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Poisonous Tree Frog Could Bring Wealth to Tribe in Brazilian Amazon

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CAMPINAS INDIAN RESERVE, Brazil — Fernando Katukina is chief of an indigenous tribe that lives largely without running water, electricity, or links to the world outside this remote corner of the western Amazon.

A member of the Katukina tribe in the Brazilian Amazon gave a dose of poisonous tree frog secretion to Paulo Bernarde, a biologist investigating possible medicinal uses of the substance.

But Chief Fernando says he possesses a treasure that could be at the cutting-edge of biotechnology. If a plan initiated by the chief is successful, his tribe's fortunes will be transformed by an asset he and the Brazilian government believe holds great promise for the global pharmaceutical industry: the slime from a poisonous tree frog.



Tribal shamans have used the slime as an ancestral remedy to treat illness, pain, even laziness. The crucial ingredients are compounds with anesthetic, tranquilizing and other medicinal properties. Scientists say the promise lies in isolating peptides from the frog's slime and then reproducing them for medicines to treat hypertension, strokes and other illnesses

Already, Chief Fernando has the full backing of Brazil's government, which sees the frog slime as a stepping stone to significantly advance its own research and development in pharmaceuticals. In particular, the scientific challenge of the frog, known locally as the kambô, will deepen Brazil's expertise in pharmacogenomics — the combined use of genetics and pharmacology — and it takes advantage of the traditional knowledge of indigenous people.

"Traditional knowledge can help modern medicine and generate significant economic benefits, too," said Bruno Filizola, technical coordinator of the project and a biologist at the environment ministry in Brasília, Brazil's capital.

The indigenous dimension is also crucial because Brazil, like other developing nations, is trying to fight back against what it perceives as biopiracy, the theft of biological resources from the country's native habitats for commercial use. Though the project is still in its early stages, and many starts often prove false, teams of some 20 scientists are seeking initial financing of close to \$1 million from more than a dozen local universities, state governments and federal agencies.

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There is also a great deal more than naïve hope at stake here. Brazilian scientists have already taught the country's farmers, who today are among the world's top exporters, to manipulate soils and alter crops once unsuited for the country's climate. Now many researchers believe science can turn Brazilian forests into working, productive laboratories.

"Brazil has a large, growing and capable community of scientists keen to develop their own research and products," said Joshua Rosenthal, deputy director of a division for international training and research at the National Institutes of Health in Bethesda, Md.

Moreover, Brazilian researchers have not forgotten the case of the jararaca, the Amazonian viper. The pharmaceutical giant Squibb used the snake's venom to develop captopril, a blood pressure medicine it began selling in 1975. Though available generically since 1996, the medicine at its commercial peak was the largest selling product for the company, now part of New York-based Bristol-Myers Squibb, grossing \$1.6 billion in 1991.

"Because of past errors," reads a document from the Brazilian Environment Ministry, "captopril is not Brazilian."

Though home to the world's largest rainforest and one of the most biodiverse ecosystems on the planet, Brazil traditionally has been slow to develop its so-called genetic patrimony — the plants and animals within its territory and the potential they offer for profit. The Ministry document also laments Brazil's historical research lag and the consequent loss of billions in potential revenues from pharmaceuticals, agricultural products, and other commercial goods.

An overview for the effort known as Project Kambô, written by a team of researchers at the Environment Ministry, says, "The national genetic patrimony could be the key to Brazil's transformation in the global political and socio-economic context."

The effort comes as developing countries increasingly promote the idea of developing and commercializing their traditional medicines and local arts. And they are questioning the rights of foreigners to exploit their locally derived products. At a United Nations gathering in the southern Brazilian city of Curitiba last month, delegates from developing nations called for changes to international law that would allow governments to block — or at least share profits from — foreign patents on biological resources found in their territory.

In December, at a World Trade Organization meeting in Hong Kong, India's trade minister told delegates that progress in global trade talks hinged on similar changes.

Private industry is wary. The road from research to finished product is long and costly. Rare is the compound, companies argue, that in unadulterated form would become the next wonder drug or other commercial bonanza.

"Developing nations should take a lead by working to develop their own resources — not blocking the efforts of others to research and invest," said Alan Oxley, a former Australian trade ambassador who is now a consultant in Melbourne and runs a research institute funded in part by the U.S. pharmaceutical industry.

Brazil aims to take a lead through the kambô. The project was launched last year after Marina Silva, Brazil's environment minister, received a letter from Fernando, the Katukina chief, denouncing the growing use of kambô poison by outsiders. Its perceived benefits in recent years fueled a pirate trade in the poison in cities across Brazil.

The poison could be dangerous if administered wrongly, Chief Fernando warned. And its use, the letter added, is nothing less than biopiracy; if economic gain is generated by the remedy, the Katukina tribe should get a cut.

Ms. Silva, a native of the tribe's home state of Acre, agreed. She authorized a ministry project to study the kambô, stipulating that any profits derived from the research be shared with the Katukina.

"The know-how is the tribe's," she said in a recent telephone interview. "They must share in any rewards."

Scientists have studied the kambô before. Called the giant monkey frog in English, because it climbs high into the rainforest canopy, the kambô first sparked attention among foreign researchers decades ago. Some of the compounds from the poison, secreted through the frog's skin, have even been patented abroad.

Yet because scientists are still struggling to understand the poison, none of those patents have led to successful products. "These compounds have potent effects on human physiology," said Paul Bishop, a biochemist at [ZymoGenetics](#), a Seattle-based pharmaceutical company, and the author of five patents based on kambô poison. "But we don't fully understand them all or just why they occur in the defenses of this tree frog."

That is where Brazil hopes to excel. While biologists and chemists investigate the kambô, its habitat and the poison's makeup, a team of anthropologists and physicians will study the long-term impact of its use on the Katukina.

One morning in mid-March, two scientists from the Federal University of Acre visited the tribe's reserve, a 125-square mile section of jungle near the Peruvian border. There, amid one of five clusters of wooden cabins, two shamans agreed to administer the kambô remedy, known in Portuguese as the "vacina do sapo," or "frog vaccine."

Reginaldo Machado, a biologist, stood shirtless and sweating next to an older shaman, who touched the red-hot end of a burning twig three times to the scientist's shoulder. The other shaman, another twig in hand, then daubed the sticky, mud-like poison on each of the tiny burns.

Mr. Machado, already in pain from a flare-up of chronic kidney stones, within seconds sprang from the wooden shack, suffering hot flashes, nausea, and stomach aches. Ten minutes later, he returned, expressing surprise.

"I actually do feel stronger," he said. "There's more to this than myth."

Though western dress long ago replaced the grass skirts traditionally worn by tribal

people, the frog remedy is one of a handful of customs the Katukina preserve.

After catching the frog in nearby trees, tribe members tie it spread-eagle style between two posts, collecting slime from its back and sides with a piece of wood, where it dries. They then release the frog and later, with water or saliva, re-hydrate the dried poison before applying it.

Despite the term "vaccine," the slime does not vaccinate against any specific germ or illness.

Once the body processes the poison's toxins — hence Mr. Machado's sweats and indigestion — its compounds induce what users say is a prolonged sense of alertness and wellbeing. Because they believe it heightens their senses, Katukina hunters traditionally use it most: Long rows of burn scars dot their arms, chests and stomachs.

Most Katukina speak only the tribal variant of pano, a native Amazonian language group. Fernando, one of only two tribe members to work outside the reserve, is convinced of the kambô's value, and adamant that the medication, if used by others, can improve a tribal economy that is currently at the level of subsistence.

"The vaccine belongs to us," he said. "Science might help us develop it, but kambô knowledge is Katukina."