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MEXICAN MEDICINAL PLANTS
A THERAPEUTIC RESOURCE OF PHYSICIANS AND
TRADITIONAL HEALERS

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SUMMARY

In this paper we offer a review of the relationship between Mexican physicians and the use of medicinal plants in health attention in Mexico. In this overview, we start insisting that in Prehispanic medical systems and also in the Spanish domination times (1521 -1821), medicinal plants were the main resource for medical attention. The main characteristic is the tension developed between the official health attention system and the traditional one and their utilization was officially recognized. We review the most important medical texts coming from indigenous medicines and those wrote by Spanish physicians which recommended medicinal plants in their therapeutics. The changes derived from the development of the scientific method towards the experimental acquisition of knowledge are also reviewed, with the natural orientation to isolation of active principles and the justification of the employment of medicinal plants only by the pharmacological confirmation of their effects. We offer a synthetic narrative on the foundation and work of the Instituto Médico Nacional of Mexico in the turn from the 19 to the 20th century. Also are presented the renovation of the medicinal plants studies at the Mexican National University (UNAM) and in other institutions and the tensions between popular and scientifically validated uses.

Key words: Mexican Medicinal Plants - Mexican Traditional Medicine -
Pharmacological research on Mexican medicinal plants (History)

The relationship between Mexican physicians and medicinal plants has been contradictory in the last century, previously was rich and multidimensional. In this essay we will present a survey of this changing relationship in different time periods, following the different concepts of knowledge and science about the action of medicinal plants on humans. These differences come from the worldview culturally accepted in the several phases of the long-term development of Mexican culture with some conceptual differences characterizing these phases:

- Prehispanic Mesoamerican cultures;
- the transformation following the Spanish Conquest and the introduction of a Hippocratic–Galenic conception of health and therapeutics, including the interrelation between native conceptions and practices on the one hand and, on the other, European medicine;
- the development of a new idea of nature and human reason in medicine;
- the appearance of pharmacology in the 19th century, this one with subdivisions corresponding to the institutionalization of research;
- the impact of synthetic medicaments and the industrialization of medicines;
- the recovering of the image and usefulness of traditional medicine and its remedies in present-day health culture, with both new developments of traditional health care and the resignification and inclusion of traditional elements in mainstream medical practice.

The Prehispanic antecedent

It is well known that Prehispanic Cultures in Mesoamerica were made of a mosaic developed through a ten-thousand-year period,

in a territory going from the southwest of present United States of America to the Panama Canal, from Neolithic cultures to very sophisticated and powerful civilizations- Olmec, Teotihuacan, Mayan, Zapotecan, Mixtecan, and Nahuatl, with Acolhuas, Tarascans and Mexica (Aztecs) as their last representatives in early sixteenth century after the Spanish arrival¹.

The relations between the vegetal and the human worlds were deeply permeated by religious and cosmogonic concepts. In some traditions, as in the Maya narrative in the *Popol Vuh*, the world axis is an immense tree, a ceiba (*Bombax ellipticum*), which its extended branches supports the heavenly floors, whereas its roots, deeply inserted in the earth, make up the nine levels of the underworld². In another Central-Mexican tradition, four trees are planted at the four corners of the earth, the first of which sustains the heavens. These trees are not easily identifiable being mostly symbolic; however, naturalistic elements always appear in their representations, allowing for some hypotheses³. Trees as constituents of the very elemental cosmic structure, contribute to awareness about the importance of the vegetal world for human existence; without trees, indeed, the universe loses its coherence⁴.

Another important feature of the Mayan World is that the ultimate man, that of the actual Fourth Sun, was created from maize. Gods as *Centeotl* in Aztec mythology or *Tlaloc* as represented in Teotihuacan sculptures, have a maize-grained body and face, respectively. Other gods, *Xoxhipilli*, the Lord of the Flowers, and *Macuilxóchitl*, The Five Flower Lord, have flowers, seeds, and other plant elements in their clothes and ornaments. *Tlalocan*, the *Tlaloc's* paradise, beautifully represented in the mural paintings at Tepantitla in Teotihuacan, is a garden, a place where sacred, magical, alimentary and medicinal plants grow offering their beneficial properties to its inhabitants⁵.

The Mesoamerican Prehispanic worldview was typical of agricultural societies and civilizations developed thanks to an extensive

knowledge of surrounding nature and its elements, where plants and their products occupy a very central place. In this sense, infrastructural and suprastructural realms come in jointly, giving its substance to an image of man intimately related to the vegetal world.

In this context, medicinal plants have a particular presence. They are living beings inhabited by gods or spirits of different origins and qualities, which can be controlled and used by humans. Physicians, midwives, and some specialized priests observed, studied, and owned plants, as one among other kinds of medicaments, after they received them from the spiritual entities they were related to, and obtained the power and authorization to use them. In this way, medical activities always had a halo of magic and religion, and *titici* or *ah men* – that is, the male and female physicians in the Nahuatl and Maya languages, respectively – were craftsmen, magicians, and intermediaries between humans and spiritual entities at the same time. It is evident that the relationship between the vegetal and the human worlds was multifaceted as it resulted from the multiple possibilities of interpersonal relations between physicians and the plant spiritual owners. It was-and still is-necessary to perform rituals and to recite prayers to the principal gods, as *Tlaloc*, *Quetzalcóatl* and *Tezcatlipoca* in Central Mexico, *Chac* and *Kukulkan* in Mayan territories, or *Cocijo*, in Mixteca and Zapoteca cultures. Lower spiritual beings could be conjured and managed. In no case, plants could be used without previous permission or acceptance at a spiritual level of the human intromission into these realms⁶.

Significant examples of the plural dimension of plant management can be traced in the texts of medical spells collected in the early 17th century by Hernando Ruíz de Alarcón (ca. 1580 - ?) among the Nahuatl people in the Taxco, Guerrero, surroundings. In one of them, recited before administering a medicine for abdominal pain, the physician prays the plant spirit to come and enter the patient's belly, and chase the pain out:

Mexican Medicinal Plants

*Dígnate venir, verde sacerdote / Aquí te pongo, en las siete cuevas / Persigue al verde envaramiento / al oscuro envaramiento / blanco sacerdote*⁷.

In another spell, pronounced to cure skin eruptions, the physician talks with tobacco spirits, identified as a yellow priest cracked in nine places, and macerated in nine stones situated in nine precise places, symbolizing the nine floors of the underworld⁸.

Physicians needed knowledge-objective knowledge in the modern sense of the word-of plant characteristics in order to identify them in the field, in storages, or on markets. They also needed an accurate knowledge of their therapeutic effects, in addition to their collateral and undesirable effects. But all of this could not be complete without a preparation to adequately act in the supernatural realm. This perfectly explains the divisions and specialties among medical practitioners, with two poles: the priest, invested with medical functions, and the *panamacani* or herborist, who collects and sells medicinal plants and sometimes prepares medicaments⁹. In rural areas both roles were frequently taken by the same person¹⁰.

In cities and ceremonial centers, the priest/medicine-man was habitually devoted to the cult of a specific deity, or a group of gods and goddesses associated to guide and protect particular bio-social situations or organic functions. For example, *Quetzalcóatl*, *Xochiquetzal*, and a group of related goddesses were responsible for fertility and the positive outcome of pregnancy. The goddesses were the guardians of the sapient women also called *titici*, that is, medicine-women, who had an effective knowledge of plants with occitocic and also abortive properties, as it is the case with *cihuapahtli* (*Montanoa tomentosa* Cerv.), which was-and still is-employed all over the Mexico by traditional midwives and is useful to induce birth labour, mainly in cases of insufficient uterine contraction or to help to expulse the placenta. Also all the plants employed in the *temazcal* baths, which includes curative procedures, were under the protection and manage-

ment of *Toci*, the grandmothers called for this reason *Temazcaltoci*¹¹. Another example is the utilization of *tzitzicatli* (*Urticas* pp), which provokes an irritation of the skin and general reactions. In both cases, the midwife, called *ticitl* as she was considered as a special kind of physician, acted as a representative of the goddesses and, simultaneously, as the owner of a special power derived from both the goddesses' protection and her individual knowledge.

At it still is the case today in Mexican traditional medicines, plants were considered as a divine gift accessible through study and specialized knowledge acquired through rituals, initiation processes, or following the teachings of priests, parents, or teachers, and possibly also through dreams.

Medicinal plants were considered a resource, but not a common one. Essentially divine, inhabited by gods or spiritual beings, they were managed with kindness, even reverence in most cases, but in others induced to act by means of prayers or, if the physician was powerful, by spells or incantations. In all cases the relationship between physicians and plants always was an interpersonal action, an intersubjective work.

Besides developing this conceptual frame through their millenary history, ancient Mesoamerican cultures also acquired a deep knowledge of the natural components of their environment, together with the benefits they offer to humans. Knowledge of medicinal plants was a very important component of all these cultures. The range of ecosystems in which they were living made it possible to have access to resources from coastal to high- altitude plants, and to tropical forest to desert-grown species. The number of botanical species present in 16th-century indigenous recipe collections, that is, in the indigenous documents recording the ancient medical tradition, goes around 200. This is the number of plants used by the *titici* working in a specific community. All those recipe collections concord in recommending the same plants for the treatment of the similar illnesses.

This is a common characteristic of the texts that are fundamental for our knowledge of Mexican Prehispanic medicine.

These texts are the following, all of them coming from Nahuatl healers. The first three were collected from ancient people and *titici* who were living and working in Tepeapulco, now in the Hidalgo State, some 100 km from Mexico City: Sahagún's *Primeros Memoriales* and the two *Matritensis Codex*, the first one preserved at the Madrid Royal Academy and the second at the Royal Palace libraries¹². A fourth such text is the *Florentine Codex*¹³, dictated also to fray Bernardino de Sahagún (1498 – 1590), this time by *titici* from Tlatelolco, the twin indigenous city related to Mexico City which was maintained by the Spanish government as the *República de Indios* (Indians Republic), the center of the indigenous own government, and from Mexico City. Sahagún's last work, the *Historia General de las cosas de la Nueva España* (General History of the New Spain Things) according to the title of the so-called *Tolosa Codex*, was redacted by the venerable friar after his manuscripts had been confiscated and sent to Spain in the fifteen seventies and were recovered and published in 1829 in Mexico for the first time¹⁴.

Sahagún's works are a source of primordial value. The friar did interrogate indigenous physicians and people reputed to have a good knowledge of the healing arts. He wrote down the information he received from them in the original nahuatl language, translating it into Spanish only later. In general terms, his works reproduce the ideas and concepts of the *titici*, and transmit the descriptions of some 200 medicinal plants, together with many animals and minerals used as *materia medica*, in addition to the ways to utilize them to prepare medicaments.

The other fundamental medical work, this time wrote by an indigenous doctor, Martín de la Cruz (ca. 1500 – ca. 1555), is the so-called *Codex de la Cruz Badianus* or *Badianus Manuscript*, which original title is *Libellus de medicinalibus Indorum Herbis*¹⁵. It comes

from Santa Cruz de Tlatelolco, in the twin city of Mexico, where was a school destined to educate indigenous children. The school was managed by Franciscan friars and has indigenous medical doctors for the children attention, with the idea that the human nature of Indians was different to that of the Europeans and was a logical solution left their own doctors treat them. Martín de la Cruz, a *titici* a member of the Tlatelolco nobility, was charged by Francisco de Mendoza, son of the first New Spain Viceroy, to prepare a book on the Mexican medicinal plants.

