South American Herbs

by Daniel B. Mowrey, Ph.D.

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YerbaMate: Unequaled Natural Nutrition

Legends of the Guarani Indians

There is an old Guarani Indian legend that relates the origins of the Guarani in the Forests of Paraguay. According to the legend, the ancestors of the Guarani at one time in the distant past crossed a great and spacious ocean from a far land to settle in the Americas. They found the land both wonderful yet full of dangers. Through diligence and effort they subdued the land and inaugurated a new civilization. There were two brothers who vied for the leadership of the people, Tupi and Guarani. Eventually they feuded and divided the people into two separate nations. Each nation, or tribe, adopted the name of the brother who was its leader. Guarani was the younger, fair-skinned brother, while Tupi, the older brother, had dark skin.

Another variation of the origin of the tribes suggests that a large civilization called the Caribe (meaning "The Saints") from the Caribbean area traversed the great South American rivers, the Orinoco, Amazon and Parana, to eventually arrive at their present location. Then, as in the other legend, the Caribe split into two opposing factions, the Tupi and Guarani.

Now the two stories converge. The darker Tupi tribes adopted a more fierce, nomadic life style, rejecting the agricultural traditions of their fathers. They engaged in the practice of drinking large quantities of a caffeine-containing, highly addictive drink prepared from the guarana tree. This drink came to symbolize the baseness of their civilization, which civilization steadily declined until now the Tupi are effectively extinct, as indicated by the fact that even their language has died.

The Guarani tribes became a stable, God-fearing people who worked the land and became excellent craftsmen. They looked forward to the coming of a tall, fair-skinned, blue eyed, bearded God (Pa'i Shume) who, according to legend, descended from the skies and expressed his pleasure with the Guarani. He brought religious knowledge and imparted to them certain agricultural practices to be of benefit during times of drought and pestilence as well as on a day-to-day basis. Significantly, he unlocked the secrets of health and medicine and revealed the healing qualities of native plants. One of the most important of these secrets was how to harvest and prepare the leaves of the yerbamate tree. The mate beverage was meant to ensure health, vitality and longevity. The choice of a favorite drink by the Tupi and Guarani symbolized the opposite paths the respective groups chose to follow. The yerbamate of the Guarani provided many more beneficial properties than the Tupi's guarana without any of the deleterious side effects.

Mate became the most common ingredient in the household cures of the Guarani, and remains so to this day. In current practice in modern Argentina and Paraguay, mate tea is made from the leaves steeped in hot water. Actually, a large quantity of ground leaf is first soaked in cold water, then the hot water is added, over and over again, until all the good stuff has been extracted. In between each addition of hot water the tea is ingested through a special wood or metal straw, called a *bombilla*, that filters out the leafy material. It is also used as a cold beverage. Certain rituals of mate use in South America are extremely unsanitary from a hygienic perspective. Often, the bombilla is passed from one individual to the next around a circle. This, and associated ritualistic practices, represents aberrations of the yerbamate tradition that crept in over the centuries.

Among the native Guarani, on the other hand, the natural use of mate for healthful purposes has persisted. They use it to boost immunity, cleanse and detoxify the blood, tone the nervous system, restore youthful hair color, retard aging, combat fatigue, stimulate the mind, control the appetite, reduce stress, eliminate insomnia, and so forth.

In this booklet we will explore the properties of yerbamate in an effort to see if it qualifies for the accolades it has received down through the centuries.

Description of Yerbamate

Mate *(Ilex paraquariensis)* is an evergreen member of the holly family. It goes by several common names, including Paraguay tea, Jesuit tea, missionary tea and South American holly. It grows wild in Argentina, Chile, Peru, and Brazil, but is most abundant in Paraguay where it is also cultivated. The leaves are used nutritionally and medicinally. They are usually ground and steeped in hot water for several minutes and served hot or cold. The plant is classified according to Western herbal medicine as aromatic and stimulant, but these terms sometimes miss the mark entirely.

Constituents

Several attempts to characterize part or all of the constituents of mate have been made during the last few

decades. They agree on some points and disagree on others. This is not unusual as different assay techniques will be sensitive to different nutrients. The one thing that unites the various assays is the consistent detection of numerous vitamins and minerals. There is the usual array of resins, fiber, volatile oil, and tannins that characterize many plant substances. But then there is the growing list of vitamins and minerals, including carotene, vitamins A, C, E, B1, B2, complex, riboflavin, nicotinic acid, pantothenic acid, biotin, vitamin C complex, magnesium, calcium, iron, sodium, potassium, manganese, silicon, phosphates, sulfur, hydrochloric acid, chlorophyll, choline, inositol. Different assays find different nutrients and there is probably no single assay that has found all of them. There are certainly still other nutrients that have not been identified as yet. One group of investigators from the Pasteur Institute and the Paris Scientific Society concluded that mate contains practically all of the vitamins necessary to sustain life. They focused especially on pantothenic acid, remarking that it is rare to find a plant with so much of this significant and vital nutrient. **It is indeed difficult to find a plant in any area of the world equal to mate in nutritional value.**

In addition, mate contains a substance belonging to a very specialized class of chemical compounds. Though only a small amount of this substance occurs in mate, its presence has generated a huge amount of attention. The substance is a xanthine alkaloid called mateine. Because of all the attention heaped upon its presence in yerbamate, the following fairly extensive treatment is given, even though in reality the substance probably contributes little if anything to the activity of the plant.

Yerbamate and the Xanthine Alkaloids

The xanthines draw a lot of attention because they number among them some traditional nasties, chief of which is caffeine. Others are theophylline and theobromine. All of the xanthines have a similar stereo-chemistry but each has its own unique set of properties. For many years, and even now in some sectors, yerbamate was (is) thought to contain caffeine. *It turns out that mateine is not identical to caffeine; it differs from caffeine in some rather dramatic ways.* Some members of the scientific community still resort to calling mateine a South American term for caffeine, or to maintain in perfect knowledge of the falseness of the assertion, that two substances so similar chemically must have the same properties. Slowly, they are being forced to acknowledge the distinction between mateine and caffeine.

Remember the legend of Tupi and Guarani. Modern studies seem to validate the difference between mate and other xanthine-containing plants such as Tupi's guarana. Stereo-chemical and clinical work on xanthines in the last couple of decades have shown that, though similar in structure, the members of this class have widely varying pharmacology. In fact, there is only one effect that seems to be shared by all trimethyl xanthines: smooth muscle relaxation. It is this action that makes them, with the exception of caffeine whose smooth muscle relaxant effects are diminished by other side-effects, good clinical dilators of the bronchi and hence useful in the treatment of asthma.

Chemical assays on mate have traditionally looked for caffeine. In such tests mateine, being a simple stereoisomer of caffeine, would test positive. Until recently nobody has looked at the exact structure of the molecule—and, to my knowledge, nobody in the United States has ever made the attempt. Researchers at the Free Hygienic Institute of Hamburg, Germany, concluded that even if there were caffeine in mate, the amount would be so tiny that it would take 100 tea bags of mate in a six ounce cup of water to equal the caffeine in a six ounce serving of regular coffee. *They make the rather astute observation that it is obvious that the active principle in yerbamate in not caffeine! But then, we know for sure it is not caffeine, for caffeine is not present at all.*

Mateine has a unique pharmacology and it is unfair to compare it to caffeine (incidentally, guarana may not contain caffeine either—it may contain something that could by called guaraneine—however that substance looks like it is more deleterious that caffeine!) Mateine appears to possess the best combination of xanthine properties possible. For example, like other xanthines it stimulates the central nervous system; but unlike most, it is not habituating or addicting. Likewise, unlike caffeine, it is a mild (not strong) diuretic, as are many xanthines. It relaxes peripheral blood vessels, thereby reducing blood pressure without the strong presser effects on the medulla and heart exhibited by some xanthines. We also know that it improves psychomotor performance without the typical xanthine-induced depressant after effects.

Dr. Jose Martin, Director of the National Institute of Technology in Paraguay, writes, "New research and better technology have shown that while mateine has a chemical constituency similar to caffeine, the molecular binding is different. Mateine has none of the ill effects of caffeine." And Horacio Conesa, professor at the University of Buenos Aires Medical School, states, "There is not a single medical contradiction" for ingesting mate. Clinical studies show, in fact, that individuals with caffeine sensitivities can ingest mate without adverse reactions.

The time has come, therefore, to discard the outmoded ideas (1) xanthines are all alike, (2) that yerbamate contains caffeine, and (3) that mateine is identical with caffeine. It would be tragic indeed if nature created such a beneficial plant and then, through some bizarre quirk, contaminated it with caffeine. It is more likely that mate is, as some say, "nature's most perfect beverage," or, as others maintain, "the beverage of the God's."

Summarizing the clinical studies of France, Germany, Argentina and other countries, it appears that we may be dealing with the most powerful rejuvenator known to man. Unlike the guarana of the Tupi, the coca of the Incas, the coffee of India, or the tea of China, mate rejuvenates not by the false hopes of caffeine, but simply through the wealth of its nutrients.

