

# The role of Mexican Pharmacopeias in the construction of a national identity

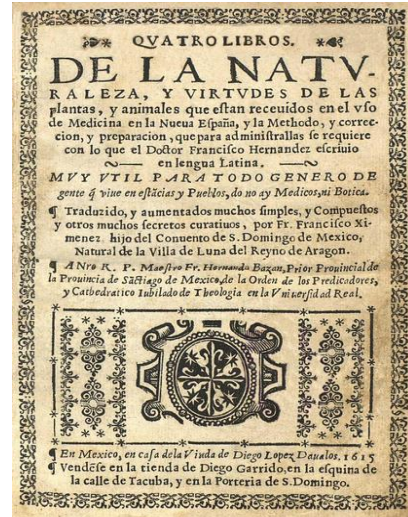
Liliana Schifter; Patricia Aceves  
Universidad Autónoma Metropolitana  
Xochimilco, México

## Introduction

From the time prior to the arrival of the Spaniards, the ancient Mexicans had already developed a deep knowledge of the qualities and medicinal uses of the local flora. Some examples of early compilations of indigenous herbal therapeutics include the renowned *Libellus de medicinalibus indorum herbis* or *Códice de la Cruz Badiano* concluded in 1552 and the work of Francisco Hernández entrusted by Philip II to command an expedition to study the american natural history. In these texts not only a syncretism of American and European traditions is evident, but also a translation of therapeutic names and uses of Mexican medicinal plants to the language of the Western scientific tradition.



An illustration from the *Códice de la Cruz Badiano*

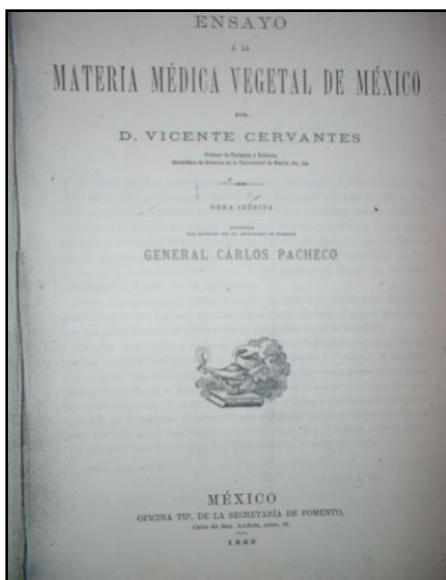


Edición de 1615 de los Quatro libros de la Naturaleza de Francisco Hernández

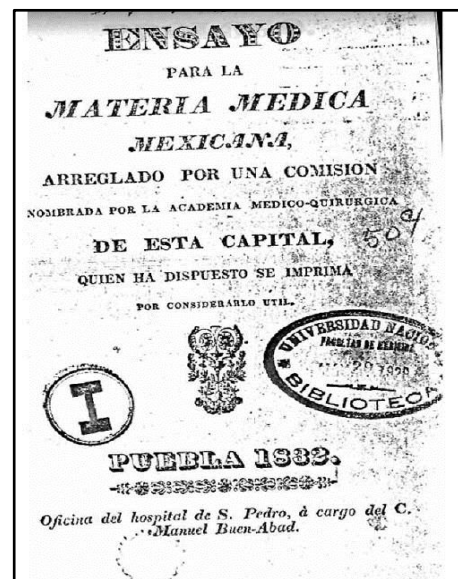
The Royal Botanical Expedition of the New Spain in 1788 endorsed the opening of a Royal Botanical Garden in Mexico City and the creation of a Botany Chair in command of the Spanish pharmacist Vicente Cervantes. This Chair was mandatory for medicine, pharmacy and surgery students, and in time became the platform necessary to undertake a series of actions focused on the institutionalization of botany and the study of modern chemistry applied to pharmaceutical practice. This event is important in the history of Mexican chemistry and pharmacy and will be discussed along the following pages. At