Healers as heirs of ancient knowledge

Following the conclusion of the Spanish Conquest, symbolically represented by the fall of Tenochtitlan in Cortés' hands on August 13th, 1521, native cultures were considered invalid, if not derived from devil's temptations. *Tezcatlipoca*, the Night God, and some other indigenous deities were considered to incite, if not to author, any kind of evils and sorcery, and to possess the soul and mind of non christian people. In this context, the *titici* became suspected to have made demoniac pacts, and their medical activity was viewed as a reminiscence of the ancient religion. A good example of this can be found in the so-called *Magliabechi Codex*, in which a man drinking a beverage made of hallucinogenic mushrooms is represented with a devilish figure taking him with his paws¹⁶. It provides a heavy link with popular Spanish beliefs valid in that time about the real existence of maleficent spirits, if not devils, which obviously inhabited some plants, particularly the psychotropic species.

Indigenous healers demonstrated their deep and extensive knowledge of natural resources. They were indispensable for the health care of both their people and the Spaniards. Tlaxcaltecan physicians attended Hernán Cortés and his soldiers after their flight from Tenochtitlan in 1520. They were appreciated for their medical ability, all the more because Spanish physicians and surgeons coming

to Mexico in these first Colonial times were scarce and not always well prepared. The indigenous physicians, who were healers or, in the best cases, medicine-men, continued to use the remedies they prescribed in pre-hispanic times. In their collaboration with *mestizo* people or with Spaniards, they revealed only their practical knowledge involving demonstrable clinical efficacy, keeping for themselves and their own people the religious and spiritual ancestral evidence. Plants were officially recorded as medicines without any reference to their spiritual “inhabitants”, excepting those “inhabited” by evil spirits. Their immense majority of them were recorded only by their medicinal properties. Knowledge of the plants, with their medicinal properties and toxicity, was highly esteemed by European patients.

The New Spain physicians and medicinal plants

Europeans in New Spain soon needed to use Mexican medicinal plants and medicaments because they could not receive medicinal resources in a good state of preservation (particularly fresh plants) from Europe. That was also the case-though in an inverted way-of the medicaments arriving from America to Europe until preservation means improved.

In the colonial history of Mexican medicinal plants indigenous and European treatments were first compared. Both had a similar level of development and, although the Hippocratic-Galenic medical system in Europe at that time had separated from religion and constituted a body of knowledge that could be characterized as scientific, its Mesoamerican equivalent, though intimately connected with the worship of the gods and requiring a whole set of magical interpretations and rituals, also contained a significant quantity of concrete knowledge which, empirically evaluated with objectivity, allowed to diagnose and accurately classify diseases, besides efficaciously treating them¹⁷.

After the disaster of the *La Noche Triste* (Night of Sorrows), when in 1520 the Spaniard soldiers flee from Mexico – Tenochtitlan and suffered heavy losses, Hernán Cortés (1485 - 1547) asked for Tlaxcala surgeons to cure his wounds and those of his soldiers. Besides witnessing to his understanding of the efficacy of indigenous doctors and medicines, such request was a gesture of great political repercussion. Before this, indeed, both Cortés and Bernal Díaz del Castillo (1495 o 1496 – 1588), the well known chronicler of the Conquest of Mexico, noticed that sellers of medicaments—most of which were made of plants or parts of plants—were present in the large market of Tlatelolco in which there were, as they said, “herbalists’ streets, where all the roots and medicinal herbs that are on earth can be found”¹⁸. Under Cortés’ government, Spanish apothecaries and a few doctors and surgeons arrived in Mexico City, and started controlling the professional practice of all of them, creating in so doing a space in which the republics of Indians and Spaniards were separated not only with regard to government, but also to knowledge and practice. As the century progressed, the situation was every moment more radicalized: indigenous healers should limit themselves to cure indigenous patients, since they knew and understood their nature, leaving for the Spanish doctors the care of Europeans. Successful important medical interventions carried out by *titici* on European patients are attested, however. One of them is the healing by an Indian of the Marquis Land state in the region of Cuernavaca of the *mirarchia*, clinically attested by a paralysis and diagnosed as a black bile invasion of the central nervous system, which affected the viceroy Antonio de Mendoza (1490 – 1552)¹⁹, and the more than possible participation of Martín de la Cruz, the Tlatelolca doctor author of the *Libellus of Medicinalibus indorum herbis*, in the treatment of the viceroy himself after the attack of apoplexy that almost killed him in 1550²⁰. Indigenous practitioners continued to heal publicly, sometimes with an official authoriza-

tion issued and signed by the viceroys, at least until the end of the 17th century. The use of Mexican medicinal plants according to indigenous medicine lasted throughout the colonial period (officially the first two centuries). Further on, it was considered as quackery, before being converted into traditional Mexican medicine in the last third of the 20th century.

On the medicinal plants used in New Spain, it is important to analyze, even briefly, the *Libellus* of Martin de la Cruz. Written in Tlatelolco between February and July 1552, it is of primary importance for the study of pre-Hispanic indigenous medicine, being at the same time the indisputable first example of blend of traditions that has been characteristic of Mexican medicine since the 16th century²¹. Without doubting the efficacy of indigenous medical knowledge and without investigating the differences between such knowledge and the Hippocratico-Galenic medicine, de la Cruz established a method for the incorporation of drugs into his compilation consisting in considering only efficacy and availability. When introducing medicinal products of European origin, he did not doubt the opinion of Pliny and the other authors-ancient and modern-whose works he found in the library of Santa Cruz de Tlatelolco and knew through the oral translation and commentaries made by friars. Incorporation of any medicine from Europe or even Asia was conditioned by the possibility of finding equivalents or substitutes in the Mexican flora, unless the plants had been introduced into, and acclimated in, New Spain. Among the examples of this process of acclimation we can mention the activity of Don Francisco de Mendoza, the son of the first viceroy of New Spain. In his properties near Cuernavaca, he successfully cultivated the root of China, which was a variety of sarsaparilla, and some species among which ginger. These plants were successfully exported to Spain later. Another case is that of Bernardino del Castillo. In his orchard in Cuernavaca, he managed to acclimatize many European plants, which he commercialized and distributed in

the territories bordering Mexico City, including his highly recommended rhubarb (*Rheum compactus*).

There was a double interest in taking advantage of Aboriginal medicines: finding equivalents of plants known in Europe and exporting some of them to the Old World, and acclimating in New Spain useful plants, many of them medicinal, of European origin. Also another option, acclimating plants from Asia, was also successfully personified by Don Francisco de Mendoza with the introduction of the China root (*Smilax pseudochina*), a then interpreted as a variety of sarsaparilla, was more complicated, but offered at the same time the prospect of greater profits by converting the vast territory of New Spain into a producer and exporter of oriental spices and medicines. Such an exporter of medicinal plants from New Spain to Seville was Nicolas Monardes, most likely related to the Mendoza family in the transatlantic trade. He formed a large company that sent to Spain several products among which the root of Michoacan (*Convolvulus Mechacana*), sarsaparilla (*Smilax sp.*), liquidambar (*Liquidambar styraciflua L.*) and balms (*Myroxylon, sp.*), earning significant amounts of money. He also provided accurate information on American medicinal plants to European scientific circles-and we say American and not only Mexican, since the second and third parts of his work refer to species from Peru, Ecuador, the coast near Cartagena, and the Darien areas near the port of *Nombre de Dios* as the of his complete work clearly indicates: *Historia Medicinal de las cosas que se traen de nuestras Indias Occidentales que sirven en medicina* (Medicinal History of the things brought from our West Indies that are useful in medicine). After a first partial edition in 1565, Monardes' work went through twenty editions in the major European languages by the end of the 16th century²². Contradictorily enough, his book and letters validated the use of Mexican medicinal plants not only in Europe, but in Mexico by endorsing them and conferring them the authority of a famous author.. For example, when Alonso Lopez de Hinojosos

(1535- 1597) in his *Summa y recopilación de Chirurgia* (Sum and recopilation of Surgery) published in 1578, wished to stress the importance and usefulness of a Mexican medicinal plant, the *tecamahaca* (*Elaphrium tecomaca*), he immediately quoted Monardes²³.

Before Monardes, Gonzalo Fernandez de Oviedo (1478 – 1557) published in Spain a wealth of data about American natural history. A substantial part of his commentary was about the properties of plants, animals and minerals used medicinally. However, as far as Mexican species and varieties are concerned, he mentioned them by hearsay, since there was little trade of new-Hispanic plants from Mexico to Santo Domingo-where Fernandez de Oviedo lived--when he wrote the definitive version of his work in 1535. And he never visited what is now Mexico. It is worth to say, however, that his data are usually correct and that many of the species he described are common to the Antilles and Mexico²⁴.

Returning to Monardes, when he published the first version of his book in 1565, he had been working as a physician in Seville for 30 years and had gained extensive clinical experience of the plants and formulas he recommended. Also, he had already been involved for more than 10 years in the trade and diffusion of Mexican medicinal plants in Europe. Among the main plants and derivatives he mentioned, we must single out the resins, as copal (*Bursera sp*) and *tacamahaca* (*Elaphrium tecomaca*); the fig tree oil, *higuerilla del infierno* (*Datura sp*), often confused with the other *higuerilla* (*Jatropha*), and liquid amber (*Liquidambar styraciflua*); purgatives as the root of Michoacan (*Convolvulus mechoacana*); tobacco (*Nicotiana tabacum L*); medicaments used against syphilis: *guaiacac* (*Guaiacum sanctum*, *G. coulteri* A.Gray), the China Root (*Smilax pseudochina*), and sarsaparilla (*Smilax sp*); *Carlo santo* (*Cirsium Mexicanum* DC), useful against rheumatic fluids from the head and against amenorrhea; the West Indian rhubarb, recommended to purge cholera and phlegm, and as hepatoprotector, Dragon's

Blood (*Calamus Draco*, *Croton Draco* Schltldl, and *Pterocarpus sp*), with styptic properties²⁵.

The most significant contribution to the study of natural history in New Spain and its medicinal flora came from Francisco Hernandez (ca. 1514 to 1517 – 1587) between 1570 and 1576. Hernández travelled intensely not only in central Mexico, but also in territories on the northeast coast of the Gulf of Mexico, in the zone known as Huasteca, in Zacatecas, Oaxaca. Searching for--and identifying--medicinal plants, he clinically researched their therapeutic properties, translating the indigenous explanations and classifications into humoral medicine terms. His work was only published in 1651. It was not the full version, however, but a summary made by Nardo Antonio Recchi (1540 - 11595), an Italian physician working at the Spanish court. The integral text was not published until 1790, when the scientists of the Madrid Royal Botanic Garden localized the original manuscripts in the Jesuit College of Madrid²⁶. Hernandez recorded and described circa 3.000 plants, including fine botanical details, and reported their medicinal effects, toxic actions and, when appropriate, their nutritional value. After his return to Sevilla, he left some plants further cultivated at the Alcazar, including the balsam tree (*Miroxylon pereirae*), *yolloxóchitl* (*Talauma Mexicana* DC. Don) and *pinipiniches* (*Euphorbia centeloides*), which grew there for years²⁷.

The book *Cuatro libros de la naturaleza de las plantas* by fray Francisco Ximénez (ca. 1560 – 1620) was particularly important, because it represented the link between the magnificent work of Francisco Hernandez and the medical practice in New Spain. Ximénez knew the summary of Hernandez' vast compilation made at the Spanish Court by Recchi, and probably had access to some of the manuscripts that Hernandez left in Mexico, precisely at the Oaxtepec Hospital, where the *Protomedico* carried out a considerable part of his work and Ximénez lived and compiled his book.