Gastrointestinal Properties

Perhaps the main area of application of mate is the gastrointestinal tract. Reported effects range from the immediate improvement in digestion to the ability to repair damaged and diseased gastrointestinal tissues.

Constipation, acute or chronic, can easily be overcome through the use of mate. Considering the seriousness of this health problem in the United States and other developed countries, a simple and effective solution such as drinking a pleasant beverage should be a welcome addition to treatment regimens. Mate appears to work mainly by softening the fecal mass, but it also appears to stimulate normal peristalsis to some degree.

Sometimes, hemorrhoidal relief can also be obtained through drinking the tea, since the bowel movement will reduce pressure on blood vessels caused by the hard stool.

Dieters use mate to suppress the appetite, while providing necessary nutrition, energy and improved elimination to compensate for a reduction in ingested calories.

Mate, Fatigue & the Nervous System

Better than any other xanthine alkaloid, mate has the ability to quicken the mind, increase mental alertness and acuity, and do it without any side effects such as nervousness and jitters. These observations have been made time and again by qualified medical experts as well as by the lay user.

The effects of mate on the nervous system are varied and not very well understood. The best guess is that it acts like a tonic, stimulating a weakened and depressed nervous system and calming an overexcited one. Certainly the nutritional value of the plant cannot be overlooked as a possible substrate for improved health and function. Our knowledge of mate's effects are currently limited almost exclusively to observation on gross changes in behavior: such as an increase in energy and vitality, better ability to concentrate, less nervousness, agitation and anxiety, and increased resistance to both physical and mental fatigue.

One consistent observation is the improvement in mood, especially in depression, that follows the ingestion of the tea. This may be a direct result or an indirect result of increased energy.

Reported improvements in memory have not been sustained experimentally or clinically, but are logical and may again be attributed to the nutrients, especially choline which is an important central nervous system neurotransmitter.

One of the remarkable aspects of mate is that it does not interfere with sleep cycles. In fact, it has a tendency to balance the cycles, inducing more REM sleep when necessary or increasing the amount of time spent in delta states. Many people report that they require less sleep when using mate. Usually such an experience is accompanied by a deeper, more relaxing sleep.

The non-addicting nature of mate makes it an ideal substitute for people who are trying to kick the caffeine habit.

Cardiovascular Effects

Heart ailments of all kinds have been treated and/or prevented through yerbamate use. Yerbamate supplies many of the nutrients required by the heart for growth and repair. In addition, it increases the supply of oxygen to the heart, especially during periods of stress or exercise. This prevents the onset of lactic acid build-up and fatigue that occur when cellular oxygen levels fall below a critical point and low-energy producing, anaerobic glycolysis sets in.

Reports of mate reducing blood pressure are not uncommon.

Mate also belongs to that class of herbal medicines called alternatives. That is, it seems to be continually striving to rid the blood of waste materials and miscellaneous toxins.

Effects on the Immune System

A consistent observation in most South American literature on mate is that it increases the immune response capability of the body, stimulating the natural resistance to disease. This also involves a nourishing and strengthening effect of the ill person, both dur-

ing the course of the illness and during convalescence, sometimes dramatically accelerating recovery times.

Exact mechanisms of action have not been worked out, but they must certainly involve both a direct anti microbial action against certain infections organisms, and a general non-specific effect on overall resistance. The nutritional content of the plant probably plays a major role here, but it is also probable that other constituents contribute to the action by stimulating the production and activity of white blood cells.

Nutritional Properties

As discussed in the section on constituents, mate contains a wide variety of essential nutrients. The interactions and synergy among these nutrients have never been systematically studied. But the stories surrounding the nutritional applications of mate tea are nothing short of amazing.

Mate is often used as a staple food, sometimes substituting for such important foods as bread and vegetables. It is easily capable of eliminating the sensation of hunger, and can impart a similar invigoration as a full meal. Peace Corps workers have reported cases in which large groups of natives remain in good health for extended periods of drought and famine, even though they eat only small meals per day. How so? By drinking copious amounts of yerbamate tea. Some natives spend their entire lives on such a diet, and live to very advanced ages, sometimes in excess of 100 years.

South American governments have adopted the practice of encouraging mothers, especially in poorer regions, to include yerbamate in the diet of their school age children.

North America and European missionaries sent to the river forests of Paraguay and Brazil routinely report periods where they themselves have gone for months at a time subsisting only on yerbamate tea with no observable ill effects other than some weight loss.

Sailors routinely use yerbamate to prevent scurvy, but that alone doesn't signify a great deal. Much more interesting are reports of mates ability to increase the sailors' ability to adapt to the hot, humid, stultifying environments of furnace rooms, galleys, boiler rooms etc. In fact, this is an extraordinary attribute of mate in general. One of the best ways to adapt to the jungle climate of South America is the frequent drinking of mate tea.

There is the story of a telegram sent during the Russo-Japanese war that stated that the only Japanese regiments that did not suffer from foot infections, apparently caused by rice consumption(?) were those that drank mate tea instead of the normally and widely ingested tea or coffee. Similar nutritional benefits have been reported by the medical researchers in the Italian army who observed the rejuvenating effects of mate among undernourished and diseased soldiers in infantry regiments.

An article in "The Society Arts Journal" noted, "Mate has and amazing power to sustain strength neither tea nor chocolate can pretend to have. Hikers using mate are able to walk six to seven hours without necessity of eating."

We might also point out that the nutrients in mate tea are in a liquefied state and are therefore more easily assimilated than the nutrients in other foods or in pills or capsules.

Endocrine/Metabolic Properties

Mate has long been known to prevent and reduce fatigue. The most logical mechanism of action at this time seems to be a direct stimulating effect on metabolism in muscle cells.

Additionally, there is growing clinical evidence that mate stimulates the adrenal glands to produce corticosteriods. This mechanism of action may account for the commonly observed action of mate to decrease the severity and incidence of allergy and hay fever.

The adrenocortical action may help explain reported cases of hypoglycemic patients responding to mate. It is possible that mate, by stimulating the adrenal cortex to secrete glucocorticoids, helps balance blood glucose levels. Similarly, it may also stimulate the production of mineralcorticoids, thereby helping to regulate electrolyte metabolism. These hypotheses are attractive given certain clinical observations, but need to be scrutinized more closely in experimental settings.

Mate reduces the effects of stress on the body. This property probably involves a combination of effects on the endocrine system, the nervous system and the immune system, but is one of the most important of the herb's actions.

Miscellaneous Uses

1. Alcohol Substitute. One finds frequent references to this property of mate in South American literature on herbal medicine. Apparently, alcoholics find the ingestion of yerbamate a pleasant substitute for liquor. The detoxification action of mate must certainly play a role here. The rapid regeneration of liver tissues and the observable increase in vigor, clarity of thought and health must all be involved in the effectiveness of mate for this condition.

2. Degenerative Conditions. Related to its amazing nutritive value are the frequent applications of mate to

overcome the debilitating effects of neurasthenia, rheumatism, diabetes and senility. The special constellation of nutritive effects of mate can sometimes be seen in a reduction or reversal of some signs of aging, including wrinkles, amount of time spent in convalescence and mood swings.

3. Headaches, Migraine, and Neuralgia. The combined effects of mate on the nervous and cardiovascular system probably helps to account for its ability to relieve various kinds of pain in the area of the skull.

4. Diuretic. There is no doubt that mate can induce diuresis. But the effect seems to be tonic in nature, i.e., it only kicks in when you need it. This is good, because we wouldn't want our bodies continually trying to divest itself or intracellular water.

5. Hair Color. It is felt by some mate aficionados that use of the herb helps maintain a youthful hair color. Admittedly far out, this claim may nevertheless contain a rudiment of validity to the degree that proper nutrition or the proper mix of nutrients might contribute to such a phenomenon.

6. Sexual Performance. Improvements in this rather subjective domain have been reported. Just how valid such reports are, even if truly believed by the participants, cannot be determined without considerable clinical research. Should mate be proved to have stimulating effect on the adrenal glands (which appears very likely), one could expect some effect on the production and regulation of androgenic hormones, with a resulting effects of some kind on sexuality.

Quality

We are just entering an era of increased trade with South America and the importation of herbal materials is still very primitive. Problems of communication, of being able to oversee operations, of simple plant identification and other problems make trade in South American herbs a difficult practice. In addition, South American herbalists are the first to admit the impurity of almost all yerbamate products currently found on the market. They are full of insect parts, materials from other plants with irritating effects of the gastrointestinal tract, and they are sometimes totally misidentified.

One common problem in the mate market is a general lack of awareness concerning the importance of allowing the plant to dry or 'cure' for several months (at least twelve) before packaging it for sale. In a general survey I recently made of about half a dozen importers, only one considered this an aspect worthy of consideration.

For these and other reasons, it is wise to purchase your mate only from a reputable firm that takes extraordinary means to overcome the inherent difficulties. You may find it difficult to locate that firm, but the search is worth the trouble.

Generally, a firm that specializes in yerbamate (and other South American herbs) will be best informed and much more careful in their importing practices from that continent.

