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Saving the ethnopharmacological heritage of Samoa

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Early European visitors to Samoa tended to denigrate the authenticity and efficacy of Samoan herbal medicine, yet bioassays indicate pharmacological activity in over 86% of Samoan medicinal plants. Novel anti-inflammatory compounds have been isolated from *Alphitonia zyzyphoides* and *Erythrina variegata*, and the anti-HIV compound prostratin has been isolated from *Homalanthus nutans*. Unfortunately, both Samoan ethnopharmacology and Samoan rain forests are threatened. In order to prevent logging, funds were raised to build a needed village school in exchange for a village covenant to protect the 30 000 acre Falealupo forest. Subsequently, four additional rainforest reserves have been established. Hopefully such conservation measures can save the ethnopharmacological knowledge of Samoa.

Sa le talitonu tagata papalagi i le aoga o vai Samoa. Ae ua faamaonia nei su'esu'ega faasaiensisi i le malolosi o 86% o la'au e fai ai vai Samoa. Ua maua ai vaila'au fou e aoga mo le fofoina o fula mai le toi (*Alphitonia zyzyphoides*) ma le gatae Samoa (*Erythrina variegata*) atoa ma le vaila'au prostratin mai le mamala (*Homalanthus nutans*), e foliga lava lea vai e aoga i le fofoina o le AIDS. E faafetaui lelei ai nei aoga faasaienisi ma le faiva o fofo Samoa. Ae peta'i, e i ai le popolega olea le toe maua ai le faiga o vai Samoa atoa ma le vao matua. Ina ia faasao ai le vao, sa i ai se sa'iliega o tupe e faia le falealoga i Falealupo ina ia osia se feagaiga ma le nuu e puipuia ana vao tele. Ua toe faia foi isi faasaoina fou e fa. O le faamoemoe o nei faasaoina o le puipuiga lava lea o la'au ma le poto o fofo Samoa e fai ai vai.

Key words: Samoa, ethnopharmacology, prostratin, conservation, ethnobotany.

Introduction

The Polynesians demonstrated masterful use of indigenous plant resources in the construction of ocean-going vessels (Banack and Cox, 1987), food preservation technologies (Cox, 1980a,b), the use of icthyotoxic compounds (Cox, 1979), natural sweeteners (Cox, 1982), and the use of kava, but not hallucinogens (see Cox, 1981) to promote social tranquility (Cox and O'Rourke, 1987).

From a Polynesian perspective, however, the greatest indigenous achievements in the exploitation of island plants was the development of ethnopharmacology. Yet many Europeans have taken a skeptical view of Samoan ethnopharmacology (I use the term 'European' to include peoples derived from Europe such as Americans, Australians and New Zealanders). In this essay I discuss (1) the origins of European denigration of Samoan ethnopharmacology, (2) the possible efficacy of Samoan ethnopharmacology, and (3) possible strategies for preserving Samoan ethnopharmacology.

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Methodology

Journals of early missionaries and visitors to Samoa were studied to document early European attitudes toward Samoan ethnopharmacology. Extant Samoan herbal medicine was studied from 1984 to 1992. Seven populations were chosen for study, including two traditional villages (Fa'ala and Falealupo tai on Savaii), two non-traditional villages near Apia (Pesega and Aleisa, on the island of Upolu), and three expatriate populations (Auckland, New Zealand; Honolulu, Hawaii; Laie, Hawaii).

In each population traditional healers were interviewed directly in the Samoan language. Interviews were documented with notebooks, portable computers, tape recorders, and video recorders. In remote villages electronic gear was driven by solar panels. Voucher specimens of all plants identified by healers as medicinal are deposited in the Brigham Young University Herbaria (BRY) and the Gray Herbarium of Harvard University (GH). Fresh plant collections for pharmacological testing were preserved in 70% EtOH in 1-liter aluminum bottles filled, then extracted in a rotary evaporator, lyophilized, and stored in a −20°C freezer until pharmacological analysis. Extracts were

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screened at the Institutionen för Farmakognosi, University of Uppsala, Sweden for gross pharmacological activity (details appear in Cox et al., 1989); at the National Cancer Institute in Bethesda, MD for in vitro anti-HIV-1 activity (details appear in Gustafson et al., 1992) and at the Schering Research Institute in Bloomfield, NJ for inhibition of phospholipase A_2.