All the medical treatises written and published in Mexico in the late 16th century and early 17th century provide us with many examples of Mexican medicinal plants extensively recommended by physicians. Later on, toward the end of the 17th century, Agustín de Vetancourt (1620 -1700) reported in his *Theatro mexicano* the quotidian activity of indigenous healers and the presence of medicinal plants and herbal preparations at the markets. He also mentioned that the main authority on the therapeutic properties of these plants was Hernandez' legacy²⁸.

In the second half of 18th century interest in the study of nature and medicinal plants increased. Martín Sessé (1751 – 1808) and José Mariano Mociño 1757 – 1820) launched the most important expedition for their study. Starting in Mexico City in 1785 and returning in 1803, they explored all the territories of New Spain and Guatemala, identifying, drawing, and collecting plants. Unfortunately, their results were not published because of internal problems in Spain and the Napoleonic invasion. Sessé died in 1808 and Mociño in 1820 without achieving the publication of their results and gravures. Only at the end of the 19th century did the *Instituto Médico Nacional* of Mexico publish beautiful volume and, in 2015, the National University of Mexico (UNAM) finally could publish a complete edition, in 13 volumes, of the illustrations of plants and animals collected during the expedition²⁹.

Fray Juan Navarro (? End of 18th century) authored the very interesting *Historia Natural o Jardín Americano*. A royal decree instructed the priests and religious communities to study Nature in their surroundings. Navarro compiled all accessible information from the Querétaro Santa Cruz College, where friars curious of *natural things* collected medicinal plants and related data during the whole century. Juan Navarro added both literary evidence and data that he collected by personally observing the plants in the fields and the mountains around Querétaro. His book, preserved only in manuscript form, is a vast collection of drawings of almost 500 plants that remind the

illustration of Dioscorides's Renaissance editions. The text on the facing pages details the medicinal properties of the plants, with the instructions for their prescriptions and preparations³⁰.

The 19th and early 20th century

In Mexico, the last decades of the 19th century and the first of the 20th sharply contrasted with the previous years of wars, invasions, and internal infighting. They were characterized by a great stability and an apparent bonanza, although exploitation and continued impoverishment gradually pushed most of the population to the limits of despair. In 1910, this disastrous situation culminated in an armed movement. The discourse of modernity, expressed in terms of positivism in education and science, was fully reflected in the image of health achievable through hygiene and public health, and took as a symbol the express wish of the President of the Republic in this period, General Porfirio Díaz (1830 – 1915), who stressed the importance of studies aimed at “the formation of the General Hospital and mental hospitals”³¹ in his report to the Congress of April 1, 1890. A few months later, on September 16, he repeated that improvement was urgently required for “the progress of science and the state of culture in the capital of the Republic”. In this view, a general and a mental hospital became symbols of improvement, progress, and culture as signs of modernity. Health and healthcare were taken as clear indicators of the country's entry into the concert of civilized nations³².

This was a double-sided coin: modernity contrasted with tradition. In Mexico, tradition meant the active presence of native cultures who were threatened with disappearance for the sake of the long awaited modernity and technological progress identified as the way to a better quality of life. The racism that despised Indians was transformed into a benevolent acceptance of the educated Indian. The undeniable pre-Hispanic indigenous background was an important pillar

of a somewhat nebulous identity, the defense of which became a sign of nationalism. The recovery of past history emerged within the frame of positivist thought through the *Historia Antigua de México* (Ancient History of Mexico) by Manuel Orozco y Berra (1816 – 1881)³³, and also in the first volume of the monumental *Historia de la Medicina en México* (History of Medicine in Mexico) by Francisco Flores (1862 – 1931), published in 1888³⁴. The work recovered a remarkable number of curative resources known by old Mexicans in order to emphasize the amount of knowledge they represented, their superiority, or at least their equal efficacy compared to contemporary European medical knowledge, in addition to prefiguring certain aspects of scientific knowledge. They were, therefore, both, tradition and modernity, the two central factors that marked Mexico's struggle at the end of the century to find its own defining expression.

It is interesting to consider some of their most notable features, derived precisely from the dyad that characterized and defined Mexican medicine and is an identity marker, with a derivation from ancestral tradition and, at the same time, an aspiration to be part of the most modern science.

Therapeutics was a terrain where early signs of a nationalist tendency appeared. There was a tradition, several times affirmed and denied during the colonial period, which recognized the existence and effectiveness of a sizable number of Mexican drugs. It is no surprise that *guaco* (*Aristolochia* sp., more probably *A. asclepiadifolia* Brandg.) was among the treatments proposed against intermittent fevers and was chemically analyzed as early as 1836³⁵. Sarsaparilla (*Smilax asperata*), then in the form of an essence³⁶, also made the balm of copaiba³⁷, until becoming the *pipitzahuico* acid extracted in the middle 1950s from *pipitzahoac* (*Pererzia adnata*, actually *P. hebeclada* (DC.) A. Gray), an authentically Mexican plant³⁸.

There is always an ambiguous attitude towards traditional healers, bonesetters, midwives and traditional herbalists, who are tolerated

and are ubiquitous, though officially forbidden and considered as not knowing the efficacy of their treatments. However, during the last twenty years, therapeutic nationalism developed and was systematized, together with the development of pharmacology and the first and fruitful attempts to institutionalize medical research.

The Instituto Médico Nacional (National Medical Institute)

A National Medical Institute was founded in Mexico in 1888. Its objective was the study “exact and complete of our flora and its applications to the therapeutics”³⁹. This short statement contained an ambitious program that would have consequences of paramount importance for Mexican medicine and science. The Institute was not created on a whim. It had important antecedents resulting from a determined ideology, and took as models research institutions that had begun to flourish in the Old World by that time. It is not a coincidence that the first building of the Pasteur Institute was inaugurated that same year or that the Imperial Institute of Berlin. The National Medical Institute of Mexico was directly supported by funds coming from the Secretariat of Development, headed by the enthusiastic promoter of the project of a renovated Mexico that General Carlos Pacheco was. Such funds were the most generous possible within the already chronic poverty in which the State was developing.

The first task was the elaboration of a medical geography of the country. A questionnaire reproducing those used in geography was made, and it was distributed to compile a repertoire of the national flora and fauna, which was completed in July 1888⁴⁰. This was the first major enterprise in this field, which was followed, many years later, in 1990 by the publication of a new atlas by a team headed by Jaime Sepúlveda (1954 -)⁴¹. Collected information provided the basis for the work of the institute that was beginning to take shape along the lines defined by General Pacheco and the group of scientists working with him.

Mexican Medicinal Plants

The Institute was organized during the last months of 1888 under the direction of Fernando Altamirano (1848 – 1907). It was originally made of four commissions defined as follows: “one will oversee investigating what each plant is according to the science of Linnaeus, another will do chemical analysis, another will say at the end of laborious experiences what are the toxic and biological effects [of the plants], and another, finally, will reveal to the scientific world the existence of new agents to combat the miseries and pains of humanity”. Based on these objectives, the first commission was responsible for the identification of plants, the constitution of a herbarium and a museum of drugs, and the drawing of watercolors of the plants, in addition to botanical and pharmacological descriptions; the second commission would pursue with analytical work, but it would also extract and prepare active ingredients to be delivered to the third and fourth commissions that would make laboratory and clinical experimentation, respectively. A fifth commission was soon added, which would deal with medical and statistical geography⁴².

The raw material soon began to flow to the new Institute, so that samples of 800 different plants were available by June 1889 to be exhibited at Paris fair. The evident intention was to convert the traditional ancestral knowledge of Mexican medicinal plants into positivist science.

The background of botany

Botanists and physicians have often shared objectives and many physicians have completed important botanical work. When the National Medical Institute was founded, its field was by no means virgin territory, since recognition of the useful and medicinal plants in different regions of Mexico had been on the agenda of scientists in the years immediately preceding the creation of the Institute. Mexican dyeing substances were important at that time, with an emphasis on the historical tradition dating back to pre-conquest times, which was

well documented from the 16th century onwards. There also was an interest in avoiding dependence on foreign providers of medicines or foreign arbitrariness. On the other hand, it should not be forgotten that, even when the concept of active principles and the techniques for the extraction of alkaloids and chemical preparations were already widespread, synthetic drugs did not exist⁴³. There already was a fair amount of PhD theses in both Pharmacy and Medicine on the techniques for preparing extracts, the pharmacodynamic action of cocoa, extracted from *Theobroma cacao* L.⁴⁴, and the physiological activity of foxglove (*Digitalis purpurea* L)⁴⁵, or the active principles extracted from plants such as papain from papaya (*Carica papaya*)⁴⁶. Two scientists who had a special interest in studying aboriginal flora need particular recognition: Manuel Urbina (1844 – 1906) and Manuel Villada (1841 – 1924). Urbina is known for a catalogue of Mexican plants published in 1887 by the National Museum, in which he offered a complete repertoire of the flora with nearly 500 pages of careful description⁴⁷. Later he was interested in studying the taxonomic relationship between the plants recognized by Francisco Hernandez in the 16th century and the relevance of their classification, analyzing in this sense *copal* (*Protium copal* (Schlkd. & Cham) Engl)⁴⁸, *peyote* (*Lophophora williamsii*) and *ololiuhqui* (*Turbina corymbosa* (L) Raf)⁴⁹, *amates* (*Annona squamosa*)⁵⁰, *zapote* (*Manikara Zapote* (L) van Royen)⁵¹ and pumpkin (*Cucurbita pepo* L)⁵². From 1904, he collaborated with the National Medical Institute and published in its *Annals* studies on the identification of several plants⁵³. At the same time, he worked on the edible plants and roots of the ancient Mexicans, and published his research in the *Annals* of the National Museum⁵⁴. Villada began earlier; already in 1865, he published a book on the flora of the Pachuca and Real del Monte area, in the State of Hidalgo⁵⁵. Further on, he focused on the properties and production sites of different plants⁵⁶. Between 1887 and 1914 he went on, publishing a series of articles, most of them

in the official journal of the National Academy of Medicine, *Gaceta Médica de México*, with which he gradually compiled a repertoire of indigenous plants ordered by botanical families with the *compositae*⁵⁷, the *euphorbiaceae*⁵⁸, the *papaveraceae*⁵⁹, the *leguminosae*⁶⁰, the ferns⁶¹, the *labiadae*⁶², and the *Solanaceae*⁶³. As early as 1914, he concluded this work with a catalog of indigenous poisonous plants⁶⁴.

The rescue and reissue of the classics of Mexican medical botany

One of the first objectives of Fernando Altamirano, Jose Ramirez (1852 – 1904), Jose Ramos (1859 – 1909) and the group of scientists who formed the *Instituto Médico Nacional (National Medical Institute)*, was to publicize and disseminate the most important works on *Materia Medica* wrote in Mexico. The two parallel editions of Fray Francisco Ximenez's *Four Books of Nature and Virtues of Plants and Animals*, both published in 1888, opened the list. The edition curated by Antonio Penafiel (1831 – 1922) was first published by the Printing Office of the Ministry of Public Works and, further on, in close connection with the Institute⁶⁵. The other, edited by the indefatigable researcher and bibliographer Nicolas Leon, was printed in Morelia⁶⁶. They were followed by two publications in 1889: Antonio de la Cal and Bracho (*Ensayo de la Materia Médica Mexicana (Essay for Mexican Materia Medica)*), coming from this renowned apothecary established in Puebla from 1795, book that was published for the first time in 1832⁶⁷, and Vicente Cervantes' (1755 – 1829) *Ensayo de la Materia Médica Vegetal de México (Essay on the Vegetal Materia Medica of Mexico)*⁶⁸. Then came the works of Martin Sessé (1751 – 1808) and Mariano Mocino (1757 – 1820) on Mexican flora, resulting from the Royal expedition carried out by order of Carlos III⁶⁹. The index of the plants described in the works of fray Francisco Ximénez and Francisco Hernández (1517 – 1587) were published in 1900 and 1901, respectively⁷⁰.