Yerbamate and Stevia

Some people find the taste of pure yerbamate somewhat unpleasant, kind of like alfalfa. For this reason the practice of combining mate with the very pleasant tasting stevia, a nutritional herb from South America, has become a very popular way of enhancing the flavor and the nutritional value. It indeed makes for a regal treat.

Stevia is a very healthful herb in its own right, being widely used both internally for stomach ailments and blood sugar regulation, and externally for skin problems, such as acne, cuts, bruises and burns.

The Bombilla

The Argentines and Paraguayans developed a method for ingesting yerbamate that, in concept, deserves to be emulated by other nations. The method uses a straw, usually metal, that has a fine metal filter attached to the end which is inserted in the tea. The straw replaces the tea bag as a means for keeping fibrous material from being mixed with the ingested liquid tea.

The bombilla has the advantage that it can be inserted directly into the bulk of leaves and twigs (twigs must be removed from material put in a tea bag). As one sucks on the straw embedded in the mass of herb, the herbal material becomes lodged against the screen and the liquid is drawn through it. This process forcibly removes far more of the nutrients from the herb than any other practical method. Some of the finer particulate matter works its way through the holes in the strainer and is ingested, but this material caused no discomfort whatsoever and is good for you. The better bombillas can be placed in a dishwasher for cleaning.

The bombilla method was probably developed by the natives as experience taught them that they received a good deal more nutritional value by using this method of extraction.

The bombilla method has received some criticism from an hygienic point of view. Indeed, when used in the mate rituals of South America where the straw is passed from one to participant to another around the circle, it probably is an unsanitary practice. But if a bombilla is used by only one person, it has much to contribute in both hygiene and nutrition.

Lapacho: Ancient Herb, Modern Miracle

Into the Light

This pamphlet attempts to explain the meaning behind the stack of research that has been published concerning the anti-cancer, antiviral and other properties of the South American herb known as Lapacho. While a much larger volume could be written about the empirical data that has been collected around the world on the almost unbelievable properties of this plant, my chief concern is with the experimental, medical and clinical data that bears a more certain scientific aura.

One of the last great, but largely untapped, reserves of natural resources on the face of the earth is South America. The herbal medicines that abound on this continent have been largely denied to the rest of the world. The inaccessibility of the great forest, combined with a general lack of interest, have kept the secrets of the region shrouded in darkness. Africa is a continent of light by contrast.

Efforts to increase the availability of South America herbal remedies have been extremely arduous and difficult. Only with great effort are we able to bring together all the resources necessary to successfully identify, harvest, and export such plant materials. Much material coming into the U.S. from its southern neighbors has been falsely identified, adulterated, or harvested incorrectly. Rare is the importer who even knows what to look for.

Nowhere have these difficulties been more apparent than in the marketing of lapacho. Lapacho (Tabebuia avellandedae, & T. impetiginosa) comes from the rain forest and mountains of Paraguay, Argentina and Brazil. We have known about this plant for almost 100 years, yet efforts to import medicinally active lapacho have failed more than they have succeeded. In spite of the difficulties, the interest remains extremely high because this plant holds great promise for the effective treatment of cancers such as leukemia, candida and other troublesome infections, debilitating diseases (including arthritis), as well as a host of other complaints.

Anyone familiar with the recurring ginseng and goldenseal fiascos will appreciate the similar state of affairs that exists in the business of lapacho. In fact the chances of obtaining good quality ginseng and goldenseal in American health food stores are greater than the odds of obtaining good quality lapacho. A vast majority of commercial lapacho is void of significant activity. The reason is primarily a lack of quality control at every stage of the enterprise. Gatherers, unaware as to which parts of the plant contain the active material, harvest all parts of the plant; curers, unaware of the traditional lapacho curing practices, make assumptions that are more often wrong than right; shippers pay little attention to protecting the material from the hazards of transportation; manufacturers, unaware of what constitutes really good lapacho (having never bothered to go to South America and have a look), don't have any idea how to set up quality control or standardization practices that guarantee activity.

You must exercise extraordinary care in your purchases of lapacho and buy only when you have ascertained the expertise of the manufacturer. Generally speaking, the best lapacho will be obtained from manufacturers specializing in this herb.

Description

Lapacho is also known by the Portuguese name of Pau D' Arco and by tribal names such as Taheebo and Ipe Roxo. It is an evergreen tree with rosy colored flowers and belongs to the Bignonia family. Some texts distinguish between *Lapacho colorado (red lapacho - ipe roxo)* (scarlet flowers) and *Lapacho morado (purple lapacho)* which grows in cooler climates such as high in the Andes, and high places in Paraguay. Recent evidence suggests that these two varieties of lapacho possess superior medicinal properties, with a slight bow going to the purple as the best of all.

Nearly 100 species of lapacho trees are known but only a few of these yield high quality material. It takes extremely skilled gatherers to tell the difference. Half or more of the battle involved in bringing high quality lapacho to the marketplace is finding and retaining qualified gatherers.

Constituents

The medicinal part of the tree is the bark, specifically the inner lining of the bark, called the phloem (pronounced floam). The use of whole bark, containing the dead wood, naturally dilutes the activity of the material.

Most of the chemical analyses of lapacho have been performed on the heartwood of the tree, rather than on the phloem or inner lining of the bark, which is used medicinally. It is unclear why this has occurred. One rea-

son may be that the heartwood contains enough quantities of a couple of important constituents, mainly *lapachol* and *tabebuin,* to satisfy current research interests. Once the therapeutic activity of those constituents has been thoroughly investigated, perhaps researchers will turn their attention to the phloem. Until then, it is probably safe to assume that the living bark contains a similar set of active constituents as the heartwood plus some others that make it more effective and would account for the living bark's greater popularity as a folk medicine. Traditionally, as anyone who chooses to examine the herbal literature of the world can verify, it is the living bark of a plant, especially a tree or shrub, that is used medicinally—not the heartwood. The reason is simple: the nutrients and representative families of chemical substances used to sustain the life of the tree are found in greatest concentration in the cambium layer and phloem of the living bark.

The life processes of a mature tree are carried out in the thin corridor lying between the outer bark and the inner heartwood. Pull the bark off of a tree and you will notice moist, very thin layers of tissue that seem to shred when picked at with the hands. This is the cambium layer. Its purpose is to create new tree tissues, such as phloem, through cell division. The newest, youngest phloem cells are just outside the cambium. As new phloem is added, older cells are crushed and pressed into the bark. Younger, newer cells added to the inside of the cambium layer are called xylem. Newer xylem is called sapwood; older xylem is crushed and pressed into the heart of the tree. It is therefore known as heartwood. The actively conducting tissues of a tree are the thin layers of fresh xylem and phloem on each side of the cambium. The outer bark and heartwood are essentially inactive materials that only serve to provide strength to the tree. Indiscriminate combining of older, less active layers of bark and tree with the younger, living tissues results in a dramatic dilution of active principle and medicinal value. Yet it is a common practice.

Lapachol is just one of a number of plant substances known as *napthaquinones* (N-factors) that occur in lapacho. *Anthraquinones* or A-factors, comprise another important class of compounds. The N-factors are not common except in herbal tonics. Seldom do both N- and A-factors occur in the same species. Several of the remarkable properties of lapacho may be due to a probable synergy between A- and N-factors.

Quercitin, xloidone and other *flavonoids* are also present in lapacho; these undoubtedly contribute to the plant's effectiveness in the treatment of tumors and infections.

Folklore

The native Indians of Brazil, northern Argentina, Paraguay, Bolivia and other South American countries have used lapacho for medicinal purposes for thousands of years. There are indications that its use may actually antedate the Incas. Before the advent of the Spanish, the Guarani and Tupi-Nambo tribes used great quantities of lapacho tea. In the high Andes, the Callawaya, the Quechua, Aymara and other tribes also used lapacho ("taheebo" to them) for many complaints.

Lapacho is applied externally and internally for the treatment of fevers, infections, colds, flu, syphilis, cancer, respiratory problems, skin ulcerations and boils, dysentery, gastro-intestinal problems of all kinds, debilitating conditions such as arthritis and prostatitis, and circulation disturbances. Other conditions have reportedly been cured with lapacho including lupus, diabetes, Hodgkin's disease, osteomyelitis, Parkinson's disease, and psoriasis.

It is used to relieve pain, kill germs, increase the flow of urine, and even as an antidote to poisons. Its use in many ways parallels to that of the immuno-stimulants echinacea on this continent and ginseng in Asia, except that its action appears to exceed them both in terms of its potential as a cancer treatment. The Guarani, Tupi and other tribes called the lapacho tree "Tajy," meaning "to have strength and vigor," or simply, "The Divine Tree."

Modern Guarani Indians prefer the purple lapacho, but also use the red lapacho. They use only the inner lining of the bark.

The use of lapacho may not be limited to tropical countries. A Yugoslavian scientist, Voislav Todorovic, claims that he has found evidence that the plant was used by the Vikings and the Russians. He also claims that a Russian chemist (in the late 1800's) manufactured a toothpaste that contained lapacho that was supposed to have been extremely effective in preventing tooth decay.