Results and Discussion

European ethnocentricism and the denigration of Samoan ethnopharmacology

The efficacy and authenticity of Samoan ethnopharmacology has been questioned from the time of first European contact. Analysis of the accounts of early missionaries have led some to conclude that Samoan herbal medicine developed after European contact (Macpherson, 1985). However, since Samoa was one of the first areas settled in Polynesia, with pottery shards reliably carbondated as early as 940 B.C. (Davidson, 1979), it is unlikely that no medicinal plants were used in Samoa prior to European contact. I suggest that the absence of missionary comment on Samoan ethnopharmacology does not necessarily evidence lack of a precontact herbal medicine tradition since missionary accounts are largely silent on many aspects of plant uses that would capture the attention of a botanically adept observer. For example, the use of plants as fish poisons (Cox, 1979) and in food-preservation technologies (Cox, 1980a,b) received little mention in the journals of missionaries. However, missionary accounts did denigrate the medical acumen of Samoans (Williams, 1838; Turner, 1861, 1884; Stair, 1897). For example, missionary George Turner wrote:

> The Samoans in their heathenism seldom had recourse to any internal remedy except an emetic, which they used after eating a poisonous fish. Sometimes juices from the bush were tried; at other times the patient drank on at water until it was rejected; and, on some occasions, mud, and even the most unmentionable filth, was mixed up and taken as an emetic draught. Latterly, as their intercourse with Tongans, Fijiians, Tahitians, and Sandwich islanders increased, they made additions to their *pharmacopoeia* of juices from the bush.
>
> (Turner, 1884, pp. 139–140)

I suggest that the early European missionaries were predisposed to either ignore or denigrate Samoan ethnopharmacology because (1) a developed system of ethnopharmacology ran counter to their view of Samoans as unenlightened heathen, (2) spiritualism and witchcraft had a greater saliency to the Christian vocation of missionaries, and (3) traditional herbalism competed with sale of arsenic, mercury, and other European 'medicinal' compounds to the Samoans (Cox, 1991).

It is difficult to reconcile the view that Samoan herbalism was derived subsequent to European contact from other Polynesian islands, such as Tonga (Turner, 1884; Stair, 1897,) with the fact that early European visitors to other islands (including Tonga) argued that those herbal traditions were not indigenous either (Martin, 1817). As in most indigenous oral tradition, the antecedents to Samoan ethnopharmacology are not completely clear, but the abundance of indigenous plants and the relative paucity of European introductions in their ethnopharmacopoeia indicate that Samoan ethnopharmacology existed long before European contact. Certainly the Samoan healers themselves believe they are continuing a pre-European tradition (Cox, 1991). Furthermore, early botanically adept observers including Powell (1868), Reinecke (1898) and Kramer (1903) recorded lists of Samoan medicinal plants that other, less botanically adept observers, missed.

But it is clear that early European observers questioned the efficacy and rationality of Samoan ethnopharmacology. Even the confidence of the Samoan people in their ethnopharmacology was eroded by contact with Western culture. As early as 1895, Reinecke wrote that 'The trust of the Samoans in their medical science continuously disappears in favor of the viewpoint of the medical representatives' (Reinecke 1895, p. 22). Yet despite European pressure, many Samoans persisted in their faith in Samoan ethnopharmacology. In 1923 the Lieutenant Commander of the U.S. Navy Medical Corps in Pago Pago wrote:

> A majority of the Samoans believe that their own crude drugs and harsh medical treatment are more efficacious than the purer manufactured drugs supplied to them through the Medical Department.
>
> (Hunt, 1923, pp. 147–148)

Yet Hunt (1923, p. 150) also reported that many of the European residents, including missionaries, frequently resorted to the Samoan doctors. The report of the American Samoa Department of Health for 1933 (Stephenson, 1934) had an extensive discussion of Samoan herbalism. Christophersens's floristic works (1935, 1938) also mentioned the medicinal uses of Samoan plants. A government health manual admitted that Samoan

