of its existence only recently. It is partnered by the Catholic University of Louvain in Belgium, which has undertaken to draw up an ABS contract for every international research project involving the isolation and possible utilisation of natural ingredients. The entire operation was initiated by Fernand Gbaguidi's PhD professor and mentor, Joëlle Quetin-Leclercq of Belgium.

Using funds provided by Belgium, the professor has sent material worth about 350,000 euros to Porto Novo since 2006. In return, Quetin-Leclercq and her team in Benin are at liberty to study and analyse whatever interests them. About 10 doctoral dissertations as well as over 20 scientific papers have resulted from this; some in collaboration with Gbaguidi, some without his knowledge.

The Beninese scientist and his colleagues and students in turn are able to test traditional remedies for malaria or high blood pressure and identify interesting plant molecules. For instance, clinical trials for a self-developed anti-malaria agent from a local mugwort species are currently in progress. It is a good ABS project, one could say—even without the blessings of Bossou.

But Gbaguidi is not happy. Running the lab consumes large sums of money, and it is exorbitantly expensive to replace and repair equipment. The funds from Belgium will dry up soon, and neither his university nor the ministry are willing to take over the financing. "It is absurd," complains Gbaguidi, "we need this lab to carry out our independent research, but they don't understand that."

He is also somewhat at odds with Joëlle Quetin-Leclercq. "I have hardly any control over what she is investigating," he says, choosing his words with care. "While our financial support runs out, she is at liberty to carry on her research on our samples. Is that fair?"

So does Gbaguidi have other options, then? Contacts with alternate universities or firms, possibly even with L'Oréal? "Unfortunately not," he sighs. "L'Oréal works with another professor, and no one is willing to tell me the details of their collaboration."

Chapter 4: Partnerships and Dreams

In Belgium, at the Institute for Pharmacy and Plant Medicine, Catholic University of Louvain near Brussels, Joëlle Quetin-Leclercq, in her mid-50s, couldn't be bothered that her lab is located in a dilapidated building from the 1970s. Sacks of plant material from Porto Novo are piled in her office, along with samples from Vietnam, Madagascar and Rwanda. Quetin-Leclercq is well travelled—and has lost her illusions along the way.

"There is a 99 per cent chance of my

Fighting over Bio-piracy Treasures

The West has often wanted to appropriate biological resources. Four cases and what has become of them.

SLIMMING SUPPLEMENT HOODIA

The San people of the Kalahari Desert in southern Africa have used the succulent *Hoodia gordonii* as an appetite suppressant for ages. But the South African Council for Scientific and Industrial Research isolated the active ingredient of the plant without their consent and patented it in 1995. They sold the rights to British firm Phytopharm, who, in collaboration with Unilever of America, used it to develop a slimming supplement. After hard-fought negotiations, the San finally reached an agreement with CSIR in 2003 for 6 per cent of the latter's royalties. But in 2010 Phytopharm surrendered the licence as clinical trials showed too many side-effects. No *Hoodia*-based dieting supplement is ready for the market at present.

MARINE GENETIC CODES

In 2000, American biochemist Craig Venter mapped the human genome. In 2003, he set out to discover the DNA of marine organisms in order to make this resource available to researchers—for nano-biotechnology research, for instance. Although Venter isn't claiming patent rights to his discoveries, critics have accused him of hiding facts from the governments in whose waters he is collecting his samples, including facts about the profit potential of his inventory. Nor can he guarantee that those who will benefit financially from his discoveries will share revenues with source countries. This is a matter of some concern since one of Venter's principle sponsors, the United States, has not ratified the Convention on Biological Diversity.

Mimosa: effective cure for malaria.

COUGH SYRUP FROM GERANIUM

In April 2010, German firm Schwabe withdrew five patents for the manufacture of its Umckaloabo cough syrup. These patents included existing ones as well as those under processing. The reason: several organisations had complained to the European Parliament that the active ingredient of the syrup originated from the *Pelargonium sidoides* geranium of South Africa and that the product was based on the traditional knowledge of that country. On their part, Schwabe created the Umckaloabo Foundation to fund aid projects for children here. The sale of the syrup meanwhile continues (gross turnover: 40 million euros per year).

GLUTEN-FREE BREAD AND PLASTIC OIL

Bread made from teff, a gluten-free grain, is a staple in Ethiopia. In Europe, it could ease the life of allergy sufferers. In 2004, the Dutch firm Health & Performance Food International signed an ABS agreement with the Ethiopian Institute for Biodiversity Conservation (IBC) for access to several varieties of teff. Though initially a success, the project eventually failed due to communication problems, not least within Ethiopian public agencies. IBC has since learnt from its mistakes, and in 2005 it started a more successful project with a British firm on use of oil from the *Vernonia galamensis* plant for the manufacture of a variety of items—including PVC.

retiring without discovering a single plant molecule from which a medicinal ingredient can be derived," she says. "[And] if the government of Benin thinks that a pharmaceutical discovery can put it out of its misery, then it is dreaming."