Early Scientific Work

Research on lapacho has been going on for a long time. E. Paterno isolated the active constituent, lapachol, in 1884. In 1896, S.C. Hooker established the chemical structure of lapachol and L.F. Fieser synthesized the substance in 1927! So it would be a mistake to call lapacho a modern discovery.

As early as 1873, physicians were aware of the healing action of lapacho. Dr. Joaquin Almeida Pinto wrote during that year, "Pau D' Arco: Medicinal Properties: prescribed as a fever-reducer; the bark is used against ulcers; also used for venereal and rheumatic disorders

and especially useful for skin disorders, especially eczema, herpes and the mange. Another early physician, Dr. Walter Accorsi, reported that lapacho, "eliminated the pains caused by the disease (cancer) and multiplies the body's production of red corpuscles."

However, the science of lapacho began properly with the work of Theodoro Meyer in Argentina who tried for decades with little success to convince the medical world of the value of lapacho for infections and cancer. Data from his laboratory are astounding in terms of the success rate observed when applying the herb in dozens of different kinds of cancer. Much of Meyer's work was primitive by modern research standards and most of it lacked adequate controls and statistical evaluation. But the shear bulk of it is good evidence for the efficacy of lapacho. The Meyer era ended at his death in 1972 with the scientific world left still largely unconvinced of the usefulness of lapacho as a modern medicinal agent. Perhaps the most important things Meyer accomplished from a scientific point of view were (1) to bring lapacho to the attention of the rest of the world, (2) to extract the plant from the jungles of the Amazon, and (3) announce, "Here is a folk remedy with great promise of all mankind."

Independent of Meyer, a physician in Brazil (about 1960) heard of lapacho's miraculous curative powers and used it to treat his brother who was lying in a Santo Andre, Brazil hospital dying of cancer. His brother recovered and the physician, Dr. Orlando dei Santi, began to use the herb to treat other cancer patients at the hospital. Other physicians joined the team and after a few months several case histories of cures were recorded. In the typical case, pain disappeared rapidly and sometimes complete remission was achieved in as little as four weeks.

Because of the work at the Municipal Hospital of Santo Andre, lapacho has become a standard form of treatment for some kinds of cancer and for all kinds of infections in medical establishments throughout Brazil. It should be noted that after the first reports of "miraculous" herbal cures appeared in Brazil, the international government ordered a blackout of any more public statements by doctors involved in the research. The silence was finally broken by Alec De Montmorency, who in 1981 published a lengthy review of the ongoing clinical work in Brazil. This report succeeded in stimulating worldwide interest in the plant.

In 1968, Dr. Prats Ruiz of Concepcion, Argentina, successfully treated three cases of leukemia in his private clinic. Some of these results were widely published and also helped to establish the popularity of lapacho among the "civilized" inhabitants of South American countries.

American physicians, of course, tend to look disparagingly upon the clinical evidence from backward areas of South America, preferring instead sanitized evidence from their own brightly lit laboratories. The weight of South America clinical evidence has not been sufficient to cause widespread acceptance of the treatment outside South America, but it has stimulated research interest abroad. Pharmaceutical companies regularly screen lapacho for the presence of substances that could be the basis for new drug applications. *As we shall see, however, no isolated component of lapacho comes anywhere close to being equal to the combined activity of all constituents, or in other words, to the whole herb.*

Drug Detox Observations. A common thread that runs throughout early and current empirical and clinical reports of lapacho treatment is the consistent observation that the herb eliminates many of the common side effects of the orthodox medications. There is no explanation of this action, but it is so often seen that one cannot easily doubt its validity. Pain, hair loss and immune dysfunction are among the symptoms most commonly eliminated.

Modern Investigative Work

While scientific research on lapacho has been going on for decades, most of it is worthless from a medicinal point of view. Some of it, however, is very good and has resulted in the isolation of several individual medicinally active constituents and in the analysis of their properties. The current interest in AIDS has stimulated renewed interest in lapacho since the herb is such an effective anti-viral substance.

The main problem with *American* research on the plant is the tunnel-vision with which the work is engaged. Without any understanding of the ultimate source of the plant's effectiveness, researchers routinely isolate what they *think* should be the active component and apply it in standard screening trials. The results of such research are sometimes strong, sometimes weak, and always inadequate by definition. It didn't surprise anyone that the trials performed by the National Cancer Institute were less than convincing. And it also didn't surprise anyone when that same institute rejected out-of-hand the highly positive results obtained by many non-American researchers who utilized different methods. The self-serving tendency of the American medical/regulatory establishment to accept only its own research is indulged by the rest of the world's scientific community with polite and somewhat amused patience, as they wait for America to grow up.

The following is a summary of some of the effects of lapacho and/or any of its constituents that have been validated by modern research:

1. Laxative effect. Regular use of lapacho will maintain regularity of bowel movements. This property is undoubtedly due to the presence of the napthaquinones and anthraquinones. Users of lapacho universally report a pleasant and moderate loosening of the bowels that leads to greater regularity without any unpleasant side-effects such as diarrhea.

2. Anti-cancer effect. The greater part of the basic research on lapacho, both in the United States and in other countries, has dealt directly with the cancer question. Obviously this issue is of great importance. Any tendency of lapacho to ameliorate the course of cancer should be made known to all persons likely to benefit from it. **The absence of side effects makes lapacho a treatment of choice even in conjunction with standard forms of therapy.** The user has nothing to lose and much to gain from the judicious use of lapacho. Naturally, any and all treatment of a cancerous condition should be done under the supervision of a qualified physician.

Some constituents or groups of constituents of lapacho have indeed been found to suppress tumor formation and reduce tumor viability, both in experimental animal trials and in clinical settings involving human patients. In addition, anecdotal data abounds to such an extent that to overlook its importance is to turn one's back on a potentially invaluably source of aid and health. Leukemia has proven particularly susceptible to the application of lapacho and several of its constituents. Some researchers feel that lapacho is one of the most important anti-tumor agents in the entire world.

Part of the effectiveness of lapacho may stem from its observed ability to stimulate the production of red blood cells in bone marrow. Increased red blood cell production would improve the oxygen-carrying capacity of the blood. This, in turn, could have important implications for the health of tissues throughout the body. Also needed for oxygen transport by red cells in iron. This might explain the augmentation in lapacho's therapeutic properties when it is combined with iron-rich yerbamate, another South American plant. In fact, it is native practice to almost always combine these two plant species.

3. Anti-oxidant effect. *In vitro* trials show definite inhibition of free radicals and inflammatory leukotrienes by lapacho constituents. This property might underlie the effectiveness of lapacho against skin cancer and definitely helps to explain observed anti-aging effects. Modern science has recently uncovered the importance of free radicals in the generation of many debilitating diseases, from cancer to arthritis. These molecules are even heavily implicated in the normal aging process. Reversing their action has become big business in world health circles. Anti-oxidants, or free-radical scavengers, have emerged as premier candidates for the role of healers and disease-preventers. Among the anti-oxidants few have greater potency than lapacho and other constituents of lapacho.

4. Analgesic effect. The administration of lapacho is consistently credited in reports issuing from South American clinics as a primary modality for lessening the pain associated with several kinds of cancer, especially cancer of the prostate, liver or breast. Arthritic pain has also been relieved with lapacho ingestion.

5. Antimicrobial/anti-parasiticidal effects. Includes inhibition and destruction of gram positive and acid-fast bacteria *(B. subtilis, M. pyogenes aureus, ect.),* yeasts, fungi, viruses and several kinds of parasites. Two troublesome families of viruses inhibited by lapacho are noteworthy: Herpes viruses and HIV's. Together, these viruses account for much of misery of mankind. The anti-malarial activity of lapacho spawned a great deal of research interest in early decades of this century. A 1948 article reviewed the progress and indicated that the N-factors, especially lapachol, were among the most promising anti-malarial substances known at the time. Lapacho's immuno-stimulating action is due in part to its rather potent antimicrobial effects.

6. Anti-fungal effect. Lapacho is often singled out as the premier treatment for candida or yeast infections. Lapachol, N-factors and xyloidone appear to be the primary active principles. By the mid 70's the list of N-factors that inhibited Candida albicans and other fungi had grown to several dozen.

It would be misleading to categorically state that the N-factors in lapacho have proven antimicrobial and antifungal activity in and of themselves. Studies have shown that the manner in which they occur in the plant must be taken into consideration. We know, for example, that antifungal activity is lost when the N-factors are tightly bound to highly water-soluble or highly fat-soluble groups. It has not been clearly determined how the N-factors occur in lapacho.

N-factors, obtainable from various chemical supply companies, have become favorite testing agents in government/university labs due to the rise in yeast infections resulting from increased use of cytotoxic drugs, corticosteroids, antibiotics and immunosuppressants.

An interesting application has been reported in which toe and fingernail fungi infections are relieved by soaking these appendages in lapacho tea off and on for a couple of weeks.