the opening of the course of 1791 Vicente Cervantes unveiled *the Ensayo a la materia Médica vegetal de México*. In his work, Cervantes describes 293 plants of therapeutic importance using the Linnaean method; additionally he proposes 108 species to be used as their possible substitutes. Most of the collected plants he refers come from orchards, gardens, canyons, and mountains surrounding the city of Mexico. The text of Cervantes would find continuity in the work of one of his students; Antonio de la Cal y Bracho another Spaniard who published the *Ensayo para la materia médica mexicana* in the city of Puebla in 1832. The text describes products from the three kingdoms of nature and gathers the knowledge generated by ancient

botanical tradition, also there is a clear intention to continue with the ideals that guided the works of the Royal Botanical Expedition to replace the medicinal plants that came from abroad with those of indigenous origin. In this perspective, it is evident that there is a continuity between the works of Cervantes and Antonio De la Cal: from the 180 plants described by the latter, 113 were previously cited in the text of Cervantes. It is also possible to say that these two texts were the most important predecessors to the natural products section of the 1846 *Mexican Pharmacopoeia*. From the 180 plants comprising De la Cal's text, only 32 are missing in the 1846 Pharmacopoeia.



The *Ensayo a la materia médica vegetal de México* de Vicente Cervantes

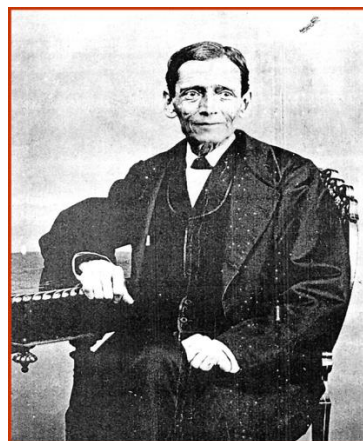


Antonio De la Cal's *Ensayo a la materia médica mexicana*

### **The *Farmacopea Mexicana* (1846)**

The process for the institutionalization of pharmacy in Mexico was rather slow. It was not until 1833 that a Pharmacy Chair was created at the National School of Medicine. During the first half of the 19th century, the Mexican scientific community formed a close social group in which pharmacists were a minority whose interests and ambitions were rarely supported by the most influential sectors of the country. This was due to several reasons. Pharmacists lacked a solid organization and were disjointed, the public in general did not attribute the importance deserved to the performance of their activities, and their formation within the aforementioned National School of Medicine was deficient and incomplete. However, and despite the small size of the group, the commitment of the first professors of pharmacy that emerged from this institution never waned. Especially in one of them, Professor Leopoldo Río de la Loza, President of the *Academia Farmacéutica de la Ciudad de Mexico* founded in 1839 with the express aim to publish a national pharmacopoeia that would fulfill the need for a modern and updated pharmaceutical formulary in which national materia medica was exclusively discussed, and once and for

all, nomenclature and methodology to prepare medicines were uniformed.



Leopoldo Río de la Loza (1807-1876)



The Seal of the Academia Farmacéutica de la ciudad de México created in 1839

The *Farmacopea Mexicana* published in 1846, was highly anticipated by the scientific community, and the text did not disappoint them. The dedication and time invested in this first edition by its authors were evident, as it also was their intent to promote the use of local materia medica in accordance with the flourishing nationalism of a a country who had recently obtained its independence.

