

An Ethnobotanist's Circuitous Route to the Amazon

By Dr. Memory Elvin-Lewis

I evolved into an ethnobotanist by a serendipitous event. After my BA in Bacteriology and Genetics, I trained as a medical technologist and worked in that capacity for a number of years. My graduate training was in medical microbiology, virology and epidemiology. As a faculty member at Washington University School of Dental Medicine in the early 1970s, I was studying a couple of local Burkett's Lymphoma cases linked to an outbreak of infectious mononucleosis in a middle school in nearby Granite City. It was known that these diseases were caused by Epstein Barr virus infections, with the latter known to cause jaw and ovarian tumors. However, unlike tropical Africa where this malignancy was known to be more common in children, its occurrence in the Midwest was a rare and unexpected event.

As luck would have it, I was invited to accompany my botanist husband, Dr. Walter Lewis, to Ghana. As head of the herbarium at the Missouri Botanical Garden and a professor at Washington University, he was part of a team from the Academy of Sciences selected to help scientists there establish their research priorities in agriculture. It was an ideal time for me to visit since this country was undertaking clinical trials with vincristine to treat this aggressive B cell lymphoma. It was wonderful to see first-

hand how this plant-derived compound was saving the lives of these seriously affected children. This event was my first introduction into how plant-derived compounds had true medicinal and pharmaceutical value.

Since an understanding of the underlying causes of dental disease were evolving at that time, I also inquired as to the general dental health of Ghanaians. I was told it was not considered a major issue since it was their belief that the use of local chew sticks and sponges used to clean teeth possibly possessed preventative properties. To test this hypothesis I began conducting studies in my laboratory to see if this might be true. At first, it was necessary for me to learn techniques used by pharmacognosists to extract these plant specimens and to test these for their antibiotic activities. To my delight, I found that, not only were my African specimens active against organisms causing tooth decay, but many contained sufficient fluoride to inhibit bacterial enzymatic activities related to plaque production as well as protecting tooth enamel.

During that period Walter and I started writing our book *Medical Botany*, which was designed to present data about pharmaceutical discoveries from plants as well as representative plants used worldwide in the context of those which were considered harmful, healing, and psychoactive. Like a book on internal medicine, the chapters were further divided into how these might affect specific human systems. To begin each chapter, we described how each system functioned. We divided the work according to our expertise and also learned from each other along the way. We also took a course in pharmacognosy at a school of pharmacy so as to better understand these aspects. Because of these efforts,



we were able to collate a massive amount of data regarding plant uses for a wide variety of purposes which later was applied to our research elsewhere. It was considered the first of its kind, and won many awards for its usefulness as a teaching text and reference book. It was published in 1976, and a much larger second edition evolved in 2003.

Thus this small "back burner" project evolved into studying plants used for oral purposes worldwide. These efforts were funded by the National Geographic Society,

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Above: Dr. Memory Elvin-Lewis (top), who decided to study the effects of chew stick cleansing on teeth (center) after her first visit to Ghana (map, left).

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World Health Organization and Pan American Health Organization as well as commercial entities in Egypt and India. Also, I was fortunate to elicit the expert help of Walter, numerous other botanists, phytochemists, and scientists and the cooperation of local informants to define how careful plant selection was directly related to the oral health of the users. Among others that worked with me at Washington University were: Drs. Kenneth Keudell and Jennifer Gosling who, as microbiologists, studied the antimicrobial effects of chew sticks, Dr. Edward Kennelly who, as a graduate student, identified antibiotic dammarane compounds in the Jamaican chew stick, *Gouania lupuloides*, as did Dr. Adenwole Okunade who isolated bio-reactive compounds from the African chew stick, *Garcinia afzelii*, Drs. E. El-Najdawi and H.J. Wedner who investigated essential oil hypersensitivity in aphthous stomatitis patients, Dr. Samuel Rosen at Ohio State University School of Dentistry who collaborated with me in investigating the anticariogenic in rats, and Dr. Robert Stillman, who evaluated the benefits of tea drinking among Chicano school children in an USPH clinic in Dallas, TX. Reference to the chapter on Oral Hygiene in the 2nd edition of *Medical Botany* provides a comprehensive review of the subject, in addition to details of the work done by my students and collaborators.

Noteworthy was an early study conducted in 1975 in collaboration with the botanist J.B. Hall and dental and other students at the University of Ghana. This effort was the first to utilize epidemiological techniques and FORTRAN analysis. It involved surveying 887 individuals in 11 linguistic groups to determine how their chew stick and chew sponge preferences were related to their oral health. It also provided a way to identify the seven favored taxa from the 173 species that were known. Correlating these data with laboratory findings, it was possible to establish the concept that the most favored plants were likely to be the most efficacious and bioreactive. I named the technique ethnodontal/medical focusing.