The historical contribution made by the Ministry of Public Works with all these publication was invaluable and witnessed to the de-

velopment of a conscience in search for its origins with all required scientific seriousness. When, however, all this material is contextualized in the creation of a medical research institute, the interest in the history of medicinal plants and the reproduction of historical milestones in the field appear as a prelude to new research and take a new dimension: they were positivist data claimed as essential by 19th-century science. In so doing, the *Instituto Médico Nacional* assumed a double historical function: on the one, hand, being a repository of, and a witness to, a rich tradition, and, on the other hand, developing the new, modern Mexican medical science that provided the basis for spectacular transformations in therapeutics. Innovation took the form of experimental physiology, of which pharmacology was an integral part.

A point that should not be neglected is the compilation and publication of bibliographies, a task that was also made by the Institute on its own, leading to the publication of the *Mexican scientific bibliography* of Manuel Olaguíbel (1845 – 1900) in 1889⁷¹, and of the *Biblioteca Botánica Mexicana (Mexican Botanical Library)* of Nicolás León (1859 – 1929) in 1895⁷², which was published as a supplement of the *Mexican Materia Medica*. The *Bibliotheca* is of particular interest, because León showed his well-known erudition and provided the reader, who is identified as a future researcher, with a vast repertoire of data on both the Mexican works on the topic and their authors.

The Materia Medica

Mexican scientists at the turn of the century devoted a certain part of their efforts to recovering materials from both popular and scientific traditions in their different historical stages, and compiling a repertoire which would result in a Mexican *Materia Medica* compendium no longer necessarily indigenous or exotic, but corresponding to the new national reality. This transformation resulted in incorporating all the traditions self-proclaimed as Mexican that were merged.

Results were not long to come. The small catalog that the *National Medical Institute* presented in Coyoacán exhibition in 1895 formalized this program as did also the samples of plants taken to Paris earlier (1889) and to some other scientific conferences in the United States over the next decade⁷³.

There was no shortage of information and a clear desire to share samples and exhaustive data collection. One example of this was the alphabetical *Repertory of indigenous drugs and their common applications* published in three volumes in 1891, with first two presenting pharmacological data and the third the therapeutic applications of 93 drugs of vegetal origin⁷⁴. Another such example was the *Datos para la Zoología Médica Mexicana (Data for the Mexican Medical Zoology)* of the biologist Jesus Sanchez (1842 – 1911) published in 1893⁷⁵. The most important activity consisted in compiling the *Datos para la materia medica mexicana*, the five volumes of which were published between 1894 and 1908⁷⁶. In about 1.200 pages, the *Datos* offered the botanical, chemical, pharmacological and therapeutic information of the plants studied at the *Institute*, with a multidisciplinary character that constituted one of its main innovations and attractions. By 1894, the botanist Jose Ramirez (1852 – 1904), working with Fernando Altamirano (1848 – 1907), drew up a first list of plants, 50 in total, and established the following method for their study: first of all the identification and botanical description, followed by chemical studies and the preparation of extracts and active galenic forms; then, came the physiological analysis, which covered the general toxicology and the specific pharmacological properties of the plants; the conclusion offered the data resulting from their experimental therapeutic use⁷⁷. It is not surprising that, in these conditions, the Ministry of Public Works sponsored in 1896 the publication of a new *Mexican Pharmacopoeia* that, emanating from the *Mexican Pharmaceutical Society*, became the official vehicle for the communication of the large amount of data generated in the laboratories of the *Instituto Médico Nacional*.

Meanwhile, the director of the Institute, Fernando Altamirano, used the forum offered by the International Congress of Americanists of 1895 to present a synthesis in which brought together the historical past with the plan of the work in progress when discussing the *Natural applied history of the ancient Mexicans*⁷⁸.

The research activity linked with this repertoire culminated with Juan Manuel Noriega's (1869 – 1958) *Curso de Historia de la Drogas* (*Course of History of the Drugs*), an immense volume of 834 pages published in 1902, which gathers all the information collected and generated in the previous 15 years⁷⁹. Altamirano prepared the publication of English and French summaries of the *Mexican Materia Medica* to give an international diffusion to the scientific activity represented by these works⁸⁰.

From Materia Medica to Pharmacology

Without underestimating the efforts required to compile the repertoires and study the Mexican *Materia Medica*, this was only a part of the program that led to the creation of the *Instituto Médico Nacional* and the definition of its research agenda. The inauguration of the Instituto in the same year as Pasteur's Institute in Paris was a significative coincidence. The visits of Jose Ramirez (1852 – 1904), first, and Eduardo Liceaga (1839 – 1920) a few months later to the famous French scientist opened a fruitful professional relationship between the researchers of both countries, and allowed to clarify many ideas that had remained nebulous in the minds of Mexican researchers about what a laboratory is and should be. The purchase of material and equipment abroad, and the absence of real experimentation slowed down the starting of research. However, these deficiencies were soon rectified, and efficient facilities were in place by 1890 with the units indispensable to start research, including a section of chemistry made of two laboratories with a further one planed, and a section of physiology and pharmacology.

The design of the experiments to be made in the laboratory was quite simple, but not without interest. Once a plant was identified, the Analytical Chemistry section proceeded to identify its active principles and to define what type of preparation offered the highest expectations. On this basis a sufficient quantity of the product was prepared for the physiological study to begin, which is the main focus in the present essay, since pharmacology lived for many years in the shade of physiology and constituted a good part of experimental physiology. It is enough to recall Claude Bernard's physiological model when he studied curare and its action.

At the beginning, attention focused on 20 plants, among which some with a febrifugal actions, such as the *Michoacan quina* or *bitter husk* (*Coutarea latiflora*)⁸¹, along with others of recognized antispasmodic action, such as *chicalote* (*Argemone Mexicana Willd*)⁸², or well-detected antiarrhythmic drugs, such as the *Spartium Junceum* L, better known as the "broom of the country", from which an active ingredient called *esparteïn* had been extracted⁸³. The antiarrhythmic action of the drug was soon verified on dogs. The importance of accurate botanical identification of the plants must be stressed, as the same popular names were sometimes applied to different botanical species because of some similar appearance. For example, "broom of the country", *Spartium*, is not to be confused with the actual broom (*Tecoma Stans* (L)) H.B.K.), the pharmacological properties of which are totally different (it is a hyperglycemiant). Within these first group, *sinicuiche* (*Heimia salicifolia* (H.B.K.) Link) must be mentioned. A quite common plant in the State of Michoacan, it has been credited with the verified ability to provoke auditory hallucinations⁸⁴.

Different plants were studied with different approaches, something that was problematic for the scientists at work. Nevertheless, monographic studies of very satisfactory quality started to be published with regular periodicity in *El Estudio* and *Anales del Instituto*

Médico Nacional, both published by the *Institute* between 1889 and 1893, and from 1894 on, respectively. Step by step a method applicable to all the tested plants was developed allowing not only for a better integration of the research activity in the different units of the Institute, but also for maintaining a simultaneous advance of trials in the teams of chemistry, physiology and therapeutic.

From 1890 on, the *Instituto* was involved in the study of other old acquaintances, as *yoloxochitl* (*Talauma Mexicana* (DC) Don), a magnoliacea reputed from pre-Hispanic times for having cardiotoxic actions⁸⁵, *estafiate* (*Artemisia Mexicana* Willd), compared from the beginning of the Colonial period to European wormwood⁸⁶, or the active principle of avocado seed (*Persea Americana* Mill) called *perseita*⁸⁷. From the following year on, however, two plants reputed for their hepatotoxic effects began to be tested: *Bocconia frutescens* L, the *gordolobo*, and *itzcuinpahtli*, known as *Puebla herb* and also as *false gordolobo* (*Senecio canicida*). Research started by injecting subtractive, intravenous, and intraperitoneal extracts into different small animals, such as mice or pigeons, trying to establish a connection between the time elapsed between injection by different pathways and the appearance and nature of toxic manifestations. The appearance of paralysis and death in the case of *Bocconia* allowed to speak of a group of plants the toxicity of which was mainly exerted on the central nervous system, and to proceed with a second series of experiments, in which the plants were compared to morphine in different preparations, and to cocaine hydrochloride⁸⁸. On the basis of *senecio* their high hepatotoxicity was soon established⁸⁹.

The intravenous injection of massive doses of the different preparations made it possible to establish the principle of toxicity as the capacity of the preparation to kill the animal of experimentation, and, conversely, also the threshold where there would be no risks in the subsequent phase of the investigation. The tolerance to high doses injected in this way to overly sensitive animals resulted in high safety rates.

The distinction between therapeutic properties and pharmacodynamic characteristics is a nuance that was worked on with greater attention from 1892 on, when scientists understood that what was expressed in popular or even medical terms by the patients to whom a treatment was applied, and what did actually happen to them, did not indicate accurate knowledge of the physiological properties and action of drugs within the organism. The former was a clinical appreciation and the latter a product of experimental work and its discussion. It thus appeared that attention should concentrate on the actual action of drugs in the organism. Plants the effects and benefits of which were immediately tested, such as the *Michoacan quina* (*Coutarea Latiflora* Moc & Sessé), continued to be brought to the laboratory for more than 10 years, to perfectly discriminate it with all pharmacodynamic minutiae. In 1903, Manuel Toussaint, assisted by Daniel Vergara Lope (1865 – 1938), finely analyzed its mode of action in the frog. It is not surprising then that the new collection of monographs published in 1897 presented new and more complete data on plants known from a long time like *ahuehuete* (*Taxodium mucronatum*), *sinicuichi* (*Heimia saloicifolia* (H.B.K.) Link), *cihuapahtli* (*montanoa tomentosa* Cerv), the latter being studied from the very beginning because of its reputation as an abortive⁹⁰. Belladonna (*Atropa belladonna*) was also particularly researched as it abundantly grew in Mexico even though it is native to the Mediterranean. It could be obtained in great quantity and duly studied, including on the basis of the multiple studies carried out throughout the world at that time⁹¹. A newcomer in the years 1892-1893 was the *white zapote* (*Casimiroa edulis* La Llave & Lex), reputed to have hypnotic properties. Its study generated a series of interesting controversies that are not yet over. Once proved that the oil of its little seeds caused death in a combination of neurogenic and hypovolemic shock, the doses were titrated and it was established that even women suffering from advanced stages of gynecological cancers could sleep again after having been

administered an infusion. Hypnogenic actions at the central level have been corroborated, but severe hypotensive activity has also been found, probably also at the central level. Eduardo Arnedáriz (1853 – 1916), one of the principal scientists analyzing this plant, worked between 1894 and 1897 with aqueous, alcoholic, and hydro-alcoholic extracts applied through different routes. On the basis of an experimental model in frog she identified a glucoside⁹². The study of stereo-sulfuric extracts, as was the case with the *drunken strawberry tree* (*Arbutus* ?), allowed to enrich observations and to broaden the field of incidence of the studies. Curiosity did not cease and Mexican plants were compared to their equivalents from other sites, with various species and varieties. Meanwhile, high neurotoxicity was better identified. Studies on *Llorasangre* (*B oconia arborea* S. Watson) went from the isolation of its alkaloids to the discovery that bocoína, soluble in alcohol, produced acceptable analgesia even though it also generated an irritation depending on the amounts of free acid it produced⁹³. Also, new studies were carried out on *senecio* to determine its action on body temperature, in addition to comparing results between aqueous extracts and other liquid preparations. In June 1894 talks were going on about some plants: *piru* (*Schinus Molli*), strawberry tree, *madroño*, (*Arbutus sp*), *colorin* (*Erythrina Americana* Mill)⁹⁴, *sangre de drago* (*Jatropha dioica* Sessé ex Cerv)⁹⁵ and *sage* (*Buddleia perfoliate* H.B.K.)⁹⁶, reported to have no toxic effect on any of the “major internal organs”. This allowed for studies on living animals and even clinical trials on humans, at the San Andres Hospital pavilions and, after 1905, at the newly founded General Hospital of Mexico.