Yet the professor is actually well disposed towards Benin, sympathetic to its cause. She regularly accepts exchange students from Benin and mentors diploma and doctoral candidates. Setting up Gbaguidi's lab was a huge effort as well. And perhaps also her last—because she considers his request, even though very gently expressed, for continued support for the lab as rather audacious.

"We did not set up the lab to discover a blockbuster or a luxury cream, but to enable Benin's students to learn pharmaceutical research in plants and treat their sick," she asserts firmly.

So why then does the contract mention ABS? The professor snorts: "Because the legal department of the university insisted on it, though my lab has no commercial interest of any kind."

Isn't it a new experience for a European professor to have developing nations making demands? She smiles and runs a hand through her hair. "I get offers of collaboration every week from tropical countries. If Benin no longer wants us, we can easily go elsewhere."

Does Gbaguidi have anything to say in response? Does Bossou have the expertise to discuss ABS contracts with university lawyers? Does a poor country like Benin have any hope at all of dealing with an industrialised nation like Belgium on an equal footing? As long as the Nagoya Protocol does not come into force, as long as ABS contracts do not need to be licensed by the secretariat of the Biodiversity Convention, as long as there is no threat of penalties and sanctions for infringements, developing countries don't really stand a chance.

Chapter 5: ABS Makes Things Better—and Creates More Work

Paris, 8th Arrondissement, Place Saint-Augustin. The Union for Ethical BioTrade likes things environment-friendly, but also grandiose—glittering chandeliers, gold stucco, the lot. The lobby group is hosting a seminar on the Nagoya Protocol and the hall is packed. Representatives of cosmetic firms from all corners of the globe are present: the German company Beiersdorf of Hamburg has sent a senior executive, as have Guerlain of Paris, Natura Cosméticos of Brazil, Weleda of Germany—and, of course, L'Oréal.

All the companies, irrespective of whether they want to, will be subject to the provisions of the Nagoya Protocol—this has been ratified. Because their creams, lotions, powders and perfumes are based on foreign genetic resources, on exotic extracts, essences and molecules.

"So in addition to the eco-label and fair trade, we now have to consider benefit-sharing as well?" asks one participant, full of righteous indignation.

"Yes, we are totally taken aback as well," admits the representative from Amorepacific, the South Korean luxury cosmetics brand.

"For 3 years we have been exporting a root from Venezuela," says the delegate from Weleda. "Now our partners there are suddenly demanding a 3 per cent share in profits. How are we supposed to react?"

Rachel Barre, manager of the Worldwide Raw Materials Department at L'Oréal, is up on stage and trying to reassure her peers: "An ABS contract has advantages for both sides. We finally have legal security and gain new marketing opportunities. We can tell stories with our products, we are actively contributing towards sustaining biodiversity. This kind of thing creates loyal customers." Barre presents a project in Morocco as a practical example: in collaboration with the University in Rabat, L'Oréal is planning to develop a cosmetic product from argan oil; in turn, it is financing adult literacy classes for the women who produce this oil. An official ABS project could perhaps grow out from this.

All this sounds great, but what about your company's project in Benin?

Rachel Barre looks at us, surprised. How did we learn about that? After a long pause, she finally says there is a lot she is not at liberty to disclose.

Trade secrets.

But she does admit to a minor research collaboration with nutritional scientists in Cotonou, a doctoral dissertation on a fruit that could eventually be marketed as a slimming supplement. More than this she really cannot reveal.

Does an ABS contract exist? Is she in touch with Bienvenu Bossou? Or with the Fernand Gbaguidi's laboratory? No, replies Barre, visibly contrite.

"We are just starting out with ABS as well."

Against robbers, bandits and evil spirits: the labels on these magical potions promise relief from afflictions other than just bodily ones.

Epilogue: What's Next?

"We must push national parliaments into enacting the Nagoya Protocol soon," says Suhel al-Janabi, one of the managers of the ABS Capacity Development Initiative. This organisation plans to help countries like Benin implement the Protocol by law. "We will get the ratification through very soon," promises Bossou. The only problem is, he still has nothing on hand to report, no enquiries or offers from firms or universities.

Laboratory head Fernand Gbaguidi, too, is disappointed. His funds are depleting fast, though a visit to Joëlle Quetin-Leclercq has improved chances of a fresh collaboration. Voodoo *président* Antoine Padonou, at least, sees a glimmer of hope. He says he has had visits from French researchers who are interested in his paste. He is not worried and is just waiting for further developments—without any assistance from Colonel Bossou. Government authorities? Too complicated. An ABS contract? He doesn't need it.

But the voodoo healer is quick to add: "I would not recommend abusing our trust. We have our own ways of dealing with backstabbers." ■