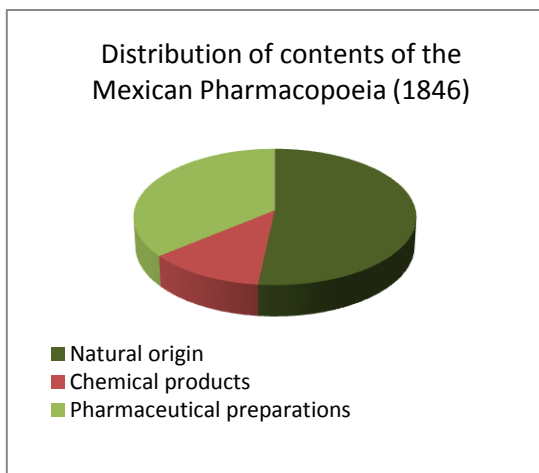


The *Farmacopea Mexicana*, 1846

The result was a text with a singular identity composed by a collection that covers a series of systematic observations about the healing power of medicinal plants in the country. Many of them date back to prehispanic times, and have prevailed in record up to our days. The first section of the Pharmacopeia focuses on the natural history of drugs or simple substances, and is certainly the most innovative and extensive; just the products of botanical origin are more than 450. It should be noted that its American homonymous in its three sections, does not exceed 300 drugs. Even so, the therapeutic properties of the plants comprised in both texts are very similar. In the first section of the Mexican Pharmacopoeia, the contributions of Rio de la Loza are also noteworthy; his analytical studies to detect the

falsifications of the cocoa seed and other species were highly appreciated in his time. The second section of the *Farmacopea Mexicana* includes a number of chemical preparations used in pharmacy in an ascending order according to their degree of complexity. Their preparation instructions, uses, dosage and incompatibilities with other drugs and chemical substances, are included for all of them. Berzelius's nomenclature was the first choice. The authors preferred it because they considered it to be the most concise, a circumstance that to their eyes made it widely recommended for a pharmacopoeia. The third section of the text is dedicated to pharmaceutical preparations. As in the section before, each one had its own monograph, where their names (common, scientific, and Latin), their components, the method to compound them as well as their therapeutic indications and doses were indicated.

The final part of the *Farmacopea Mexicana* included a list with the permitted prices for drugs and compounded medicines in Mexican drugstores and the list of books, medicines, and chemical and pharmaceutical equipment that had to be present in these establishments.



Source: SCHIFTER, Liliana, *Evolución histórica comparada de la Farmacopea Mexicana; análisis de su papel en el contexto internacional*, PhD Thesis, Universidad Complutense de Madrid, 2006.

It is very important to emphasize that in the context of XIX century Mexico, where autonomy from Spain had only been obtained 25 years ago, the publication of a national pharmacopoeia that addressed in a scientific and systematic way the advantages and benefits derived from the use of indigenous medicinal plants, was a crucial step in the construction of a national identity.

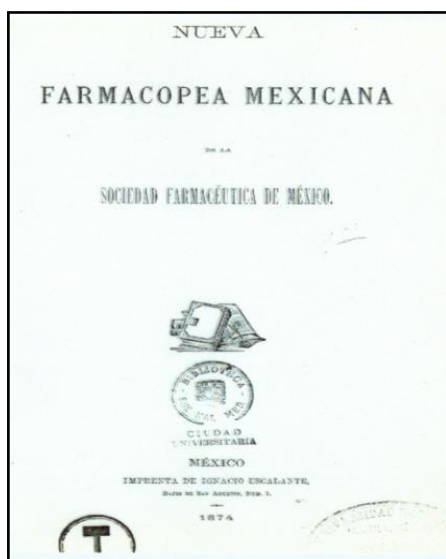
During the following years, the history of Mexico was characterized by constant armed conflicts which hindered the chances for scientific and technological development in all areas. In spite of this unstable situation an enhanced sense of nationalism permeated all levels of Mexican society and pharmacists were not the exception. During the 19<sup>th</sup> century, their work was defined largely by

their desire to contribute to the growth of the country through science. However, they had to face numerous difficulties as the war and the economic crisis in which the country was submerged strongly affected the scientific institutions. This was the case of the *Academia Farmacéutica*, which dissolved just after the publication of the Pharmacopoeia. Two decades later, the situation had not improved; in 1864 French troops occupied Mexico City imposing a Second Empire and Maximilian I from Hapsburg as the Emperor. The Republic was not re-established until 1867 with the return of Juárez to the Presidency.