TABLE 1

SAMOAN MEDICINAL PLANTS

Samoan name	Latin name and Cox voucher number	Status	Parts	Use
A'atasi	*Rorippa sarmentosa* (Forst f ex DC) Maebr. *1038*	Feral	leaves	Analgesic, emetic, antifungal
'Ago	*Curcuma longa* L. *1058*	Feral	rhizomes	Fevers, rashes, internal distress
Aloalo	*Premna obtusifolia* R.Br. *813*	Wild	leaves	Inflammation
			stem	Inflammation
Aloalo tai	*Clerodendrum inerme* L. Gaertn. *1009*	Wild	leaves	Inflammation
Aloalo vao	*Mussaenda raiateensis* J.W.Moore	Wild	stem	Inflammation
			leaves	Inflammation
Aoa	*Ficus obliqua* Forst.f. *988*	Wild	roots	Inflammation
Ateate	*Wedelia biflora* (L.) D.C. *1013*	Wild	leaves	Inflammation
			stem	Internal distress, anti-fungal
Aute Samoa	*Hibiscus rosa-sinensis* L. *1048*	Cult.	stem	Inflammation
'Ava	*Piper methysticum* Forst.f. *1056*	Cult.	rhizomes	Internal distress, inflammation
'Ava'ava'a'itu	*Piper* sp., *Macropiper* sp. *830*	Wild	stem	Inflammation
			leaves	Inflammation
'Ava pui	*Zingiber zerumbet* (L.) J.E.Smith *1026*	Wild	nodes	Inflammation
Fa'amoegalo	*Cymbopogon citratus* DC *968*	Cult.	stems	Anti-bacterial, anti-fungal
Fa'i	*Musa paradisica* L. *1020*	Cult.	roots	Inflammation and Hallucinations
	Ethnovariety Fa'i pata	Cult.	meristems	Wounds
Fasa	*Pandanus tectorius* Parkinson *874*	Wild	roots	Internal distress
Fau	*Hibsicus tiliaceus* L. *984*	Wild	bark	Appendicitis
			root sap	Eye injuries
Fetau	*Calophyllum inophyllum* L. *822*	Wild	leaves	Inflammation
Filimoto	*Flacourtia rukam* Zoll.et Mor. *990*	Wild	bark	Inflammation
Fisoa	*Colubrina asiatica* L. *985*	Wild	leaves	Maternity complications
Fu'afu'a	*Kleinhovia hospitata* L. *847*	Feral	bark?	Inflammation
Fuefue moa	*Ipomoea pes-caprae* (L.) R. Br. *981*	Wild	leaves	Inflammation
Fuefuesina	*Vigna marina* (Burm.) Merr. *1007*	Wild	leaves	Inflammation, maternity complications
Fue manogi	*Piper graeffei* Warb. *808*	Wild	leaves	Inflammation
			stems	Internal distress
			bark	Appendicitis and stomach pain
Fueselela	*Hoya australis* R.Br. *1001*	Wild	leaves	Inflammation, cardiotonic
Fue vai	*Mucuna gigantea* (Willd.) DC. *1017*	Wild	stem	Analgesic
Gatae samoa	*Erythrina variegata* L. *969*	Cult.	bark	Inflammation, anti-viral
Ifi	*Inocarpus fagifer* (Park) Fosberg *1030*	Feral	meristems	Inflammation
			roots	Internal distress
			bark	Appendicitis & stomach pain
	Ethnovar. Ifi lanu moana *1042*		bark	Antibacterial
	Ethnovar. Ifi lanu mumu *1043*		bark	Internal illness
Kuava	*Psidium guajava* L. *972*	Cult.	leaves	Diarrhea
La'au fai lafa	*Cassia alata* L. *998*	Cult.	leaves	Ringworm
La'au sauga	*Ocimum sanctum* L. *1032*	Cult.	leaves	Anti-bacterial
Lama	*Aleurites moluccana* (L.) Willd. *855*	Feral	leaves	Anti-fungal
Lau auta	*Phymatosorus scolopendria* (Burm.) Pichi Serm. *982*	Wild	rhizomes	Inflammation, chills, analgesic
			leaves	Inflammation, internal distress
Lau fala	*Pandanus* sp. *292*	Cult.	roots	Inflammation, internal distress
Lau fala ula	*Pandanus* sp.	Cult.	roots	Internal distress
Lau pata	*Macaranga harveyana* Muell. Arg. *1037*	Wild	stem	Internal distress
			roots	Wound healing, antibacterial
Lau talotalo	*Crinum asiatica* L. *10757*	Cult.	leaves	Inflammation
Lau tamafalu	*Micromelum minutum* (Forster f.) Seemann *829*	Wild	bark	Antifungal, antibacterial
			leaves	Antibacterial, analgesic
Lau ti	*Cordyline terminalis* (L.) Kunth *967*	Feral	leaves	Inflammation
Ma'anunu	*Tarenna sambucina* (Forst.f.) Durand *1019*	Wild	bark	Inflammation, internal distress
Magele	*Trema cannabina* Lour. *1028*	Wild	root	Eye infections
Mago	*Magnifera indica* L. *965*	Cult.	bark	Internal distress, inflammation
Mamala	*Homalanthus nutans* (Muell. Arg.) Pax *842*	Wild	bark	Tonic
			leaves	Inflammation, internal distress
			stems	Anti-viral
			roots	Internal distress, analgesic