Also, by applying this method as well as identifying other efficacious principles already known in the literature, we were able



to establish the cultural and therapeutic rationale behind the plants used for tooth blackening among the Peruvian Jivaro and others in Amazonia with the collaboration of botanists at the Museo Historia Nacional in Lima. While tooth blackening was primarily used to obtund the bitter flavor of ayahuasca when used as a recreational beverage to elicit a communal hallucination, it also had dental benefits. Like *Camellia sinensis* tea, which I had previously studied, it prevented plaque build-up by the presence of its catechins and fluoride in dissociating the adherence, co-aggregation and acid production and formation of the sticky slime layers of glucans or levans of oral bacteria. In Peru, logistical support was graciously provided by Occidental Petroleum. In extending our studies on tooth extraction plants in Columbia, not only did Dr. Jose Perea Sasian from the Universidad Nacional de Colombia, Bogota drive us to our study sites in Cundinamarca, but he also volunteered to extract one of his teeth bloodlessly and painlessly using the sap of the local species, *Maclura tinctoria*. This plant was also found to have cosmopolitan value for the same purpose from Madagascar and throughout tropical Africa.

These studies laid the groundwork for establishing the pharmacopeia of the Acheul Jivaro and neighboring localities situated on rivers in Loreto, Peru during the 1980s. This work was funded by NSF with Walter as PI in addition to both Occidental Petroleum and Petro Peru providing us with logistical and other support. We were able to conduct this research through the gracious hospitality of the indigenous people who gave their prior informed consent. We collaborated with ethnolinguists such as Mr. Daniel Fast and Dr. Maurizio Gnerre as well as numerous Peruvian botanists at

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Dr. Elvin-Lewis with her best friend, Julia, who provided her with food from her garden and fish from the river (top). Because of seasonal flooding of the river, homes were built on stilts (center). The raised huts, only seen at rivers edge, were more common in mestizo communities and were cooler and distant from biting river flies. (bottom).

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the Museo Historia Nacional and specialists at the MBG and elsewhere.

During that period from 1982 to 1988 we lived with our hosts for several weeks at a time, travelling to our sites by dug-out canoe, motor boat or oil company helicopter. Every day was full of excitement and adventure and something neither of us will ever forget. We will forever be indebted to these wonderful people who taught us so much about their culture and the uses of their medicinal plants. Examples of some of the plants we found with efficacious properties included *Eucharis amazonica* bulbs, effective against *Staphylococcus aureus* infections, and *Balansia cyperi* sclerotia containing ergobalansin found on the species *Cyperus prolixus* (known as piri piri). It is used as a common parturition aid throughout Amazonia, not unlike the related European species *Claviceps purpurea* on *Secale cereale* (rye) with its source of ergot alkaloids such as ergometrine and methylergometrine. Sadly, as the decade came to a close, it was evident that much knowledge was being lost as acculturation progressed.

In the 1990s we continued to work in Peru. An observation we made during our earlier work elicited my interest as a virologist when claims were being made that "you do not die of hepatitis if you take the root of this plant." Taking some samples back to our laboratory, I had them extracted and evaluated at Georgetown University Medical Center NIAID Hepatitis Contract Laboratory through the collaboration of Drs. J. Gerin, B. Korba and J. Casey. A number of specimens were found bioreactive against the local strain of Hepatitis B (HBV) and its satellite Hepatitis D virus (HDV) that had been collected at a nearby military base by Dr. Douglas Watts who was affiliated with the NAMRID unit in Lima. Also, through the courtesy of Dr. Gordon Cragg at the National Cancer Institute, it was found that the most bioreactive plant was inhibitory against HIV, possibly because HBV and HIV have reverse transcriptases.

To affirm these mechanistic studies, preliminary clinical evaluations by the Peruvian hepatologist, Dr. Alejandro Colichon, had already shown that the use of an extract of this plant was efficacious in

a number of his HBV patients. He was very knowledgeable regarding the need to find solutions to curtail this endemic disease, which was lethal to so many that acquired it or the dual infection. For some time he had been assessing rates of this disease in the region and the response of immunization to the current HBV vaccine. By eliciting his collaboration and using this preliminary data, I was able to obtain a



grant from what was then called the Office of Alternative Medicine at NIH. It was the object of this proposal to evaluate the therapeutic value of viral hepatitis remedies known to individuals in our original study locations and to apply ethnomedical focusing techniques, as well as clinical and serological analyses to assess their effect. My medical collaborator who accompanied me to the villages was Dr. Mauricio Navaro who was an affiliate in Dr. Colichon's laboratory. He did the physical examinations on the patients, and I conducted preliminary work on biomarkers found in their blood and urine. Liver function tests and other biomarkers were conducted in Dr. Colichon's laboratory.

It took us five years to complete this investigation, since logistical support from Occidental Petroleum was irregular; floods and low rivers made them impassible at times, and concerns about terrorists groups were always omnipresent. One quarter (523/2015) of the populations of 14 communities on four river systems were surveyed to understand their plant uses to treat hepatitis. Rates of infection on four river systems varied from 0.01-0.08%. Of the 358 individuals tested for their acute carrier status, 34 had been recently infected and four others were identified as chronic carriers.