### **The *Sociedad Farmacéutica Mexicana***

The objectives of the former *Academia Farmacéutica* had continuity in the *Sociedad Farmacéutica Mexicana* founded in 1871. Work for the publication of a new edition of the pharmacopoeia began at the end of the year and continued uninterruptedly for the next three years. Finally, in 1874 the *Nueva Farmacopea Mexicana* was published; the text certainly maintained the spirit and the quality of its predecessor. As in the previous text, the contents were distributed into 3 sections: natural products, chemical products and

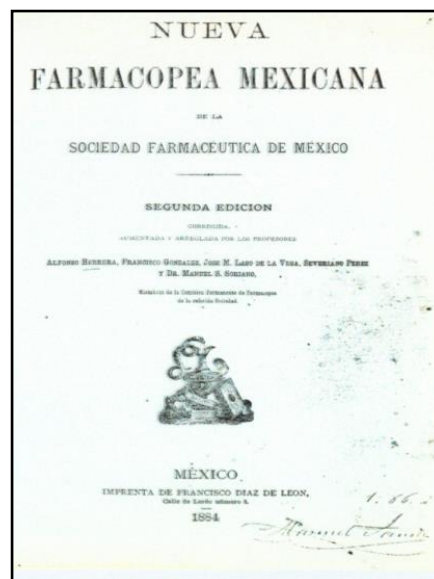
pharmaceutical preparations with the general rules to compound them.



The *Nueva Farmacopea Mexicana*, 1874

At the end of the text, an appendix on mineral waters was included. These sections were preceded by a series of tables of equivalences of temperature, weight and other measures of utility for the laboratory and pharmacy office. Among the most important preparations are cod liver oil, aconite, chloroform and glycerin. Some of the drugs included for the first time were: atropine, chromic acid, strychnine sulphate and numerous fluid extracts. The introduction of phenol, iodoform, and chloral hydrate, indicate the strong influence that surgery had at that time. The *Nueva Farmacopea Mexicana* was very well received by the scientific community, nationally and internationally, it even won a gold medal

at the exhibition of pharmacopoeias in Buenos Aires. The second edition of the text appeared ten years after, in 1884.



The *Nueva Farmacopea Mexicana*, 1884

The *Société de Pharmacie* in Paris called it "a model of its kind", and the jury of the international exhibition that was held in Chicago awarded the text a special honor diploma. The number of plant species compiled in the first section increased, and would continue to do so in subsequent editions. It seemed that the national medicinal plants, hand in hand with galenic pharmacy compounding, had their continuity ensured in official pharmaceutical texts. Editors saw in indigenous plants the way towards progress. Twelve years later, the third edition of the *Nueva Farmacopea* was published in 1896.



intact although the three sections of the text increased their number of contents. The text's presence in all pharmacies was now mandatory, so as a consequence, it was widely used and known among doctors and pharmacists across the country. At this point it is important to note that the editors of the Mexican Pharmacopoeia did not work in isolation, their close collaboration with other scientific institutions is quite evident. In this sense, it is of fundamental importance to comment on the contributions to the text derived from the work done in a key institution for the development of pharmacology and analytical chemistry in Mexico during this period: the *Instituto Médico Nacional* (IMN) founded in 1888. The aim of this institution was to investigate local medicinal plants, as well as their possible application and marketing. Another important element under the responsibility of the Institute was to contribute to the creation of a national therapeutic (pharmacological) model based on medicinal plants. In this context, one of the great contributions of the IMN was undoubtedly the elaboration of various texts where the results of the investigations taking place within its walls were publicized. Among these works are the *Datos para la materia medica Mexicana*; a collective edition published

in five volumes between 1894 and 1907, which collects and synthesizes state of the art knowledge about Mexican medicinal plants.



The Instituto Médico Nacional (1888)