Materia medica gradually went from general experimental physiology to pharmacodynamics. The attempts of the *Istituto Médico Nacional*, conceived within a mix of nationalism and progress in terms of experimental positivist science, were fruitful. Scientific articles of quality proliferated. Fernando Altamirano (1848 – 1907)

was author of about 200 publications, J Martínez del Campo 568, Villaseñor 275, Luis E. Ruiz (1853 – 1914) 100, Domingo Orvañanos (1844 – 1919) 40, Eduardo Armendáriz (1853 -1916) just over 350⁹⁷. Although bibliometrics does not necessarily mean scientific development, it provides a general idea. The production of the Institute was fundamental for the development and continuity of Mexican science. Its closure by the government of Venustiano Carranza (1859 -1920) in September 1915 was a severe blow and delayed further developments for 20 years. The relationship between the Institute's researchers and the teaching faculty at the *Escuela Nacional de Medicina* and the schools that began to proliferate in the country, was equally key, as was also the relation with institutions that integrated studied drugs into treatment. The abundant production of first-hand scientific material is a feat of the groups of Mexican scientists who, in the last decade of the 19th century and the first of the 20th, knew how to bring Mexican pharmacology to the level they would dream, as an experimental science of top quality without altering its identity as fundamentally national.

Medicinal plants in 20th-century Mexican medicine

After the *Instituto Médico Nacional* closure in 1915, research on medicinal plants was reduced to a minimum. The Institute's collections of plants were stored until they provided the foundations for a herbal at the Institute of Biology of the National University 50 years later. During this time, interest in these plants shifted from medicine and pharmacology to botany.

Research on the isolation of active principles of plants did not start another time until 1952, when a new Department of Pharmacology was created as an independent unit in the laboratories of Physiology of the National University Faculty of Medicine. Medicinal plants were not considered as medicaments by themselves, but only as a source for chemically isolated substances. In this view, traditional

medical knowledge, seen as only remains of ancient times, was considered as essentially wrong. In the meantime, however Mexican Medicine became aware of its historical antecedents from the 1920s onwards. Available data on indigenous prehispanic treatments began to be collected, and some of them were submitted to experimental analysis. It is not casual that two of the most important figures involved in the historical study of Mexican Medicine, Fernando Ocaranza (1876 – 1975)⁹⁸ and Ignacio Chávez (1897 – 1979)⁹⁹, were a physiologist and a clinician, respectively. Furthermore, both had a keen interest in researching active principles in Mexican plants. Two relevant examples were the identification of tonicardiac effects in extracts of *Yolloxóchitl* (*Talauma Mexicana* (DC) Don)) and of an alcaloid (eriacomina) isolated as the oxitocic active principle of *Cihuapahtli*, also known as *Zoapatle* (*Montanoa tomentosa* Cerv)¹⁰⁰. Interestingly enough, these pharmacological activities were already described in 16th-century indigenous medical texts.

In the 1930s anthropological studies significantly developed. They showed that, in all the indigenous cultures all over the country and among a vast majority of contemporary rural people, popular medicine was not only a domestic, practical kind of medicine, but also a theoretical system on illnesses and therapeutic resources. Its practitioners shared a common heritage, coming from the Prehispanic times. This was particularly evident through the analysis of groups that appeared to be unrelated and were characterized by a great diversity of idioms and dialects¹⁰¹. Though first recorded and described as an ethnographic curiosity, traditional medicine soon attracted medical attention. A conceptual revolution happened when, Alfonso Villa Rojas (1897 – 1998) from an anthropological viewpoint, and Gonzalo Aguirre Beltrán (1908 – 1996), from a medical and anthropological transdisciplinary one, proposed and developed intercultural experiences. A new institute, the *Instituto Nacional Indigenista*, founded in 1948, established its own system for medical care, with

the intention to provide indigenous populations with “modern western scientific medicine”. The cultural resistance of populations, together with the geographical isolation and poor state of medical facilities resulted in increasing the coexistence and exchanges between the two medical systems instead of introducing western medicine as the unique health attention possibility.

Another crucial factor toward the integration of Prehispanic and Western medicine in Mexico was the unexpected discovery that *barbasco* (*Dioscorea composite* Schltdl) is a source of every kind of steroids related with the then recently discovered cortisone. Many of these steroids were identified by a group working in Mexico and led by Russell E. Marker (1902 – 1995), George Rosenkranz (1916 -) and Luis Miramontes (1925 - 2004). This achievement drew the attention to traditional medicinal plants as a source for modern “scientifically developed” medicaments.

In the mid 1970s the importance of Primary Health Attention, the politics of the World Health Organization to extend medical services all over the world, and increased attention to medical service based in hospitals, offered an opportunity to work on traditional medicines and have traditional practitioners as primary health care providers, according to the Chinese model. As a result, sanitary authorities needed to modify their attitude toward traditional medicine. Over the past 150 years, Mexican government instances were mainly interested in introducing modern western medicine all over the country in order to replace the medical practices coming from indigenous traditions and popular knowledge based on Hippocratic western tradition introduced by the Spaniards. Midwives were recognized on the basis of local prestige and sustained work through many years, and most frequently also as descendents of several generations sometimes going back to 16th century if not earlier. Traditional healers were considered as owners of a real knowledge derived from an unofficial medical tradition. Study of Prehispanic indigenous medicine became

important to penetrate a complex system sustained by a specific worldview, and to have a repertory of medicaments, mainly plants and their derivatives. Recognition of traditional medical knowledge and awareness that traditional healers manage in fact the primary health care of a considerable percentage of the population, became official only in 1991 thanks to the efforts of the collaborators of the *Instituto Nacional Indigenista* (National Indigenist Institute).

The following step was to start research on traditionally used medicinal plants, first with the preparations used by traditional healers and further on through pharmacological analysis aimed at isolating active principles. Compilation of a catalogue of the vegetal medicinal resources recognized by traditional healers of different ethnic rural *mestizo* groups was a prerequisite, to be followed by scientific validation—in Western terms—of this therapeutic arsenal.

Building on the studies at the National University and the *Instituto Politécnico Nacional*, the *Instituto Mexicano para el Estudio de las Plantas Medicinales (IMEPLAM)*, a Mexican Institute for the Study of Medicinal Plants (IMEPLAM) was created. With Xavier Lozoya Legorreta (1945 -) as its first director, this Institute started its activities in 1975 with an interdisciplinary structure, bringing together humanistic disciplines as history and anthropology and basic sciences as botany, pharmacology, and biochemistry. Its first publication was the *Estado actual del conocimiento de las plantas medicinales mexicanas*¹⁰², which offered a panoramic view of the field. It contains interesting considerations about how to bring the new possibilities of health policy development to the study of medicinal plants and to the analysis of their effects. It also offers also significant insights on such historical problems as the significance of medicinal herbalism in Prehispanic and colonial times, Ethnobotany and scientific expeditions, phytochemistry, toxicity and preclinical research. Then, José Luis Díaz (1943 -) coordinated two very important works published in 1976 and 1977, respectively: *Índice*

y sinonimia de las plantas medicinales de México¹⁰³ and *Usos de las plantas medicinales de México*¹⁰⁴. Both were the first systematic effort to offer a comprehensive idea of the universe of Mexican medicinal plants after Maximino Martínez' *Plantas Medicinales Mexicanas*¹⁰⁵. The second work above included an appendix containing *Términos médicos asociados con las plantas mexicanas*¹⁰⁶, aimed to reduce, if not eliminate, mistakes and ambiguities in plant terminology. After a short independent life, IMEPLAM was integrated into the recently created *Centro de Estudios Económicos y Sociales del Tercer Mundo*, also destined to have a short life, as it was integrated in 1981 into the *Instituto Mexicano del Seguro Social*, (IMSS), (National Social Security Institute). A research facility was built for the Institute at Xochitepec, Morelos, and a herbarium of medicinal plants, which is now a reference, was created aside the Botanical Garden of Universidad Nacional Autónoma de Mexico (UNAM), in Mexico City. Xavier Lozoya (1945 -) and Mariana Meckes - Fischer (1946 -) compiled a *Flora medicinal de México*¹⁰⁷, and Abigaíl Aguilar Contreras (1948-) directed the compilation of the *Herbario Medicinal del Instituto Mexicano del Seguro Social* published in 1994¹⁰⁸. Information about medicinal plants was also collected and published in the 1980s in some of Mexican states, like Veracruz, México, Yucatán and Aguascalientes. *Xiuhpatli (Herba officinalis)* is a beautifully edited collection of monographic chapters on some Mexican medicinal plants that presents the results of the Lozoya experience and feelings after more than 20 years of work¹⁰⁹. At the same time, the UNAM Institute of Chemistry (IMSS) developed a refined research program on plant chemistry and possible medicinal uses. Two volumes collecting recent results were published in 1996 and 1999 under the title *Plantas medicinales de México*¹¹⁰. The same Institute established from the early 1980s a program denominated IMSS/ COPLAMAR, aimed to provide medical care to inhabitants of marginal zones. Such program included cultivation

of medicinal plants previously investigated scientifically and useful in common diseases and ailments in primary school areas. Also it attempted to develop local health systems integrated in a national scheme. The first results of ethnobotanical research were published by Xavier Lozoya (1945 -) and Javier Velázquez Moctezuma (1950 -), and provided an important source for the enrichment of the herbal. Research at the *Instituto Nacional Indigenista* in the late 1980s and early 1990s might be the most important work on Mexican medicinal plants carried out after Francisco Hernández (1517 – 1587), and Sessé (1751 -1808) and Mociño (1757 – 1820) explorations. The health and medical resources of all indigenous communities were intensively researched all over the country. Coordinated by Arturo Argueta and Carlos Zolla, the results were published in a series of encyclopedic volumes: *La medicina tradicional de los pueblos indígenas de México*¹¹¹, *Flora medicinal indígena de México*¹¹², *Atlas de las plantas de la medicina tradicional Mexicana*¹¹³, and a complete and actualized *Nueva Bibliografía de la medicina tradicional Mexicana*¹¹⁴. This significant program was conceived as a research basis to plan and modernize the health care of indigenous communities. It implemented a new approach to health care, made of intercultural hospitals where official and traditional medical services are offered in a complementary way. The first such hospital was created in Cuetzala, Puebla, followed by those in the area of Tepic, Nayarit, in Chiapas. The transformation of the *Instituto Nacional Indigenista* into a National Commission, had a negative impact on such hospitals, even though it generated some advantages.

We have mentioned the existence of Botanical Gardens of medicinal plants. The seat of the Department of History and Philosophy of Medicine within the Faculty of Medicine of the UNAM at the *Palacio de la Escuela de Medicina* has a very small such garden, whereas the the Botanical Garden of the UNAM as an excellent section of medicinal plants the collection of which is increased

by Edelmira Linares (1952 -) and Robert Bye (1947 -) thanks to their ethnobotanical explorations. Another garden, of larger dimension and well cared, is that of the *Instituto Politécnico Nacional* Homeopathy School, which hosts research on homeopathic uses of plants and also extensive studies on antitumoral treatments based on plants like those of José Weizel¹¹⁵. A little garden has been installed at the place of the Viceroy palace where there is now the National Palace, seat of the federal government. The most promising is that of the National Institute of Anthropology and History (INAH) in Acapatzingo, Morelos. Resulting from more than 30 years of work under the direction of Paul Hersch Martínez (1955 -), it has now a very rich collection of plants, both local and acclimated, and a museum on Mexican traditional medicine. The catalogue of the plants and the ethnobotanical studies made in the very communities where the plants are employed provide information serving as a useful basis for clinical applications. Phytotherapy has been recently included among the services offered by some official institutions as the Health Secretary of Mexico City.