7. Anti-inflammatory. The anti-inflammatory and healing action of lapacho extracts was demonstrated in a study in which purple lapacho extract was administered to patients with cervicitis and cervico-vaginitis, conditions resulting variously from infections (candida albicans, trichomonas vaginalis), chemical irritations and mechanical irritation. The lapacho extract was applied intra-vaginally via gauze tampons soaked in the extract and renewed every 24 hours. The treatment proved to be highly effective. One wonders what might happen were the tampon method combined with the ingestion of strong teas.

The anti-inflammatory action of lapacho might also account for its observed tendency to reduce pain, inflammation, and other symptoms of arthritis. Anecdotal accounts of complete cures are even available. As yet virtually untested in research settings, the purported ability of this plant to reduce symptoms of joint disease may be ultimately validated and added to the growing list of benefits to be enjoyed by the daily ingestion of lapacho tea.

8. Other beneficial effects. Routine screenings have revealed several minor properties of lapacho that might occur if needed in certain individuals: diuretic, sedative, decongestant, and hypotensive, to name a few. Unfortunately, space limitations preclude a lengthy discussion of all the benefits of lapacho, but some of the major actions listed above require further elaboration, as follows.

Anti-viral

One of the strongest actions of lapacho is against viruses. The range of viruses inactivated by lapacho extends from those that cause the common cold to those that are responsible for AIDS. It has been shown to actively inhibit, kill or stunt the growth of several dangerous viruses, including *herpes virus hominis types | and ||, polo virus, vesicular stomatitis virus, avian myeloblastosis virus, rauscho murine leukemia virus, friend virus, and rous sarcoma virus.* Several other viruses are also inhibited by lapacho's N-and A-factors.

One N-factor, *beta-lapachone,* inhibits enzymes in virus cells that directly affect the synthesis of DNA and RNA. It is also a potent inhibitor of the enzyme *reverse transcriptase,* involved in RNA/DNA relationships. Once these processes are inhibited, the virus is unable to take over the reproductive processes of the cell and cannot, therefore, replicate itself and infect other cells. Such inhibition is a characteristic of most substances that are being tested for activity against AIDS and Epstein-Barr. The enzyme in question is a key to the action of retroviruses. These viruses, also known as ribodeoxyviruses or oncornaviruses, have been implicated in the development of several kinds of experimental cancers. Beta-lapachone is obtained simply by treating lapachol with sulfuric acid; and tests show that it has a unique method of action *vis-a-vis* the reverse transcriptase inhibition.

Note: *Sulfurous compounds in some plants, especially yerbamate, when combined with lapacho, might provide a catalytic base for the transformation of lapachol to beta-lapachone, and hence increase the effectiveness of the lapacho. In this light it is interesting to note that native folklore teaches that yerbamate is a catalyst for lapacho; yerbamate becomes the foundation for lapacho therapy.*

Antiparasitic

Lapacho components have been intensively studied in terms of their action against two rather nasty parasites: *Schistosoma mansoni* and *Trypanosoma cruzi*, both responsible for considerable disease and misery in tropical countries. Lapacho was effective against both. Taken by mouth, lapachol is eventually secreted onto the skin via the sebaceous glands where it acts as a topical barrier, inactivating microorganisms soon after they contact the skin. Meanwhile, throughout the G.I. tract, it is performing the identical function on the mucous membranes preventing the penetration of parasites. The mechanism of action is not well understood, but is felt to involve the uncoupling of cellular respiration (see Cellular Mechanics Section), the stimulation of lipid peroxidation and superoxide production, and the inhibition of DNA/RNA biosynthesis.

Cancer

Lapacho has been extensively investigated for potential anti-cancer activity. Even the National Cancer Institute has gotten in the act. But in their own typical way, they managed to drop the ball before achieving success. They *restricted* their investigations to lapachol and once they found that this substance had side effects that offset its potential therapeutic benefits, they abandoned the project. The holistic practitioner readily perceives the fallacy of that approach and is skeptical of applying isolated herbal constituents. As if in conformation of that skepticism, *research that involved whole lapacho has produced clinical anti-cancer effects without side effects.*

Animal research in the United States made a gigantic stride forward when it was discovered that lapachol inhibited solid tumors (Walker carcinosarcoma 256 and Ehrlich solid carcinoma) and Ehrlich ascites cell tumors. Such research then took a gigantic stride backwards when

clinical toxicity of lapachol prematurely ended these investigations.

One interesting line of research has shown that lapachol is more effective when ingested orally rather than injected into the gut or into the muscles. These results contradict a substantial amount of research on orthodox drugs that indicates the superiority of injectable routes. What is the meaning of this anomaly? Could it be a sign that natural routes of administration (i.e., oral) are better suited for natural substances? *The further removed from the natural state, the more active substances become when injected directly into the blood stream, and the less able the natural processes of the body are in dealing with them.*

Using the wood of the plant, several researchers have studied the effects of lapachol, alpha-and beta-lapachone and xyloidone on experimental cancer (Yoshida's sarcoma and Walker 256 carcino-sarcoma). As high as 84% inhibition was observed on Yoshida's sarcoma and no toxicity was found.

In one clinical study, South American researchers administered lapachol to patients with various forms of cancer, including adenocarcinoma of the liver, breast and prostate, and squamous carcinoma of the palate and uterine cervix. Taken orally, the substance resulted in temporary reduction of all conditions and in a significant reduction in pain. Duration of treatment was anywhere from 30 to 720 days, with an average of about two months. For example, one patient with liver cancer presented with a significant reduction in jaundice accompanied by other sighs of improvement after eight days of therapy. The results were in close accord with results obtained by the same researchers in animal studies. One wonders what the administration of whole purple lapacho phloem might have accomplished in this setting. Other lines of evidence suggest that even better results may have been obtained.

A Note on Nausea: In the human study reported above, some patients dropped out of the experiment due to nausea. This is a common observation in some, but certainly not all, people who begin to experience the cleansing action of lapacho (and other healthful herbs). As toxins (and toxic medicines) and wastes are drawn out of the cells, or flushed out, or physiologically expelled from the cells through the action of the herb, they tend at times to accumulate in the blood, lymph nodes, skin, liver and kidneys awaiting the opportunity to be expelled from the body. Backing up, they can on occasion produce sensations such as nausea. The body may even try to rid itself of some toxic substances by vomiting. Not to worry. These transient signs indicate that the herb is working. Remember the body only has three basic processes for getting rid of wastes: (1) lower bowel movement, (2) sweating, (3) urinating. The use of lapacho can so overload these processes in the early stages that discomfort may be produced.

Cellular Mechanics

Every cell of the body requires oxygen and glucose to obtain energy for life-sustaining functions. The oxygen and glucose are subjected to a fairly complex metabolic process in the tiny energy producing structures in the cell called mitochondria. This process requires numerous enzymes and coenzymes. The oxygen and glucose are converted to carbon dioxide and water which are then returned to the blood. The CO2 is exhaled by the lungs (hence this metabolic process is often called "respiration"); excess water is eventually drawn off through perspiration or through the kidneys. During this conversion, several free electrons are freed up which are immediately utilized by another pathway to produce ATP (adenosine triphosphate). The energy currency of the cell-ATP is the molecule every cell is required to utilize, or spend, to obtain energy. The two paths-one for breakdown of glucose and one for synthesis of ATP-are tightly coupled together. Should they become uncoupled, the cell can no longer obtain energy, and it dies. Such poisoning has acquired the name of *"uncoupling of oxidative phosphorylation"*.

Many agents have been found that uncouple oxidative phosphorylation. Many of them resemble the N-factors in lapacho. In fact, it has been found that lapacho works like other *benzoquionones,* i.e., it uncouples the mitochondrial oxidative phosphorylation occurring in cancerous cells, *but not in healthy ones. This selective killing (cytotoxicity) of tumor cells is what makes lapacho such a potentially valuable agent for the treatment of cancer.*

One of the games science plays is attempting to discover at what point cellular respiration is broken up by chemical agents. The components of lapacho seem to interrupt the process at several points, usually by inhibiting an enzyme or coenzyme that is required for the next step in the chain to occur properly. For instance, lapacho inhibits the proper functioning of *ATPase,* the enzyme that catalyzes the finally step in the formation of ATP.

Lapachol has also been shown to inhibit the amount of another substance required for cellular reproduction: uridine triphosphate. This molecule is the main source of substances (called pyrimidine nucleotides) that are required by cells in order to build DNA, RNA and most other important proteins of the body. Lapacho may actually block the synthesis of pyrimidines in cancer cells

(by inhibiting the enzyme dihydroorotate dehydrogenase). The result would be certain cellular death.

There is also evidence that lapachol interacts directly with the nucleic acids of the DNA helix in cancerous cells. If such interaction, or bonding, takes place then DNA replication would be impossible. The result is also eventual death of the cell.

Finally, lapacho constituent beta-lapachone has been shown to weaken malignant cells, even to the point of cellular death, by stimulating a process known as lipid peroxidation, which produces toxic molecules.