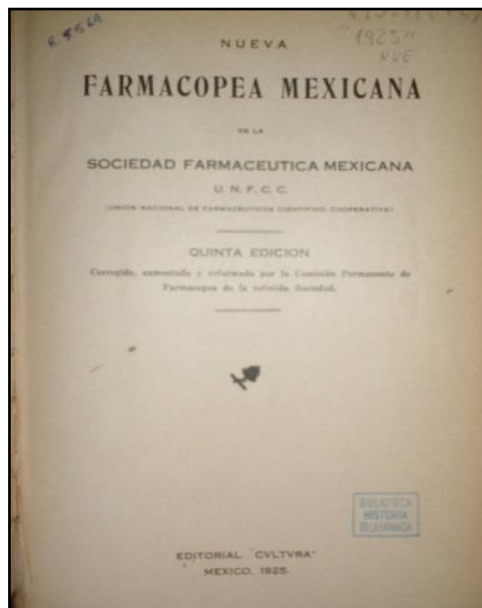
In addition to their own investigations, in the individual monographs for each plant, the authors added information from inaugural thesis and contests of the National School of Medicine, other information collected from the original colonial texts on the natural history of indigenous plants, as well as observations arising from medical practice in public and private hospitals.

It is clear that the 4th edition of the Mexican Pharmacopoeia of 1904 was enriched with the studies conducted in the IMN during this period. Within the Institute, the study of materia medica was part of the concerns of a group of doctors, pharmacists and naturalists interested in consolidating a local tradition based on Mexico's own resources and oriented towards the



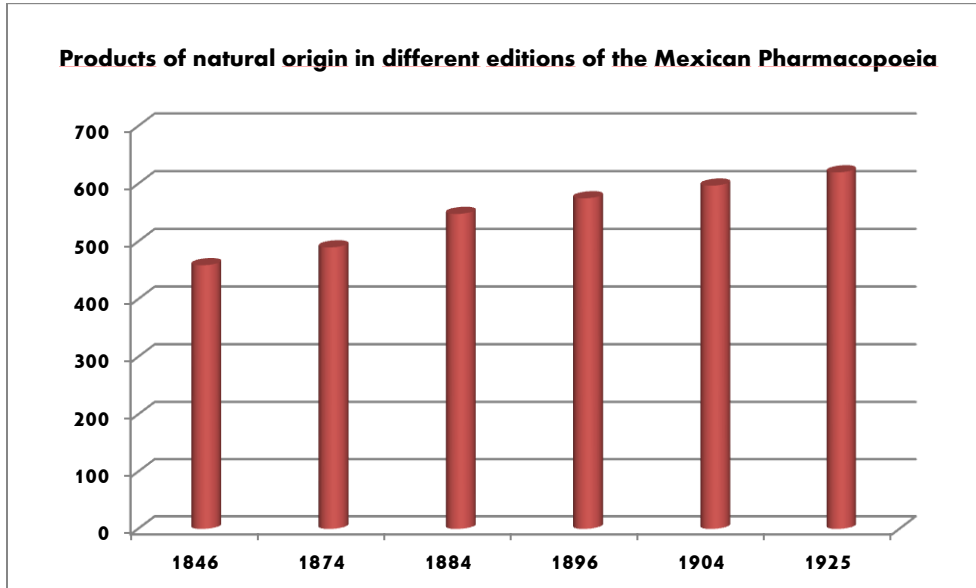
resolution of specific health problems bedeviling the country. In this context, from 1910, the work of the Institute focused on the elaboration of a *Farmacología Nacional* or National Pharmacology. This work published in 1913, had a great impact on the 5th Edition of the *Nueva Farmacopea Mexicana* published in 1925 which includes almost every medicinal plant compiled in the text of the IMN. The structure of the 1925 edition stays true to the original. A number of tables precede the natural products section followed by the chemical products and pharmaceutical preparations chapters. As in the previous cases, the first section continued to grow; in addition to some monographs of new plants that were added in this version, the text was enriched with illustrative sheets of both plants and animals. This increase was due to the fact that the *Sociedad Farmacéutica Mexicana* counted for the elaboration of the text with the materials of the *Farmacología Nacional*; whose literary and intellectual property had been donated to them by the Minister of Development following the closure in 1915 of the IMN. This way the *Sociedad Farmacéutica* obtained new information to modify, update and increase the contents of the *Nueva Farmacopea Mexicana*. For their part, the second and

third sections -especially the third- also increased their number of monographs notably.