Conclusion

Medicinal plants are a controversial matter in present-day health care, because they constitute a very interesting and economically accessible resource in primary health care and, consequently, are very attractive for introduction into practice. Also pharmacological research on medicinal plants has been insistently developed in Mexico in the last decades and generated a good number of active principles isolated from plants. The future is promising, but not without risks, the most important being public policy and international tensions. The richness of Mexican flora is a fact and, at the same time, a temptation.

BIBLIOGRAPHY AND NOTES

Bibliografía generale

- Abigaíl Aguilar A, Camacho JR, Chino S, Jácquez P, López ME, Herbario Medicinal del Instituto Mexicano del Seguro Social. México: IMSS; 1994.
- Altamirano F, *Materia Medica mexicana. A manual of mexican medical herbs* México. St. Louis: The Mexican National Comission; 1903.
- Altamirano F, *Abregée de matiére Médicale du Méxique*. México: Instituto Médico Nacional/ Imprenta Tipográfica de la Secretaría de Fomento; 1909.
- Argueta A (ed.), *Atlas de las plantas de la medicina tradicional Mexicana*. 3 vols. México: Instituto Nacional Indígenista; 1994.
- Benavides PA De, *Secretos de cirugía*. Ed. Facsimilar. México: Academia Nacional de Medicina; 1992.
- Cal Y Bracho A De La, *Ensayo para la Materia Médica Mexicana*. Puebla: Ofna del Hospital de San Pedro; 1832.
- Cal Y Bracho A De La, *Ensayo para la Materia Médica Mexicana*. México: Oficina Tipográfica de la Secretaría de Fomento; 1889.
- Cervantes V, *Ensayo a la Materia Médica Vegetal de México*. México: Oficina Tipográfica de la Secretaría de Fomento; 1889.
- Chávez I, *México en la cultura médica*. México: El Colegio Nacional; 1948.
- Cruz M De La, *Libellus de Medicinalibus Indorum Herbis*. México: Instituto Mexicano del Seguro Social; 1964. Edited later in two volumes by Fondo de Cultura Económica, México, 1978.
- Díaz JL, *Índice y sinonimia de las plantas medicinales de México*. México: IMPELAM; 1976.
- Díaz JL, *Usos de las plantas medicinales de México*. México: IMEPLAM; 1977.
- Díaz JL, *Plantas mágicas y sagradas de la medicina indígena de México*. In: López A, Austin Y, Viesca C (eds.), *México Antiguo. Vol I de Historia General de la Medicina en México*. México: UNAM/Academia Nacional de Medicina; 1984. pp. 231-250
- Fernández De Oviedo G, *Historia general y natural de las Indias*. Sevilla: Juan Cromberger; 1535.
- Hernández F, *Rerum Medicarum Novae Hispaniae Thesaurus*. Roma: Ex typographie Vitalis Mascardi; 1651.
- Hernández F, *Historia Plantarum Novae Hispaniae*. Madrid: Ex typographia Ibarrae heredum; 1790.
- Hernández F, *Historia Natural de la Nueva España*. 2 vols. México: UNAM; 1959.
- Fernández Del Castillo F, *Historia bibliográfica del Instituto Médico Nacional de*

Mexican Medicinal Plants

- México. 1888-1915. México: Imprenta Universitaria, UNAM; 1961.
- Flores F, Historia de la Medicina en México. 3 vols. México: Secretaría de Fomento; 1886-1888.
- Frampton J, Joyfull newes out of the Neuwe Founde Worlde written in Spanish by Nicholas Monardes physician of Seville. London: 1577.
- Instituto Médico Nacional, Datos para la Materia Médica Mexicana, Primera parte (1894), Segunda Parte (1898), Tercera parte (1900). México: Oficina Tipográfica de la Secretaría de Fomento; 1894, 1898, 1900.
- Instituto Médico Nacional, Farmacología Nacional formada por el Instituto Médico Nacional. México: Tipografía Económica; 1913.
- León N, Biblioteca botánica mexicana. México: Oficina Tipográfica de la Secretaría de Fomento; 1895.
- López Austin A, Cuerpo humano e ideología. 2 vols. México: Instituto de Investigaciones Antropológicas, UNAM; 1980.
- López Austin A, Viesca C (eds.), México Antiguo, Vol I de Historia General de la Medicina en México. México: UNAM / Academia Nacional de Medicina; 1984.
- López De Hinojosos A, Summa y recopilación de Chirugía. México: Antonio Ricarco, 1578, reedición, México, Academia Nacional de Medicina; 1977.
- Lozoya X (ed)., Estado actual del conocimiento de las plantas medicinales mexicanas. México: IMEPLAM; 1976.
- Lozoya X, Meckes De Lozoya M, Plantas medicinales de México. México: IMSS; 1982.
- Lozoya X, Xiuhpatli, herba officinalis. México: Secretaría de Salud /UNAM; 1999.
- Márquez C, Lara Ochoa F, Esquivel Rodriguez B, Mata Essayag R, Plantas medicinales de México. Composición, usos y actividad biológica. 2 vols., México: Instituto de Química, UNAM; 1999.
- Martínez M, Plantas medicinales de México. México: Editorial Botas; 1933.
- Monardes N, Primera, Segunda y Tercera partes de la Historia Medicinal de las cosas que se traen de nuestras Indias Occidentales que sirven en Medicina. Sevilla: en casa de Alonso Escribano; 1574.
- Montoliú M, Cosmovisión y salud entre los mayas de Yucatán. In: López Austin A, Viesca Y C (eds.), México Antiguo, Vol I de Historia General de la Medicina en México. México: UNAM/Academia Nacional de Medicina; 1984. pp. 283-288.
- Navarro FJ, Historia Natural o Jardín Americano (manuscrito de 1801). ed. facsimilar. México: Universidad Nacional Autónoma de México (UNAM) /Instituto Mexicano del Seguro Social/Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado; 1992.

- Noriega JM, Curso de Historia de las Drogas. México: Oficina Tipográfica de la Secretaría de Fomento; 1902.
- Ocaranza F, Historia de la Medicina en México. México: Laboratorios Midy; 1935.
- Ortiz De Montellano B, Aztec Medicine, Health and Nutrition. New Brunswick & London: Rutgers University Press; 1990.
- Orvañanos D, Ensayo de Geografía Médica y Climatología de la República Mexicana. México: Oficina Tipográfica de la Secretaría de Fomento; 1889.
- Ramírez E, Contribución al estudio de la farmacodinámica del zoapatle. Octubre de 1934. Reproducida en Ramírez E, Obras completas. 2 vols., México: El Colegio Nacional; 1934; pp.183-191.
- S/A, Índice alfabético de la obra de fray Francisco Jiménez (sic) titulada Cuatro libros de la naturaleza y virtudes de las plantas y animales. México: Oficina Tipográfica de la Secretaría de Fomento; 1900.
- S/A Índice de los nombres mexicanos de las plantas descritas en la obra de Francisco Hernández. México: Oficina Tipográfica de la Secretaría de Fomento; 1901.
- S/A, Repertorio alfabético de drogas indígenas y de sus aplicaciones vulgares. 3 vols. México: Oficina Tipográfica de la Secretaría de Fomento; 1891.
- Sahagún B De, Historia General de las cosas de la Nueva España. 4 vols., México: Editorial Porrúa; 1959.
- Sahagún B De, Códice Florentino. 3 vols., facsímile. México: Secretaría de Gobernación; 1984.
- Sahagún B De, Códice Matritense del Real Palacio. no 1097
- Sahagún B De, Primeros Memoriales. ed. facsimilar. Oklahoma: Oklahoma University Press; 1998.
- Sánchez J, Datos para la Zoología Médica Mexicana. México: Imprenta Tipográfica de la Secretaría de Fomento; 1893.
- Sessé M et Mociño J M, Plantae Novae Hispaniae. México: Oficina Tipográfica de la Secretaría de Fomento; 1893.
- Sessé M et Mociño J M, Flora Mexicana. México: Oficina Tipográfica de la Secretaría de Fomento; 1894.
- Sessé M et Mociño J M, Real Expedición Botánica a Nueva España. 13 vols., México: UNAM/Siglo XXI; 2010 – 2016.
- Urbina M, Catálogo de Plantas Mexicanas. México: Imprenta del Museo Nacional; 1887.
- Urbina M, Plantas comestibles de los antiguos mexicanos. México: Imprenta del Museo Nacional; 1904.
- Urbina M, Raíces comestibles de los antiguos mexicanos. México: Imprenta del Museo Nacional; 1906.

Mexican Medicinal Plants

- VV AA, Flora medicinal indígena de México. 3 vols. México: Instituto Nacional Indigenista; 1994.
- Vetancourt A De, Theatro mexicano. México: en casa de doña María de Benavides viuda de Juan de Rivera; 1697.
- Viesca C, La herbolaria en México prehispánico. In: Lozoya X, Estado actual del conocimiento de las plantas medicinales mexicanas. México: IMEPLAM; 1976. pp.11-26.
- Viesca C, Lamy P, Ibarra R y Díaz J L, Términos médicos asociados con las plantas mexicanas. In: Díaz J L, Usos de las plantas medicinales de México. México: IMEPLAM; 1977. p. 313-329.
- Viesca C, La herbolaria medicinal en México Prehispánico. In: Bondani A y Sanfilippo J (eds.), La Investigación científica de la herbolaria medicinal mexicana. México: Secretaría de Salud; 1993. pp. 19-35.
- Viesca C, Ticiótl, Conceptos médicos de los antiguos mexicanos. México: Depto. De Historia y Filosofía de la Medicina, UNAM; 1997.
- Viesca C, La medicina prehispánica. In: Vázquez J. y Ochoa L. (eds.), Gran Historia de México ilustrada. 5 vols. México: Planeta De Agostini/CONACULTA/ INAH; 2001. Vol I, pp. 321-340.
- Villada M, Estudios sobre la flora de Pachuca. Mineral del Chico, Real del Monte y Barranca Honda. México: Imprenta de J.M. Andrade y F. Escalante; 1865.
- Villada M, Plantas aromáticas, medicinales y de recreo e instrucción sobre sus propiedades y lugares de producción. México: Imp. de Miguel Ulloa, 1883.
- Weizel B J, Las plantas y su uso antitumoral. México: Instituto Politécnico Nacional; 2012.
- Ximénez F, Quatro libros de la naturaleza y virtudes de las plantas y animales que están receuidos en el uso de Medicina en esta Nueva España. México: en casa de la viuda de Diego López Dávalos; 1615.
- Ximénez F, Cuatro libros de la Naturaleza y virtudes de las plantas y animales. Ed. de Antonio Peñafiel. México: Imprenta Tipográfica de la Secretaría de Fomento; 1888.
- Zolla C (director), Mellado V (coord.), La medicina tradicional de los pueblos indígenas de México. 2 vols. México: Instituto Nacional Indigenista; 1994.
1. León Portilla M, Toltecatoytl. México: Fondo de Cultura Económica; 1985; Lombardo S y Nalda E (coord.), Temas mesoamericanos. México: Inah/ Conaculta; 1996. López Austin A, Tamoanchan y Tlalocan. México: Fondo de Cultura Económica; 1994.
 2. Popol Vuh. México: editorial Leyenda; 1941. pp.12 y ss.