Toxicity

While there can be no doubt that lapacho is very toxic to many kinds of cancer cells, viruses, bacteria, fungi, parasites and other kinds of microorganisms, the substance appears to be without any kind of significant toxicity to healthy human cells. The side-effects mainly encountered, and usually with isolated lapacho constituents, are limited to nausea and anti-coagulant effects in very high doses, a tendency to loosen the bowels, and diarrhea in very high doses. As indicated earlier, some nausea should be expected as a natural consequence of the detoxification process. The FDA gave lapacho a clean bill of health in 1981.

Some trials have indicated that lapachol has anti-vitamin K action. Other constituents have a pro-vitamin K action; it is likely, therefore, that the two actions cancel each other out (except possibly when one or the other is necessary-as one would expect from an herbal tonic).

Perhaps the most significant study on toxicity was published in 1970 by researchers from the Chase Pfizer & Co., Inc. Looking specifically at lapachol, these investigators found that all signs of lapachol toxicity in animals were completely reversible and even self limiting, i.e., over time the signs of toxicity decreased and even disappeared within the time constraints of the study. The most severe kinds of self-limiting side-effects they observed were an anti-vitamin K effect, anemia, and significant rises of metabolic and protein toxins in the blood stream. The diminution of these signs indicates that lapacho initiates an immediate "alterative" or "detoxification" effect on the body's cells. Once the cells are "cleaned up", the signs of toxicity disappear. This effect is quite common among herbal tonics.

How Much and When

Lapacho can be used periodically as a preventative during colds and flu season or whenever the chances for infections are high. Experience has taught that lapacho is best ingested as a tea, one or two cups a day, morning and evening. Used in this fashion, it promotes the healthy and may impart some of the other important therapeutic effects, including a positive effect on arthritis, pain, localized infection (e.g. candida) and systemic infection.

During periods of acute, active infection, lapacho should be administered several times a day in tea form. It is up to the individual to determine the optimum amount for him or her. It is not uncommon for a person's awareness of his or her personal health needs and requirements to increase dramatically when turning to a health-oriented, herbal approach.

One of the best ways to ingest lapacho is in tea form, either with tea bags, or in a loosely cut and sifted "bulk" form. Using bulk presents problems of filtering out the fiber. The use of the South American "bombilla," a metal straw with a filter on one end, normally used for drinking yerbamate, neatly solves this problem.

Capsules are also available, but are not nearly as effective as the tea. One of the most intriguing routes of administration is the recent introduction to the marketplace of a mist that is simply sprayed into the mouth and rapidly absorbed directly into the bloodstream.

It is highly recommended by this author as well as folklore wisdom that lapacho be routinely combined with yerbamate. The reasoning, based on centuries of experience in these matters by South American natives, is that yerbamate has an activating effect on the actions of lapacho. Yerbamate, of course, imparts a good deal of medicinal action itself, as discussed in the section: "Yerbamate: Unequaled Natural Nutrition."

Conclusion

Throughout the width and breath of the earth there exist plants with the amazing ability to cure and prevent the ills of mankind when used with wisdom. They grow and blossom and concentrate valuable healing nutrients within their tissues. It is the obligation of animals and people to discover these properties and utilize them in the manner intended by the governing and organizing principles of nature. The search does not begin nor end in a research laboratory. It begins with the experimentation of simple people living close to the earth, who invest nothing in their search save the desire to live healthy, prevent sickness and cure disease. It ends when the rest of the world accepts knowledge so gained, and incorporates it into their own health system.

The need for scientific examination results in the accumulation of interesting and sometimes useful data; at its best it opens new avenues for effective application of wisdom of the ancients. At its worst, it asks the wrong

questions, obtains the wrong answers, becomes puffed up by its own importance, and gets in the way of man's quest for the discovery of nature's healing gifts.

Science and folklore need not clash. When they do, it is usually because the wrong questions were asked, the wrong answers obtained, the wrong materials examined, the wrong people involved. Lapacho currently finds itself in the middle of worldwide confusion. As data showing the efficacy of lapacho accumulates in some areas of the world, other areas continue to ignore basic sources of information; data gathered in such a vacuum disappoints the mind and obstructs progress.

We prefer to believe that lapacho, given enough time, will emerge into the full light of day, even from the dark and muddling laboratories of the United States, and will take its rightful place as one of the great healing herbs of the world. We prefer to believe that until then the herb will be immune to the dealings of dim and uninspired regulatory proceedings on bright continents. We prefer to believe that in the end the millions of lapacho users will prevail.

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Life With Stevia: How Sweet It Is!

"When one first observes the plant, nothing particular about it summons the attention, but when even a small piece of the leaf is placed in the mouth, one is amazed by its sweetness. A mere fragment of leaf is enough to sweeten the mouth for an hour."

Those few simple words, issued in 1899, opened one of the more remarkable chapters in the history of botanical science, and introduced the world at large to a unique and potentially revolutionary plant from Paraguay known as stevia. In South America it is primarily known as yerba dulce, but among the Guarani Indians of Paraguay, who have used the plant for centuries, it has a variety of interesting names: Caa-ehe, Azuca-caa, Kaa-he-e, and Ca-a-yupe. Most of these names, in one way or another, draw attention to the sweet, nectar-like flavor of the leaf. Many Guarani medicinal and nutritional practices incorporate stevia in one way or another. The remarkable Guarani possess one of the most advanced native cultures, in terms of philosophy, nutrition and medicine, of any similar group in the world. Yet their ways are still only vaguely understood by other people. A case in point is their use of stevia.

Despite centuries of use by the Indians, it wasn't until 1899 that the plant was discovered by "civilized" man. M.S. Bertoni (quoted above) observed that the natives used the plant to sweeten their bitter drinks. Eventually, Bertoni was to be credited with the discovery of a new species; in his honor, stevia is now known as Stevia rebaudiana Bertoni.

It is amazing to contemplate that most of the important herbs and species of the world have been known, described, catalogued and used by diverse populations for several centuries; yet here is one of the most wonderful plants of a world that went undetected until the turn of the century. Experts estimate that South America is the source of dozens, perhaps hundreds, of plants with properties as momentous as stevia that yet remain unused and unrecognized by anyone but the native populations. The Guarani are in possession of a good portion of these, some of which are becoming ever more important: yerba mate and lapacho. Others, like stevia, are less known.

Stevia as a Flavor Enhancer

There are three distinct traditions of stevia use. The first is for flavor enhancement; the second is as an herbal tea; the third is medicinal. The primary impetus for the development of stevia science was the discovery by Bertoni that the herb possessed an extraordinary sweetness. A good quality leaf is estimated to be 30 times sweeter than cane sugar or sucrose. The active constituents of stevia are considered by the world's leading food scientists as the "sweeteners of the future." Therefore, every new development in the area of stevia research is anxiously awaited and thoroughly analyzed when it appears. Countries in which the currently used artificial sweeteners are on the brink of being banned are desperately trying to find new, safe, non-caloric sweeteners. And in other countries, firms that hold exclusive rights to currently used sweeteners are extremely fearful of the advent of new, safer sweeteners, over which they will have no control. For these firms, the emergence of a totally natural, non-patentable sweetener is the ultimate horror. Stevia, whether these firms like it or not, will one day have a dramatic impact on all countries of the world. The necessary forces simply need to be properly aligned, the raging fury of mega-monstrous companies firmly bridled by caring governments, and the supply of stevia raised to meet the enormous demand. Steviosides and rebaudiosides are the principal constituents of diterpene glucosides with differing sugar molecules attached, as found in the leaves of the stevia plant. Extracted, they are currently being used as sweetening agents in several countries, including Japan, China, Korea, Taiwan, Israel, Uraguay, Brazil, and Paraguay. In Japan, commercialization of stevia was very rapid, beginning with the ban of artificial sweeteners during the 1960's. In 1970 the Japanese National Institute of Health began importing stevia for investigation, by 1980 it was being used in hundreds of food products throughout the country. This is remarkable progress, considering that as recently as 1921 scientists were just getting around to naming the main constituent (stevioside), and the molecule wasn't even accurately described until 1931, when scientists reported it to be a white, crystalline, hygroscopic powder, approximately 300 times sweeter than cane sugar. And it wasn't until 1955 that the earlier work was replicated and extended. By 1963, the complete chemical structures of the active molecules of stevia were finally worked out. To jump from there to the status of a major food sweetener by the mid-1970's was a truly astounding feat, one that would have simply been impossible in the United States or Europe. Today, the Japanese are not as encumbered with weight problems as the rest

of us; they are not, therefore, adverse to using copious amounts of plain old sugar. Yet they have access, in the form of stevia, to one of the best sugar substitutes.