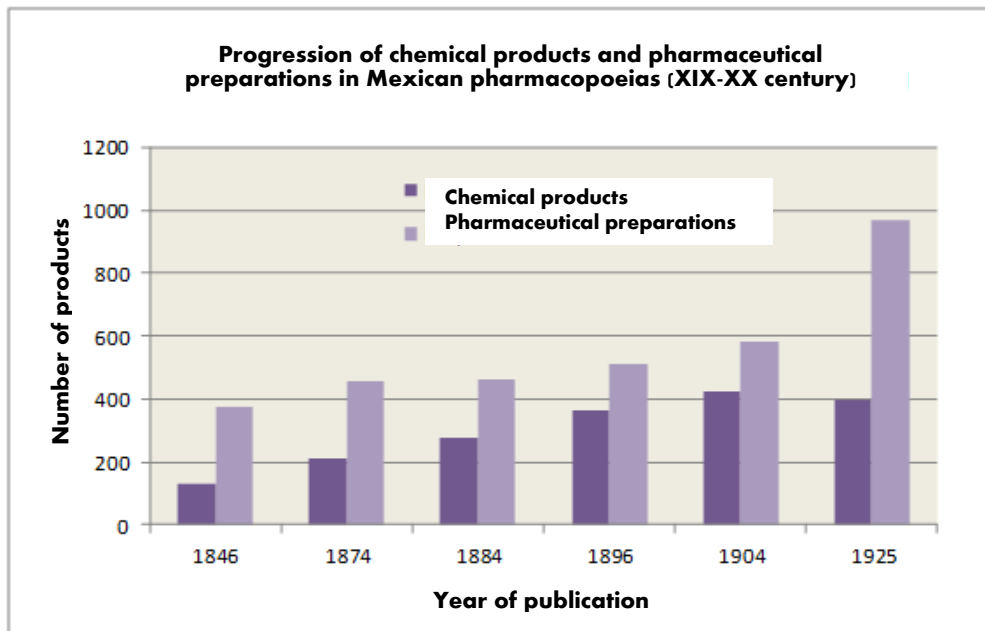


The *Nueva Farmacopea Mexicana*, 1925

It should be stressed that the *Nueva Farmacopea Mexicana* of 1925 is the best of its kind, there was no other like it. It is the most comprehensive work of its time because it manages to gather in one place the scientific knowledge about plant species typical of the Mexican soil, the most commonly used chemicals, and the preparations emanating from national pharmaceutical practice. This 5th Edition was the last published by the *Sociedad Farmacéutica Mexicana*, the final chapter of a pharmaceutical saga that lasted nearly 80 years. Now, a new stage began.



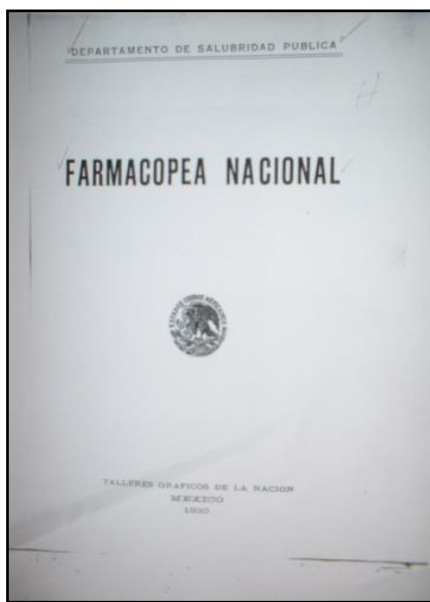
Source: SCHIFTER, Liliانا, *Evolución histórica comparada de la Farmacopea Mexicana; análisis de su papel en el contexto internacional*, PhD Thesis, Universidad Complutense de Madrid, 2006.



Source: SCHIFTER, Liliانا, *Evolución histórica comparada de la Farmacopea Mexicana; análisis de su papel en el contexto internacional*, PhD Thesis, Universidad Complutense de Madrid, 2006.