3. Códice Trocortesiano (Madrid), ff 75,76. Ed. facsímil in: Los Códices Mayas. Universidad Autónoma de Chiapas. 1985. p.122; Libro de Chilam Balam de Chumayel. Prólogo y traducción de Antonio Mediz Bolio. México: Universidad Nacional Autónoma de México; 1973. p. 63. Historia de los mexicanos por sus pinturas. In: Garibay AM, Teogonía e historia de los mexicanos. Tres opúsculos del siglo XVI. México: ed. Porrúa; 1965. p. 32.
4. López Austin A, Tamoanchan y Tlalocan. ref. n. 1. p. 16.
5. Viesca C (coord.), Teotihuacan. Cosmogonía y medicina. México: Gobierno del Estado de México/ Sanofi; 2007 specially Macuil C, Monzón A, Rosas J, Viesca C, Tlaloc, señor de la salud y los mantenimientos. pp.136-158; López Austin S, Tamoanchan y Tlalocan, ref. n. 1. pp. 186-190.
6. Viesca C, La medicina náhuatl prehispánica. México: Panorama editorial; 1985. pp. 112 y ss., 188-203.
7. Ruíz De Alarcón H, Tratado de las supersticiones y costumbres gentílicas que oy viven entre los indios naturales de esta Nueva España, escrito en México, año de 1629, conjuro XXVIII. In: López Austin A, Textos de medicina náhuatl. México: Secretaría de Educación Pública; 1993. p.196
8. *Ibíd.*, conjuro XXXVI, in: López Austin A, ref. n. 7. p. 203
9. Viesca C, Ticiotl, Conceptos médicos de los antiguos mexicanos. México: UNAM; 1997.
10. Viesca C, El Médico mexicana. In: López Austin A y Viesca C (coords.), México Antiguo. In: Martínez Cortés F (coord.) Historia General de la Medicina en México. Mexico: UNAM/Academia Nacional de Medicina; 1984. I: 217-230.
11. Codex Magliabecchiano, fo. 77; López Austin A, Tamoanchan y Tlalocan. ref. n. 1. pp. 138 y ss.; Viesca C, Medicina prehispánica de México: conocimientos médicos de los nahuas. México: D.F Panorama; 1986. pp.165-167.
12. Sahagún Bernardino De, Primeros Memoriales. ed. facsimilar Oklahoma: Oklahoma University Press; 1998; López A, Textos acerca de las partes del cuerpo humano y de las enfermedades y medicinas en los “Primeros Memoriales” de Sahagún. Estudios de Cultura Náhuatl (México) 1972; X:129-143.
13. Florentine Codex, facsimilar edition, 3 vols. México: Secretaría de Gobernación; 1979. The chapters concerning medicinal plants are 6 and 7 in book XI, contained in volume 3, ff 139v to 202v. For an English translation see Anderson A and Dibble Ch, Santa Fe and Utah: New Mexico University Press; 1950-1970; for a Spanish translation see López Austin A and García Quintana J, Historia General de las cosas de Nueva España. México: Conaculta-Alianza; 1989. See also López Austin A, De las enfermedades del cuerpo humano y de las medicinas contra ellas. Estudios de Cultura Náhuatl (México) 1969;8:87;

Mexican Medicinal Plants

- and López Austin A, De las plantas medicinales y otras cosas medicinales. Estudios de Cultura Náhuatl (México) 1971;9:125-230.
14. Sahagún Bernardino De, Historia General de las cosas de la Nueva España. México: ed. de Carlos María Bustamante; 1829. It has been published two times in 20th century, the first one: México: ed. Robredo; 1938, and the second by Porrúa, also in Mexico: 1959, the first edition in five volumes, the second one in four.
 15. Cruz Martín De La, Libellus de medicinalibus Indorum Herbis. México; Instituto Mexicano del Seguro Social: 1964. It has been published a very good facsimilar edition: México: Asociación Farmacéutica de México; 2017.
 16. Codex Magliabecchiano, fo. 90r.
 17. Viesca TC, Las plantas medicinales americanas y la medicina hipocrática. In: El impacto del encuentro de dos Mundos. México: UNAM, INAH, Grupo mexicano de amigos de la Universidad de Tel Aviv; 1988. pp. 90-105.
 18. Cortés H, Cartas de Relación. México: ed. Promesa; 1991, 2ª Carta de Relación. p. 99; Díaz del Castillo B, Historia verdadera de la conquista de la Nueva España. México: Ed. Porrúa; 1955. 2 vols. I:279.
 19. Benavides Pedrarias De, Secretos de cirugía. Ed. facsimilar, México: Academia Nacional de Medicina; 1992. fo. 61r.
 20. Viesca C, Y Martín de la Cruz, autor del Códice de la Cruz Badiano, era un médico Tlatelolca de carne y hueso. Estudios de Cultura Náhuatl 1995;XXV:479-498.
 21. Viesca C, El Códice de la Cruz- Badiano, primer ejemplo de una medicina mestiza. In: Fresquet JL, López Piñeiro JM, El mestizaje cultural y la medicina novohispana del siglo XVI. Valencia: Instituto de Estudios Documentales e Históricos sobre la Ciencia, Universidad de Valencia / CSIC; 1991. pp.71-90.
 22. Monardes N, Primera, Segunda y Tercera partes de la Historia Medicinal de las cosas que se traen de nuestras Indias Occidentales que sirven en Medicina. Sevilla: en casa de Alonso Escribano; 1574; it was translated into English by Frampton J and published as: Joyfull newes out of the Neuwe Founde Worlde written in Spanish by Nicholas Monardes physician of Seville. London; 1577.
 23. López De Hinojosos A, Summa y recopilación de Chirugía. México: Antonio Ricarco; 1578. Reedición México: Academia Nacional de Medicina; 1977. p. 132.
 24. Fernández De Oviedo G, Historia general y natural de las Indias. Sevilla: Juan Cromberger; 1535.

25. Monardes N, *Historia Medicinal*.... ref n. 22, ed. cit. (1574), ff. 2v, 4r, 6r, 7v, 83r, 12v, 16r, 18v, 64v, 102r, 78v; Viesca C, El doctor Nicolás Monardes, pionero en el estudio y la utilización de las plantas medicinales mexicanas, y su Historia Medicinal de las Indias Occidentales. In: Martínez Cortés F y Guzmán N (comps.), *Ensayos de Historia de la Medicina*. Morelia, Mich.: Universidad de San Nicolás de Hidalgo; 2003. pp. 46 – 93.
26. Hernández F, *Historia Natural de la Nueva España*. 2 vols. México: UNAM; 1959; the Spanish translation recovered the full text published as *Historia Plantarum Novae Hispania*. Madrid: 1790; the first published Hernandez text was *Rerum Medicarum Novae Hispaniae Thesaurus*. Roma: 1651. Viesca C, Francisco Hernández, protomédico de Felipe II. *Rev. Fac. Med. Méx.* 1988;31(1):17-20; Viesca C, Francisco Hernández: la obra. *Rev. Fac. Med. Méx.* 1983;18(2):43-50; Viesca C, Francisco Hernández, el Plinio del Nuevo Mundo. In: Cárdenas De La Peña E (comp.), *Temas médicos de la Nueva España*. México: Sociedad Médica Hispano Mexicana; 1992. pp. 469-500; Viesca C, Francisco Hernández. Conferencia magistral. Roma: Academia di Storia dell'Arte sanitaria; diciembre, 2013.
27. Ximénez Fray F, *Quatro libros de la naturaleza y virtudes de las plantas y animales que están receuidos en el uso de Medicina en esta Nueva España*. México: en casa de la viuda de Diego López Dávalos; 1615.
28. Vetancourt Agustín De, *Theatro mexicano*. México: en casa de doña María de Benavides viuda de Juan de Rivera; 1697.
29. Mociño J M y Sessé M De, *Real Expedición Botánica a Nueva España*. 13 vols. México: UNAM / Siglo XXI; 2010 - 2016.
30. Navarro Fray J, *Historia Natural o Jardín Americano* (manuscrito de 1801). Ed. facsimilar, México, Universidad Nacional Autónoma de México (UNAM) / Instituto Mexicano del Seguro Social / Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado, 1992.
31. Díaz P, Informe presentado al inaugurar el segundo periodo del último año de sesiones del 14o Congreso, 1o de abril de 1890. In: s/a, *México a través de los informes presidenciales*. Tomo 12. La salubridad general. México: Secretaría de Salubridad y Asistencia; 1976. p.16.
32. Díaz P, Informe presentado al inaugurar el primer periodo del primer año de sesiones del 15o Congreso. 16 de septiembre de 1890. p.17.
33. Orozco Y, Berra M, *Historia Antigua de México*. México: México; 1880-1882. 4 vols.
34. Flores F, *Historia de la Medicina en México*. México: Secretaría de Fomento; 1886-1888. 3 vols.

Mexican Medicinal Plants

35. Chabert JL, Apuntes sobre el Huaco. Veracruz: s.p.i.; 1833. Herrera JM, Análisis del guaco. Periódico de la Academia de Medicina de Méjico 1836;1:236-238.
36. Vargas J, Defensa de la esencia de zarzaparrilla. Periódico de la Academia de Medicina de Méjico 1839;4:212-227.
37. Marroquín F, Observaciones sobre el bálsamo de Copaiba. Periódico de la Academia de Medicina de Méjico 1839;4:228-230.
38. Hidalgo Y, Carpio L, Ácido Pipitzahuico. La Unión Médica de México 1865-1858;1:162.
39. s/a, Nuestro programa. El Estudio 1889; 1,1: 2
40. Orvañanos D, Ensayo de Geografía Médica y Climatología de la República Mexicana. México: Oficina Tipográfica de la Secretaría de Fomento; 1889.
41. Sepúlveda J, López M De La Paz (coords.), Atlas de la Salud. México: Secretaría de Salud; 1993.
42. s/a, Nuestro programa. El Estudio 1889; 1,1:2.
43. Hubert C, Extractos. Tesis de Farmacia. México: Imprenta del Colegio de San Antonio; 1870.
44. Herrera Y, Weixter J, Algunas consideraciones sobre la acción farmacodinámica del cacao. Tesis de Farmacia. México: Imprenta Tipográfica de I. Paz; 1877.
45. Icaza R, Algunas consideraciones acerca de la acción fisiológica de la Digital y las indicaciones de su empleo en las afecciones orgánicas del corazón. México: Imp. de Ignacio Escalante; 1872.
46. Huacuja R, Estudio sobre la papaína. Tesis de Farmacia. Morelia; 1888.
47. Urbina M, Catálogo de Plantas Mexicanas. México; Imprenta del Museo Nacional: 1887.
48. Urbina M, Notas acerca de los copales de Hernández y las burceráceas mexicanas. Anales del Museo Nacional 1897; 4, 1a época: 98-121.
49. Urbina M, El Peyote y el Ololiuhqui. Anales del Museo Nacional 1903; 7, 1a época: 25-48.
50. Urbina M, Los amates del Dr. Hernández y las Higueras mexicanas. Anales del Museo Nacional 1903; 7, 1a época: 93-114.
51. Urbina M, Los zapotes de Hernández. Anales del Museo Nacional 1903; 7, 1a época: 209-234.
52. Urbina M, Notas acerca de los "Ayotli" de Hernández o calabazas indígenas. Anales del Museo Nacional 1903; 7, 1a época: 353-390.
53. Urbina M, Identificación de varias plantas. Anales del Instituto Medico Nacional 1905;7:254-255.