TABLE 1 (*continued*)

Samoan name	Latin name and Cox voucher number	Status	Parts	Use
Maota	*Dysoxylum maota* Reinecke *1015*	Wild	bark	Tonic
Masame	*Glochidion ramiflorum* Forst. *992*	Wild	leaves	Inflammation, anti-fungal, bacterial
			bark	Internal distress, muscular aches
			stems	Appendicitis, abdominal distress
Matalafi	*Psychotria insularum* A.Gray *989*	Wild	leaves	Inflammation, maternity complications, anti-bacterial
			meristems	Inflammation, anti-bacterial, eye injuries & sun blindness
			stems	Internal illness, inflammation, anti-fungal
			roots	Anitviral, antibacterial
Mautofu-	*Sida rhombifolia* L. *1041*	Wild	leaves	Antibacterial
Moso'oi	*Cananga odorata* (Lam.) Hook.f.& Thoms. *975*	Cult.	bark	Asthma
Milo	*Thespesia populnea* (L.) Sol. *1006*	Wild	leaves	Internal illness
Namulega	*Vitex trifolia* L. *1053*	Wild	leaves	Internal illness, inflammation
Nonu 'ai	*Syzygium samarangense* (Bl.) Merr. & Perry *995*	Cult.	leaves	Coughs, asthma
Nonu fi'afi'a	*Syzygium malaccense* (L.) Merr. & Perry *841* leaf galls or swellings-mumu tuaula [E 13]	Cult.	leaf gall	Inflammation
Nonu togi	*Syzygium* sp. *991*	Cult.	leaves	Inflammation
			roots	Inflammation, yaws
			fruits	Internal distress, appendicitis
O'a	*Bischofia javanica* Bl. *1027*	Cult.	bark	Internal distress,
Onoonotea	*Laportea* sp. *1051*	Wild	leaves	Anti-bacterial,
Paogo-	*Pandanus tectorius 1061*	Wild	roots	Internal distress
Polo	*Capsicum frutescens 859*	Cult.	leaves	Anti-bacterial, maternity complications
			fruits	Internal illness
Pua samoa	*Gardenia taitensis* D.C. *1008*	Cult.	leaves	Inflammation
Pu'a	*Hernandia nymphaefolia* (Presl) Kub. *819*	Wild	bark	Inflammation, Anti-viral
Seasea	*Syzgium corynocarpum* (Gray) Muell. *1050*	Cult.	meristems	Inflammation
Seasea toto	*Syzgium sp. 1018*	Cult.	meristems	Inflammation
			roots	Internal illness
Suni vao	*Phaleria acuminata* A. Gray *57*	Wild	bark	Menstruation problems
Taipoipo	*Geniostoma samoense* Reinecke *288*	Wild	bark	Internal distress
			stems	Appendicitis, stomach pain
Talie	*Terminalia catappa* L. *1047*	Wild	meristems	Inflammation
			bark	Menstruation, maternal complications
Tipolo	*Citrus aurantifolia* Chris. *1046*	Cult.	leaves	Inflammation
Ti vao	*Cordyline terminalis* (L.) Kunth *978*	Feral	rhizomes	Internal distress
Togo	*Centella asiatica* (L.) Urb. *997*	Wild	leaves	Inflammation, bacterial, eye infection, sunblindness
Togo vai	*Rhizophora mangle*	Wild	bark	Maternity complications
Toi	*Alphitonia zizyphoides* (Spreng.) A.Gray *987*	Wild	bark	Tonic, internal distress
To'ito'i	*Scaevola taccada* (Gaertn.) Roxb. *1002*	Wild	bark	Menstruation problems
Tutuna	*Rhapidophora graeffei* Engler *976*	Wild	roots	Inflammation, hallucinations
			leaves	Inflammation, hallucinations
Ufi	*Dioscorea alata* L. *1059*	Cult.	leaves	Anti-fungal
Ulu ea-	*Artocarpus altilis* (Park) Fosberg ethnovar. *1044*	Cult.	roots	Antiviral, antifungal
Ulu ma'afala	*Artocarpus altilis* (Park) Fosberg ethnovar. *1045*	Cult.	roots	Diarrhea
Ulu maopo	*Artocarpus altilis* (Park) Fosberg ethnovar. *1036*	Cult.	roots	Internal distress
Usi	*Euodia hortensis* Forst. *1039*	Wild	stems	Inflammation, 'ghost sickness'
U'unu	*Sarcopygme* sp. *21*	Wild	leaves	Inflammation
			stems	Inflammation
Vavae	*Ceiba pentandra* (L.) Gaertner *970*	Cult.	bark	Asthma
Vi	*Spondias dulcis* Parkinson *966*	Cult	leaves	Eye infections
Vi vao	*Physalis angulata 1052*	Wild	leaves	Antibacterial