## **The *Farmacopea Nacional de los Estados Unidos Mexicanos***

The *Farmacopea Nacional* was printed in 1930; the agency responsible for its publication was the Department of Public Health. All the methods for the identification and preparation of drugs contained in the text were determined by the Department, and all those whose utility or therapeutic application were not validated by it, were excluded from the pharmacopeia. Although this was a basic measure of control and to some extent necessary, it was the filter by which many of the medicinal plants that until then had been referred to in previous pharmacopeias did not pass. It is important to say, that these plants were still very much in use in pharmacies and drugstores all over the country.



The *Farmacopea Nacional*, 1930

On the other hand, in later editions during the 20<sup>th</sup> century, the increase of chemical and pharmaceutical products is noticeable. The development of new technologies and the growing advances in the chemical and pharmaceutical industry are portrayed in the constant rise of the compounds included in these sections. In this context, a significant change between the *Farmacopea Nacional* and its predecessors lies in the type of pharmaceutical preparations included. During the second half of the 19<sup>th</sup> century, Mexican Pharmacopeias included numerous pharmaceutical preparations in the form of powders, extracts and syrups; most of them had a medicinal plant as the active ingredient. In the *Farmacopea Nacional* this changes drastically, with its publication, a tendency that came from the previous century comes to an end. This tendency was characterized by the fact that the preparation of drugs was carried out largely from medicinal plants and as a result of a process focused mainly in offering a better dosing of products of a natural origin in the form of syrups and ointments. In the 1930 edition, the subject of medicinal plants, or specifically their total extracts, loses much terrain to active principles whose chemical composition and pharmacological action was well defined. This fact, coupled with

the popularization of the use and production of synthetic drugs and patent medicines, led to the progressive abandonment of plant extracts as an object of study and curative remedy; a trend that would be consummated in the course of the first half of the 20th century and remained unchanged until much later. The structure of the text also changes completely; it is now divided into two parts. The first one contains drugs, chemical products, pharmaceutical preparations, serums and vaccines, while the second contains mainly the methods of analysis for the identification of medicinal substances. As we can see, the differentiation between products of natural origin, chemicals and pharmaceutical preparations disappeared. The articles of these three categories are mixed together and sorted alphabetically. This new orientation of the text was not uniformly accepted by all members of the health sector. In 1947 the military doctor Ricardo Pico Navarro, Secretary of the Review Commission of the *Farmacopea Nacional* addressed in a medical congress the issue of the relevance related to the text from another point of view. For him, in addition to its industrial utility, the pharmacopeia should also have a prominent role in higher education; in his opinion, professors of Pharmacology and Therapeutics at the

universities should be able to find in the text a wide range of therapeutic remedies to choose from. He also urged medical doctors to return to personalized medicine, proposing that they would come up with their own drug formulations. However, none of this happened. The next edition of the *Farmacopea Nacional* appeared in 1952.

This second edition intensifies the trend from the previous one in which products and techniques used by the chemical and pharmaceutical industry have a clear preference over natural products. The text was divided into four parts: the first one contains information about members comprising the Standing Committee as well as the list of monographs that were omitted from the previous edition, and the ones which were added in the present one. The second contains the monographs of all products: natural, chemical and pharmaceutical. A total of 407 monographs from the previous edition, the vast majority of medicinal plants and other natural products, which had been present in national pharmaceutical codes for more than one century, were abolished altogether. As for drugs that were included for the first time there are some famous names like penicillin, the sodium salt of pentobarbital and testosterone. On their part, monographs of chemical products

increased in number and content, furthermore the chemical structures of each one were included for the first time. This is in accordance with the rise of the chemical industry in those days. The third part includes methods to carry out physical and chemical measurements and equipment and instrument specifications for this purpose. Some of the technological and scientific advances observed in this second edition are as follows:

1. Instructions to carry out a microbiological assay (riboflavin specifically).
2. A section on spectrophotometry, explaining in detail its theoretical foundations, its utility and information about equipment.
3. A classification of the different containers for injectable drugs
4. A specific bacteriological test for gelatin
5. A specific section on "Plant drug analysis methods"
6. The methodology for sterility tests for liquids and solids and determination of pyrogens.

Finally the fourth part contains tables of equivalences and physical and chemical

constants, as well as official metric measures and weights.