54. Urbina M, Plantas comestibles de los antiguos mexicanos. México: Imprenta del Museo Nacional; 1904; Id, Raíces comestibles de los antiguos mexicanos. México: Imprenta del Museo Nacional; 1906.
55. Villada M, Estudios sobre la flora de Pachuca. Mineral del Chico, Real del Monte y Barranca Honda, México: Imprenta de J.M. Andrade y F. Escalante; 1865.
56. Villada M, Plantas aromáticas, medicinales y de recreo e instrucción sobre sus propiedades y lugares de producción. México: Imp. de Miguel Ulloa; 1883.
57. Villada M, Apuntes acerca de las plantas indígenas de la familia de las compuestas empleadas en la medicina. *Gaceta Médica de México* 1887;22:351-359. *Ibid* 1888;23:147-155 and 1889;24:241-349.
58. Villada M, Apuntes acerca de las plantas indígenas medicinales de la familia de las euforbiáceas. *Gaceta Médica de México* 1891;26:317-324; 1892;28:43-50.
59. Villada M, Apuntes acerca de las plantas indígenas medicinales de la familia de las papaveráceas. *Gaceta Médica de México* 1893;30:164-174.
60. Villada M, Apuntes acerca de las plantas indígenas medicinales de la familia de las leguminosas. *Gaceta Médica de México* 1894;31:194-202. *Ibid.* 1897;34:211-217; 1898;35:157-164.
61. Villada M, Apuntes acerca de las plantas indígenas de la familia de los helechos empleadas en la medicina. *Gaceta Médica de México* 1895;32:350-367.
62. Villada M, Apuntes acerca de las plantas indígenas de la familia de las labiadas empleadas en la medicina. *Gaceta Médica de México* 1896;33:301-306.
63. Villada M, Apuntes acerca de las plantas indígenas de la familia de las solanáceas empleadas en Medicina. *Gaceta Médica de México* 1899;36:293-303.
64. Villada M, Catálogo de las plantas venenosas indígenas. *La Naturaleza Botánica* 1914;I(3serie):185-187.
65. Ximénez F, Cuatro libros de la Naturaleza y virtudes de las plantas y animales. (ed. de Antonio Peñafiel) México: Imprenta Tipográfica de la Secretaría de Fomento; 1888.
66. Ximénez F, Cuatro libros de la Naturaleza y virtudes de las plantas y animales de la Nueva España. Morelia: Imp. y Lit. de la Escuela de Artes; 1888.
67. Cal y Bracho A De La, Ensayo para la Materia Médica Mexicana. México: Oficina Tipográfica de la Secretaría de Fomento; 1889; Id, Ensayo para la Materia Médica Mexicana. Puebla: Ofna. del Hospital de San Pedro; 1832. Cfr. also Ana M Huerta J, El jardín de Cal. Puebla. Gobierno del Estado de Puebla; Secretaría de Cultura; 1996.

Mexican Medicinal Plants

68. Cervantes V, *Ensayo a la Materia Médica Vegetal de México*. México: Oficina Tipográfica de la Secretaría de Fomento; 1889. Moreno De Los Arcos R, *La primera cátedra de botánica en México*, 1788. México: Universidad Nacional Autónoma de México, Instituto de Investigaciones Históricas, Sociedad Mexicana de la Ciencia y la Tecnología, Sociedad Botánica de México. 1988.
69. Sessé M et Mociño IM, *Plantae Novae Hispaniae*. México: Oficina Tipográfica de la Secretaría de Fomento; 1893. Id, *Flora Mexicana*. México: Oficina Tipográfica de la Secretaría de Fomento; 1894 (this text has been reprinted by the Faculty of Medicine, UNAM in 2017).
70. S/A, *Índice alfabético de la obra de fray Francisco Jiménez (sic) titulada Cuatro libros de la naturaleza y virtudes de las plantas y animales*. México: Oficina Tipográfica de la Secretaría de Fomento; 1900; s/a *Índice de los nombres mexicanos de las plantas descritas en la obra de Francisco Hernández*. México: Oficina Tipográfica de la Secretaría de Fomento; 1901.
71. Olaguíbel M, *Memoria para una bibliografía científica mexicana*. México: Oficina Tipográfica de la Secretaría de Fomento; 1889.
72. León N, *Biblioteca botánica mexicana*. México: Oficina Tipográfica de la Secretaría de Fomento; 1895.
73. *Catálogo de productos que exhibe el Instituto Médico Nacional en la exposición de Coyoacán*. México: Imprenta Tipográfica de la Secretaría de Fomento; 1895. 77p.
74. S/A, *Repertorio alfabético de drogas indígenas y de sus aplicaciones vulgares*, 3 vols. México, Oficina Tipográfica de la Secretaría de Fomento, 1891.
75. Sánchez J, *Datos para la Zoología Médica Mexicana*. México: Imprenta Tipográfica de la Secretaría de Fomento; 1893.
76. Instituto Médico Nacional, *Datos para la Materia Médica Mexicana*, Primera parte (1894), Segunda Parte (1898), Tercera parte (1900). México: Oficina Tipográfica de la Secretaría de Fomento; 1894, 1898, 1900. *Farmacología Nacional formada por el Instituto Médico Nacional*. México: Tipografía Económica; 1913.
77. Ramírez J, in: *Datos para la Materia Médica Mexicana*. México: Oficina Tip. de la Secretaría de Fomento, 1894-1908.
78. Altamirano F, *Historia natural aplicada de los antiguos mexicanos*. México: Actas del XI Congreso Internacional de Americanistas; 1896:365-378.
79. Noriega J M, *Curso de Historia de las Drogas*. México; Oficina Tipográfica de la Secretaría de Fomento: 1902.
80. Altamirano F, *Materia Medica mexicana. A manual of mexican medical herbs*. México: The Mexican National Commission; 1903; Id, *Abregée de*

matière médicale du Mexique. México: Instituto Médico Nacional/ Imprenta Tipográfica de la Secretaría de Fomento; 1909.

81. El Estudio 1981;IV:30-31.
82. El Estudio 1891;IV:23-30.
83. El Estudio 1889;I:177.
84. Anales del Instituto Médico Nacional 1894;I:44 y ss.
85. Anales del Instituto Médico Nacional 1895;II:18.
86. El Estudio 1891;IV:133, 248; Anales del Instituto Médico Nacional 1894;I:317
87. El Estudio 1891;IV:3,111; Datos para la Materia Médica Mexicana 1894;I:99,198.
88. El Estudio 1891; IV: 283, 344, 378, 471; Anales del Instituto Médico Nacional 1894; I: 239.
89. El Estudio 1891;IV:199.
90. El Estudio 1891;IV:2,105,174,222, Datos para la Materia Médica Mexicana. 1894;I:137,148; Anales del Instituto Médico Nacional 1896;II:43.
91. Anales del Instituto Médico Nacional 1896;II:97.
92. Armendáriz E, Zapote blanco. Anales del Instituto Médico Nacional 1897; II: 196, 206; III:108;
93. El Estudio 1891;IV:2,105,111,177.
94. El Estudio 1891;IV:2,105,177; Noriega J M, Curso de Historia de las Drogas. México: Oficina Tipográfica de la Secretaría de Fomento; 1902. p.578.
95. El Estudio 1891;IV:4,111,128, 300.
96. El Estudio 1891;IV:111; Anales del Instituto Médico Nacional 1900;IV:113,135,256,364; 1901;V:90; 1907;IX :354.
97. Fernández Del Castillo F, Historia bibliográfica del Instituto Médico Nacional de México. 1888-1915. México: Imprenta Universitaria, UNAM; 1961.
98. Ocaranza F, Historia de la Medicina en México. México: Laboratorios Midy; 1935.
99. Chávez I, México en la cultura médica. México: El Colegio Nacional; 1948.
100. Ramírez E, Contribución al estudio de la farmacodinámica del zoapatle. Octubre de 1934. Reprints in: Ramírez E, Obras completas. 2 vols. México: El Colegio Nacional; II: 183-191.
101. López Austin A, Cuerpo humano e ideología. 2 vols. México: Instituto de Investigaciones Antropológicas, UNAM; 1980. Montoliú M, Cosmovisión y salud entre los mayas de Yucatán. In: López Austin A. y Viesca C. (coords.), México Antiguo. Vol I of Historia General de la Medicina en México. México: UNAM/ Academia Nacional de Medicina; 1984. pp. 283-288. Ortiz

Mexican Medicinal Plants

- De Montellano B, *Aztec Medicine, Health and Nutrition*. New Brunswick & London; Rutgers University Press: 1990. Viesca TC, Ticiótl. México: Depto. De Historia y Filosofía de la Medicina, UNAM; 1997. Viesca TC, La medicina prehispánica. In: Vázquez J y Ochoa L (coords), *Gran Historia de México ilustrada*. 5 vols., México: Planeta De Agostini/CONACULTA/INAH; 2001, Vol I. pp. 321-340; Díaz JL, Plantas mágicas y sagradas de la medicina indígena de México. In: López Austin A y Viesca C (coords), *México Antiguo*. Vol I of *Historia General de la Medicina en México*. México: UNAM/Academia Nacional de Medicina; 1984. pp. 231-250.
102. Lozoya X (coord), *Estado actual del conocimiento de las plantas medicinales mexicanas*. México: IMEPLAM; 1976. Viesca C, *La herbolaria medicinal en México Prehispánico*. In: Bondani A y Sanfilippo J (compiladores), *La Investigación científica de la herbolaria medicinal mexicana*. México, Secretaría de Salud, 1993. pp. 19-35. Viesca C, *La herbolaria en México prehispánico*. In: Lozoya X, *Estado actual del conocimiento de las plantas medicinales mexicanas*. México: IMEPLAM; 1976. pp.11-26.
103. Díaz JL, *Índice y sinonimia de las plantas medicinales de México*. México: IMPELAM; 1976.
104. Díaz JL, *Usos de las plantas medicinales de México*. México: IMEPLAM; 1977.
105. Martínez M, *Plantas medicinales de México*. México: Editorial Botas; 1933.
106. Viesca C, Lamy P, Ibarra R y Díaz JL, *Términos médicos asociados con las plantas mexicanas*. En: Díaz J L, *Usos de las plantas medicinales de México*. México: IMEPLAM; 1977. pp. 313-329.
107. Lozoya X, Meckes De Lozoya M, *Plantas medicinales de México*. México: IMSS; 1982.
108. Aguilar A, Camacho JR, Chino S, Jácquez P, López ME, *Herbario Medicinal del Instituto Mexicano del Seguro Social*. México: IMSS; 1994.
109. Lozoya X, *Xiuhpatli, herba officinalis*. México: Secretaría de Salud/UNAM; 1999.
110. Márquez Alonso C et al., *Plantas medicinales de México II: composición, usos y actividad biológica*. 1. ed. México: Universidad Nacional Autónoma de México; 1999.
111. Zolla C (director), Mellado V (coord.), *La medicina tradicional de los pueblos indígenas de México*. 2 vols., México: Instituto Nacional Indigenista; 1994.
112. AA VV, *Flora medicinal indígena de México*. 3 vols., México, Instituto Nacional Indigenista, 1994.

113. Argueta A (coord. Gral.), Atlas de las plantas de la medicina tradicional Mexicana, 3 vols. México: Instituto Nacional Indigenista; 1994.
114. Bibliografía de la medicina tradicional mexicana. México: Instituto Nacional Indigenista; 1994
115. Weizel BJ, Las plantas y su uso antitumoral. México: Instituto Politécnico Nacional; 2012.

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