but over 1/3 of the extracts showed 40% inhibition or more. Bioassay guided fractionation has yielded the active flavononids (+)catechin 1,4′-MeO-(+)gallocatechin 2, and (+)gallocatechin 3, isolated from *Syzygium malaccense* (Myrtaceae) and *Atuna racemosa* (Chrysobalanaceae).

Phospholipase A_2 inhibitors from the Samoan ethnopharmacopoeia

A group headed by V.D. Hegde at the Schering-Plough Research Institute in Bloomfield, NJ screened extracts of *Erythrina variegata* (Leguminosae) for inhibition of phospholipase A_2, an enzyme believed to play an important role in inflammation. Samoans recognize two varieties of *E. variegata*, 'gatae Samoa' and 'gatae palagi'. They use the bark of only one variety, 'gatae Samoa', to treat inflammation. Only 'gatae samoa' exhibits significant phospholipase A_2 inhibition. Using bioassay guided fractionation, three phospholipase A_2 inhibitors were isolated and identified. These include two flavonoids (4′-hydroxy-3′,5′-diprenyl isoflavonone and 3,9-dihydroxy-2,10-diprenyl pterocarp-6a-ene) and a novel isoflavonone (4′-hydroxy-3′5′,6 triprenyl isoflavonone). The complete results will appear elsewhere, but the isolation of these anti-inflammatory compounds and the confirmation of anti-inflammatory activity in only one ethnovariety of *Erythrina variegata* lends credibility to the healer's assertions.

Antiviral compounds from the Samoan ethnopharmacopoeia

Samoan healers use water infusions of the macerated wood of *Homalanthus nutans* (Euphorbiaceae) as a tonic and to treat yellow fever. Extracts of *Homalanthus nutans* were screened by a team led by Michael Boyd at the National Cancer Institute (NCI) in Bethesda, MD for anti-HIV activity. In an in vitro tetrazolium-based assay to detect cytopathic effects of the AIDS virus HIV-1 (Gustafson et al., 1992), *Homalanthus* extracts exhibited potent activity. Bioassay guided fractionation resulted in the isolation of prostratin (12-deoxyphorbol 13-acetate). At non-cytotoxic concentrations prostratin was found to prevent HIV-1 reproduction in lymphocytic and monocytoid target cells. Prostratin also fully protected human cells from lytic effects of HIV-1. Since phorbols are known to be tumor-promoters (Evans, 1986), identification of the active anti-viral component of *Homalanthus nutans* as a phorbol raised some questions concerning the therapeutic potential of *Homalanthus* extracts. But in contrast to many other phorbol derivatives, prostratin is reportedly not a tumor promoter (Zayed et al., 1984). Furthermore, Gustafson et al. (1992) found that prostratin does not induce hyperplasia in mice, yet stimulates protein kinase C. The NCI team concluded that prostratin 'represents a non-promoting activator of protein kinase C which strongly inhibits the killing of human host cells in vitro by HIV. By these criteria, prostratin is unique' (Gustafson et al., 1992, p. 1984).

It is possible that *Homalanthus nutans* contains other phorbols that have undesirable effects. However, since prostratin is a relatively polar phorbol ester, the water infusion techniques of the Samoan healers might serve to selectively extract prostratin from the other phorbols present; we are currently investigating this hypothesis. The isolation of prostratin from *H. nutans*, its extreme potency against HIV-1, and its unique nature as a non-promoting protein kinase C activator tends to corroborate the ethnopharmacological use of *H. nutans* against diseases of viral origin. Currently NCI considers prostratin as a potential candidate for drug development.