While most of the attention focuses on the steviosides, research has shown that the rebaudiosides are actually much better tasting; there are just fewer of them. One rebaudioside in particular, Rebaudioside A, appears to be far superior. Its sweetening power is estimated to be 30% higher than that of stevioside. Efforts to genetically select for this constituent are underway in Japan. However, according to some sources, the plantations maintained by the Guarani in Paraguay contained perhaps the best tasting natural whole-leaf stevia available. Efforts to remove stevia from its native habitat and cultivate it in foreign soils may be primarily responsible for the off taste that characterizes non-Paraguayan stevia. The best stevia may indeed still be obtained only from parts of Paraguay under native cultivation. Interestingly, a recent report showed that none of the stevia used in Japan is imported from Paraguay. Of the 1000 tons used in Japan in 1982, 300 were produced in Japan, 450 came from Continental China, 150 from Taiwan, 100 from Thailand and 50 from Korea, Brazil and Malaysia. It is said that the Paraguayans will not sell to Japan. Much, if not most, of stevia sold in the U.S. is imported from China and other non-Paraguayan sources.

Along these same lines, it may be that the use of whole leaf is an easier way to obtain better taste than through efforts aimed at trying to improve the taste of certain specific constituents. It is surprising, therefore, to see how much research has gone into attempting to improve the taste of individual steviosides or rebaudiosides. Since the white crystalline powder exhibits a quite persistent bitter and astringent aftertaste, its use as a commercial sweetener often backfires. Thus, most manufacturers who use the isolated constituents of stevia usually have to combine it with other kinds of typical sugars! Since rebaudiosides taste better, methods are constantly being sought to synthetically convert steviosides to rebaudiosides. But even the rebaudiosides must be combined with other kinds of sugars to obtain the necessary sweetness. Finally, in the ultimate irony, there are processes currently under development for improving the taste of stevioside by combining it in various ways with other substances obtained directly from stevia! It is the opinion of this author that most, if not all, of these convoluted attempts to improve the taste of single constituents could be satisfactorily avoided simply by using WHOLE LEAF, or whole leaf EXTRACT, the way nature intended stevia to be used. In the final analysis, pure stevioside is attractive to manufacturers mainly because of the higher profits to be achieved from using a purified, therefore patentable, material.

In this country, where use of whole leaf is the only possible mode of administration, consumers have developed some rather sophisticated applications, especially in the medicinal area (see next section). In the area of combining with other foods, one can also find some useful applications. Stevia is appropriate for use in conjunction with a variety of other herbal teas. One can mimic the South American practice of combining stevia with yerba mate, lapacho, and other native herbs, or one can experiment with stevia in altering the taste parameters of any number of traditional teas.

Stevia is available in tea bags, or as a liquid extract. Combine one tea bag of stevia with other herbal tea bags. Try straight stevia tea. Search for commercial products that contain stevia. You may find that some of these are too sweet for your taste. Others may be just right. If you purchase stevia in bulk, individual leaves and pieces of leaf can be added to beverages, sprinkled over salads or cooking vegetables and substituted for sugar in recipes without creating a problem due to the presence of the leaf itself. A little bit goes a long way.

While there is no question that stevia is sweet, many users will admit that they have also experienced a bitter aftertaste from some brands. In fact, one of the problems with stevia products currently available from health food retailers is that many of them just plain do not taste good. They often have a distinct grassy taste, with varying degrees of bitterness associated with sweet. These differences in quality may partly be a result of using non-Paraguayan stevia, partly due to poor extraction and processing techniques and partly the result of ignorance on the part of manufacturers concerning the real nature of the stevia plant. One knowledgeable producer of stevia products is attempting to set up industry standards for grading stevia leaves according to their quality. Grade A stevia would be the highest quality, an extremely sweet grade, with little bitter aftertaste and a concentrated degree of sweetness. This grade is very difficult to obtain due to climatic conditions that prevent harvesting at just the right time. Grade B would be a little less sweet with some minor deterioration of the leaf. Most of the best stevia arriving in the United States would be classified as Grade C, a poor grade with a good deal of grassy, bitter flavor. Extracts of Grade C are particularly unpalatable, possessing far to much bitterness. Manufacturers often try to dress them up with other flavoring agents, but such attempts seldom work. Once you have tasted a premium stevia, you will never be satisfied by lesser products.

The bitter principles are actually found in the veins of the leaf, while the leafy material between the veins con-

tains the sweet components. Great care must be taken during production of stevia extract to avoid contaminating the sweet with the bitter. This pertains as much to extraction as it does to milling.

Medicinal Uses

Carrying the above thoughts a step further, there are many very legitimate reasons for using stevia as a medicinal food. In spite of the prominence stevia has obtained as a flavor enhancer, it contains a variety of constituents besides the steviosides and rebaudiosides, including the nutrients specified above and a good deal of sterols, triterpenes, flavonoids, tannins, and an extremely rich volatile oil comprising rich proportions of aromatics, aldehyde, monoterpenes and sesquiterpenes. These and other, as yet unidentified constituents, probably have some impact on human physiology and may help explain some of the reported therapeutic uses of stevia.

Hypoglycemic Action

It is probably the presence of the steviosides themselves that has produced dozens of empirical and semi-controlled reports of hypoglycemic action. Paraguayans say that stevia is helpful for hypoglycemia and diabetes because it nourishes the pancreas and thereby helps to restore normal pancreatic function. In semi-controlled clinical reports one also encounters this action. Oviedo, et.al., reported a 35.2% fall in normal blood sugar levels 6-8 hours following the ingestion of a stevia leaf extract. Similar trends have been reported in humans and experimental animals by other workers. These kind of results have led physicians in Paraguay to prescribe stevia leaf tea in treatment of diabetes; similarly, in Brazil, stevia tea and stevia capsules are officially approved for sale for the treatment of diabetes.

However, it is important to note that stevia does not lower blood glucose levels in normal subjects. In one study, rats were fed crude extracts of stevia leaves for 56 days at a rate of 0.5 to 1.0 grams extract per day. These procedures were replicated by another team of scientists. Neither group observed a hypoglycemic action. Similar negative results have been obtained by other observers. Then there is research in which the findings show trends toward hypoglycemic action, but are inconclusive. In at least one of these studies, alloxan-diabetic rabbits were used. The authors felt the results supported an anti-diabetic action, but the results were transient at best.

To date, the experimental research on the effects of stevia on blood sugar levels in human patients with either diabetes or hypoglycemia is sparse. The general feeling in the scientific community is that the mild acting nature of the plant and its total lack of toxic side effects argues against the need for extensive and expensive research programs.

However, many of the anecdotes reporting a definite and significant blood sugar lowering action in diabetics, and a pronounced exhilarating effect in hypoglycemics, are sound enough to justify considerable experimental work in this area. Perhaps, when this missing piece to the puzzle is supplied, we will then have a better understanding of how stevia works—why, for example, many diabetic humans experience a profound lowering of blood sugar levels following the ingestion of several cups of stevia tea (24-34 oz.) during the course of a 24 hour period.

Cardiovascular Action

A good deal of experimental work has been done on the effects of stevia and stevioside on cardiovascular functioning in man and animals. Some of this work was simply looking for possible therapeutic action. In neither case have significant properties been found. When any action at all is observed, it is almost always a slight lowering of arterial blood pressure at low and normal doses, changing to a slight rise in arterial pressure at very high doses. The most curious findings is a dose dependent action on heart beat, with a slight increase appearing at lower doses changing to mild decrease at higher doses. In either instances is the result remarkable, and it is extremely doubtful that humans would experience any effect at normal doses. The long term use of stevia would probably have a cardiotonic action, that is, would produce a mild strengthening of the heart and vascular system.

Antimicrobial Action

The ability of stevia to inhibit the growth and reproduction of bacteria and other infectious organisms is important in at least two respects. First, it may help explain why users of stevia-enhanced products report a lower incidence of colds and flus, and second, it has fostered the invention of a number of mouthwash and toothpaste products. Research clearly shows that *Streptococcus mutans*, *Pseudomonas aeruginos*, *Proteus vulgaris* and other microbes do not thrive in the presence of the non-nutritive stevia constituents. This fact, combined with the naturally sweet flavor of the herb, makes it a suitable ingredient for mouthwashes and for toothpastes. The patent literature contains many applications for these kinds of stevia-based products. Stevia has even been shown to lower the incidence of dental caries.

Digestive Tonic Action

In the literature of Brazil, stevia ranks high among the list of plants used for centuries by the "gauchos" of the southern plains to flavor the bitter medicinal preparations used by that nomadic culture. For example, it was widely used in their "mate". Through much experimentation, these people learned that stevia made a significant contribution to improved digestion, and that it improved overall gastro-intestinal function. Likewise, since its introduction in China, stevia tea, made from either hot or cold water, is used as a low calorie, sweet-tasting tea, as an appetite stimulant, as a digestive aid, as an aid to weight management, and even for staying young.

Effects on the Skin

One of the properties of a liquid extract of stevia that has not yet been investigated experimentally is its apparent ability to help clear up skin problems. The Guarani and other people who have become familiar with stevia report that it is effective when applied to acne, seborrhea, dermatitis, eczema, etc. Placed directly in cuts and wounds, more rapid healing, without scarring, is observed. (This treatment may sting for a few seconds, but this is followed by a significant *lowering* of pain.) Smoother skin, softer to the touch is claimed to result from the frequent application of stevia poultices and extracts.