Twenty-seven species in 14 plant families were identified, with the majority being trees and only a few herbaceous plants represented. Noteworthy was that ten of these taxa were selected for yellow plant parts, suggesting, at least in this disease, that the "Doctrine of Signatures" was frequently a defining factor as it is in other cultures.

At its conclusion, a pattern of favored plants emerged for both populations, with substitutions made when these were unavailable. Overall, when favored bio-reactive treatments were applied appro-

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Dr. Elvin-Lewis' husband, Walter, a fellow ethnobotanist and collaborator (top). The couple often traveled to various sites by dug-out canoe (center), helicopter, motor boat, or seaplane (bottom).

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privately, and for an adequate period of time, the duration and severity of disease was significantly reduced as determined by clinical, serological and physiological parameters. Co-infections with HDV were prevented when appropriate treatments were applied at the onset of disease. Again, we were able to affirm that the most popular remedy was the most

drinking masato contaminated by infectious spittle, or acquiring immunizations through improperly sterilized needles. In mestizo villages infections were related to proximity of an army base (with tattooing and prostitution), biting river flies, carriers with history of disease, etc., or river traffic bringing infectious individuals to their villages.

During this period, I was also a member of one of the survey teams studying the

bioreactive plants were identified against tuberculosis, malaria, apoplexan protozoa, cancer, etc. Unfortunately none as yet have resulted in a pharmaceutical discovery. Regrettably, this grant was terminated due to an error in the review process before additional studies on this valuable pharmacopeia could proceed.

During the time when negotiations were ongoing, I took a course at our law school

Overall, when favored bioreactive treatments were applied appropriately, and for an adequate period of time, the duration and severity of disease was significantly reduced as determined by clinical, serological and physiological parameters.

efficacious, thus verifying the value of the "ethnomedical focusing" technique. Rarely used alone, it was, especially in riverine communities where both mestizo and the Achual lived together, imbibed as decoctions or infusions of its root with other plants sequentially or mixed with plants known in cosmopolitan herbalism. These additions tended to amplify the effects of the remedy because of their anti-inflammatory, antiviral, diuretic, and other efficacious properties. Unfortunately, its popularity indicated it was becoming extirpated where it was needed the most. Choosing secondary, less potent choices was becoming more prevalent, such as when a chronic patient had to select another taxa to control recurrent events seen when reduced liver size and viral load became evident. Another significant finding was that even within family units, the formulae could vary from one person to another. In certain villages, knowledge was sometimes so incomplete as to have little therapeutic value.

Epidemiological studies indicated that transmission differed among indigenous and mestizo villages. The Achual tended to acquire their infection from one or more family members that had been exposed to these viruses through military tattoos,

medicinal plants of the Aguaruna in the Alto Marañón basin. This ICBG-Peru project, with Walter as PI, involved a multifaceted approach engaging collaborators at Washington University, Searle and a number of NIAID and NCI testing laboratories in the US, University of Louisville, the Museo Historia Nacional, Universidad Cayetano Heredia and the San Marcos Universidad in Lima. In collaboration with indigenous and university attorneys, a two year negotiation period was necessary to outline the terms of engagement and issues associated with benefit sharing before collection could proceed. These negotiations became the basis for incorporation into the sui generis laws of Peru, and were cited as an appropriate example of how to conduct bioprospecting among indigenous people.

Epicentral to this project was the application of a number of interesting concepts on how to amplify the worth of these medicinal plants by not only targeting those of known value but also conducting phylogenetic amplification surveys on similar compounds in related plant species or families, by looking for cross sensitivity among known infectious organisms, viruses, fungi or parasites, or identifying similar inhibitory targets associated with cancer or other metabolic diseases. In this way, identification of many

in intellectual property so as to be better able to understand the nuances of laws and policies involved in this evolving arena and was the first to write papers targeted to ethnobotanists conducting similar studies. Because of both our efforts, the book *Biodiversity and the Law* was dedicated to us by its editor, Charles McManis.

I would like to close by saying Walter and I became ethnobotanists together since we learned so much from each other. North American wild roses have been Walter's passion from the time he was an honors undergraduate student through his graduate work and he has published 32 papers on this subject. Over the years, I accompanied him on numerous field trips, was cited on these herbarium collections and also recently worked with him on his last *Rosa* papers. Much to my delight, in 2016 he named the first new American wild rose discovered in over a hundred years after me, *Rosa memoryae* Lewis.¹ Our last paper together was truly a collaborative effort and a testimony to this aspect. We combined his initial and current cytological studies related to *Rosa acicularis* L. karyotypic variation with aspects I did on current data associated with its ecology, phytogeography and ethnobotany.² ■

LITERATURE CITED

- ¹ Lewis, W.H. Nomenclatural novelties in *Rosa* (Rosaceae) subgenus *Rosa* recognized in North America. *Novon*, **2016**, 25: 22-46.
- ² Lewis, W.H. Elvin-Lewis, M. 2017. The worldwide significance of karyotypic variation in *Rosa acicularis* L. (Rosaceae) *J.Bot.Res.Inst.Texas*, **2017**, 11:433-454.