Efforts to save the Samoan ethnopharmacopoeia

Unlike much anthropology, which attempts to conceptualize human societies and social structures in Western terms, ethnobotany has as its ultimate goal a two-way flow of information and resources between indigenous and Western societies. The reason for this is quite simple: ethnobotanists do not view the indigenous people they work with as 'informants' but rather as colleagues.

One philosopher of science, Paul Feyerabend (1978), argues that current academic approaches to indigenous societies are intrinsically ethnocentric because they are focused on the *products* of these cultures, but refuse to seriously consider the indigenous intellectual *processes* responsible for the products:

> They [western academics] examine them [indigenous cultures], they study them, they write about them, they 'interpret' them, they use them to bolster their own ideologies but they would never grant them a fundamental role in education, and they would never permit them to displace science from the central role it now assumes. This dogmatism is only rarely noticed, for nothing is now more popular than to praise primitive art, Chinese philosophy, Indian stories and so on. What is not seen, even by the concerned cultures and races themselves is that much of this so-called art was a science as well, it contained views of the world and rules for survival in it
>
> (Feyerabend 1978, p. 177)

In this essay I have noted 6 new pharmacologically active compounds isolated from Samoan medicinal plants, with at least one considered to be an important new drug lead. Analysis of the pharmacological efficacy of the Samoan ethnopharmacopoeia has scarcely begun, and it is likely that further research will result in the discovery of more pharmacologically active compounds from Samoan medicinal plants.

Yet indigenous knowledge systems are rapidly disappearing under the onslaught of Western culture. The loss of these indigenous knowledge systems may yet prove to be one of the greatest tragedies of our age. By the time ethnobotanical studies emerge from the academic periphery to the mainstream it will likely be too late to salvage very much. Already the few ethnobotanists that exist are forced to travel to increasingly remote areas to locate healers, who frequently are aged and without any apparent intellectual heirs. Since in many indigenous societies ethnopharmacology is a specialist rather than a general tradition, the death of each healer results in an irreparable loss of generations of crucial knowledge. Hence one of the most important duties of an ethnobotanist is to document, in both western and indigenous languages, the indigenous knowledge system. It is in this spirit that ethnobotanists publish scientific articles with indigenous language abstracts; we wish to render our work easily accessible to our indigenous colleagues. My current work in process, "Samoan Ethnopharmacology — 'O le Faiga Vai Samoa", is an illustrated treatise written in both English and Samoan. Bo Landin of Scandinature Films, Karlstad, Sweden has produced the first Samoan language feature film, "Nafanua — Fa'asoaina o le Vao Matua" (Nafanua — Saving the Samoan Rainforest), which was screened to villages throughout Western Samoa using a portable generator and 16 mm film projector and broadcast on T.V. throughout American Samoa. It is our hope that these efforts will affirm the dignity and significance of Samoan culture, particularly in the eyes of the younger generation.

The debt of the research team to the indigenous healers should always be remembered during all phases of drug searches based on ethnopharmacological screens (Cox, 1990a). By the time that a drug search produces a new lead compound, it is sometimes easy to forget that the compound in the test tube was originally obtained through the willingness of traditional healers to collaborate. Thus steps must be taken from the inception of a project to protect indigenous intellectual property rights. This requires sensitivity in implementation because it is as unethical to raise hopes of financial returns among indigenous people prematurely as it is to raise hopes of cures among sick people prematurely. In Samoa we have protected these rights by written patent agreements signed by representatives of involved institutions as well as openly negotiated agreements signed with villages. In the case of prostratin, both the National Cancer Institute and Brigham Young University have guaranteed to return to the Samoan people a significant portion of any royalties.

In unmonetized cultures, financial interests can be translated into conservation efforts to preserve and protect rain forest and other habitats valued by the healers. Together with a variety of American donors I raised funds sufficient to protect the 30 000 acre lowland rainforest of Falealupo from logging. The resultant rain forest reserve is completely owned, controlled, and managed by the village. Three additional indigenously controlled preserves have been established with funds from the Swedish Society for the Conservation of Nature (Cox and Elmqvist, 1991), and a new non-profit foundation, Seacology, seeks to expand the establishment of indigenous controlled preserves throughout the islands of the South Pacific and Caribbean.

The task we face, to preserve the ethnopharmacological traditions of the world, is daunting. But we can make a meaningful attempt, if we can learn in time to jettison our ethnocentricity and reverse historical Western approaches to indigenous societies. If Western scientists approach indigenous people with an attitude of humility, generosity, and the desire to learn, both Western and indigenous societies can be benefitted.

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