Effects on Reproduction

An interesting pseudo-phenomenon arose at one time, and sadly, still receives attention from time to time, in the popular press and even by serious scientists. It is sad because the whole thing is a hoax; if not that, it is at least a case of very badly mistaken identity. It seems that in 1986 a paper appeared that claimed that certain tribes of Indians in Paraguay (the Matto Grosso) used stevia tea as a contraceptive, with apparently very good results. In subsequent experimental work, utilizing rats, these researchers found that the treatment was supposedly good for periods up to 12 months.

Subsequent work has repeatedly failed to replicate the 1968 study. Furthermore, at least one attempt to locate tribes in northeastern Paraguay that used stevia to control fertility failed to confirm the story. One effect on reproductive physiology that appears to be valid, but which is need for further study before definitive conclusions can be drawn, is a healing effect on the processes underlying prostate disease. Just how important this finding is must await further research.

Safety Information

One of the most obvious indications of the safety of stevia is that there have never been any reports of ill effects in over 1500 years of continuous use by Paraguayans. A similar indication of safety is the observation that despite over ten years of widespread use of stevioside as a sweetening agent in Japan, years in which literally scores of tons of stevioside were ingested, not a single report of side effects of any kind has been reported. Compare that record to the track record of aspartame, which is the number one source of consumer food complaints made to the FDA.

Elaborate safety tests were performed by the Japanese during their evaluation of stevia as a possible sweetening agent. *Few substances have ever yielded such consistently negative results in toxicity trials as has stevia.* Almost every toxicity test imaginable has been performed on stevia extract or stevioside at one time or another. The results are always negative. No abnormalities in weight change, food intake, cell or membrane characteristics, enzyme and substrate utilization, or chromosome characteristics. No cancer, no birth defects, no acute and no chronic untoward effects. Nothing.

The only related effect ever observed was the inhibition cell respiration (oxidative phosphorylation) in certain isolated cell components, but never in whole cells. The only observable results of this action, even after prolonged observation, was a reduction in toxicity due to a substance known as atractylignin, a poison that attacks cells of the liver. This result suggests that stevia could be used as an antidote to rare cases of poisoning by that chemical. The overall result of this action of stevia, then, turns out to be positive.

An example of a good toxicology trial was one performed in 1985 by Yamada and coworkers. They administered stevioside and rebaudioside A to rats for two years at the rate of 0.3-1% of their diet. The animals were then sacrificed and the researchers conducted biochemical, anatomic, pathological and carcinogenic tests on 41 organs following autopsy. In addition they performed ongoing hematologic and urine tests on the same animals. Each of the animals was matched to a control animal that experienced exactly the same treatment except for the stevia. In the end, the symptoms and alterations noted by the research staff did not vary at all between the groups, and no dose-response effects were noted, even at the highest dose (1%), which is equivalent to 125 times the average daily dose of sweeteners that a normal human would require.

Similar batteries of tests carried out by the National Ministry of Health and Welfare in Japan also failed to

find any form of toxicity whatsoever.

But there is a fly in the ointment, so to speak. As mentioned earlier, there has been a fear that metabolites of stevioside and rebaudioside A might be doing serious harm to the body. As one author put it: "In spite of the fact that acute oral administration of large doses of stevioside and/or *Stevia rebaudiana* extracts and long-term studies with feeding either of these materials to laboratory animals have shown them to be virtually devoid of toxic effects, one must consider the limited data available on *metabolites* (italics mine) of the major sweet principles of this plant. Now this comment was made in full knowledge of the fact that stevioside and the other glycosides of stevia are remarkable for their chemical stability; that is, due to their peculiar chemical or molecular shape, stevia glycosides are extremely resistant to acid and enzymatic degradation. They simply cannot be broken down into their metabolites under normal gastric conditions. Gastric acids and enzymes, as found in humans, are incapable of degrading these extremely stable molecules. This is in line with Pomaret's study that found that steviosides passed unchanged through the human gastrointestinal tract.

Apparently the situation is different in the rat. In 1980 R.E. Wingard and associates reported that stevioside and rebaudioside A were both degraded to steviol by rat intestinal microflora in a test tube. Steviol is one of the nasty metabolites that could, maybe, perhaps, do humans serious harm. Wingard incubated the stevioside for 2-4 days in a specially prepared solution containing the contents of the rat cecum. Under these conditions, conversion was almost 100%. However as Kinghorn and Soejarto have pointed out, there are just two things wrong with extrapolating these results to humans. First humans do not have a cecum, as does the rat; therefore, a critical step in the conversion process has no equivalent physical location in which to occur. And second, there is no good reason to believe that the microflora of the human intestinal tract contains the same microorganisms as does the rat cecum.

One would think, in light of the seriousness of the theoretical charge posed by Wingard, that scientists would be clamoring to settle the issue through appropriate experimental measures. Not so. It's as if no one really takes the threat seriously. After all, it is unlikely that some kind of observable consequence of steviol (the metabolite) intoxication would not have been reported during decades of stevia use if, in fact, a real problem existed. Since no reports have been forthcoming, we can daringly conclude (apparently along with the rest of the scientific community) that humans are different from rats.

From The Jungles To You

Imagine that you live off the land in the lush tropical forests of South America, surrounded by an almost unimaginable array of trees, bushes, flowers, exposed to thousands of types of roots and berries and leaves. You are appointed medicine man (or women) and your job is to keep yourself and the rest of the tribe healthy and to cure what ails them. What would you do? How would you go about devising techniques that work? Certainly you summon the help of whatever gods and spirits you believe in, and make the most out of whatever hype you could come up with. In that regard you would bear a close resemblance to the modern medical establishment. But then you would probably start looking for agents in nature that would serve your medicinal needs. Would you find anything? You bet you would. For the tropical forest of South America are the earth's richest storehouse of medicinal agents. You would probably jealously guard your secrets as you learned them, and eventually you might even try to make yourself into some kind of God. At some point you would select an heir to your knowledge, and over the centuries your knowledge would be enlarged upon by succeeding generations.

This hypothetical situation is a fairly accurate account of what could have happened to you, had you been a member of the Guarani Indian tribes of Paraguay. These people first came to the attention of Europeans sometimes in the 1600's and were the subject of an intense missionary effort in the early 1700's. They were found to be a beautiful, ethical, highly skilled, very intelligent and gifted culture.

Today, pure-blooded Guarani are declining in number, much of their civilization has been preserved in one form or another. Thus it is that every once in a while, someone will be lucky enough to learn one or two of the secrets of the Guarani; even more rarely, such a lucky person will share it with the rest of us. As a result, we are just barely beginning to see some of the Guarani medical remedies reach the shores of North America.

One of the most promising of Guarani medicinal substances is, of course, stevia. It is known as "sweet leaf," or "honey leaf." This suggests the primary use of the plant in folklore use. Long before the country was colonized by the Spaniards in the sixteenth century, stevia was being employed to make food and drink palatable. Medicinally, the plant was used to treat diabetic and hypoglycemic conditions, and externally for keeping skin and hair youthful and healthy. Today, in homes and some clinics in rural Paraguay, stevia in high doses is given in tea form as a remedy for high blood sugar levels. The

tonic, stomach-soothing, digestive, hypotensive and immune-stimulating actions of stevia are well known.

It is interesting to see where stevia occurs in the traditional folk remedies of the native Guarani. Numerous are the folk medicines that contain stevia, either as a flavor enhancer or for its own medicinal properties. Most of these remedies are unknown beyond the edges of the fields and jungles.

A Dietary Supplement

In 1991 the FDA banned the imporation and use of Stevia in the U.S. based on the lack of evidence proving its safety. This, in spite of the hundred of years' of use by various peoples with no reports of toxicity. In addition, well over 1,000 tons of the extract is consumed every year by the Japanese, again with no reports of toxicity. Studies examining the safety of Stevia have repeatedly concluded with negative results—in other words, no toxic effects or side effects have been found.

In September, 1995 the FDA lifted the ban on Stevia allowing it to be sold as a dietary supplement. This means Stevia cannot be sold as a sweetening agent, but simply as the health-enhancing dietary supplement it truly is.

Efforts continue to persuade the FDA to reclassify Stevia as a GRAS (generally regarded as safe) ingredient, but in the meantime, no one can deny its health promoting properties as a food supplement.

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About The Author

Dr. Mowrey is known primarily for his efforts to bring scientific data about herbal medicine to the attention of the American public. Toward this end he has published the books entitled *The Scientific Validation of Herbal Medicine,* and *Guaranteed Potency Herbs: Next Generation Herbal Medicine*, which have become standard texts in the field.

Dr. Mowrey obtained his Ph.D. in experimental psychology, with an emphasis in psychopharmacology, from Brigham Young University, and began researching herbs in the mid-70's. He is one of few American herb scientists to have published human experimental data on *whole* herbs in medical journals (e.g., "Ginger, motion sickness and psychophysics," *The Lancet*, March 20, 1982, 655-657).

Currently Dr. Mowrey is Director of the Mountainwest Institute of Herbal Sciences, in Salt Lake City, Utah.