The third edition of the pharmacopoeia appeared in 1962. The exclusion of medicinal plants is again notorious; 44 of the 94 rejected monographs were medicinal plants, also, there was not a single new article on the subject. On the other hand, some of the drugs that are still widely used today made their appearance in this third edition, such is the case of some antibiotics as novobiocin, polymyxin B, tetracycline and erythromycin, sulfa drugs such as sulfamethoxypyridazine and sulfisoxazol, new antiseptics as the benzalkonium and nitrofurantoin were included, diuretic antihypertensives like chlorothiazide and acetazolamide, antihistaminics as diphenhydramine and hypoglycemic drugs as tolbutamide, are some examples.

Twelve years later, in 1974, the fourth edition of the pharmacopoeia appeared. The 1974 Edition is divided into two parts; the "analytic part", dedicated to the methods of analysis for drugs and other products, and the second part, which contains all the drug monographs. The analytical part contains many innovations, perhaps the most remarkable is the one referred to antibiotics which describes specific

methods for their microbiological evaluation.



The *Farmacopea Nacional*, 1974

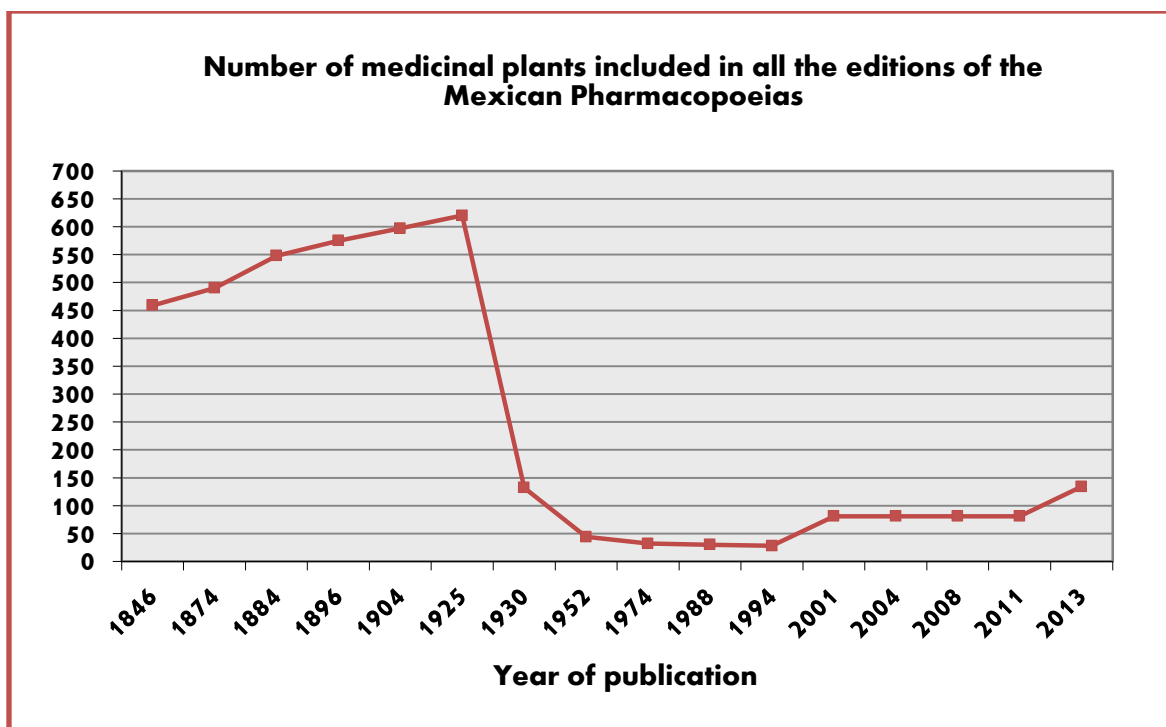
Another novelty is the appearance of extensive sections devoted to the analytical methods such as: polarography, optical rotation, refractive index and chromatography. Recommendations are given when using each and other technical advice is included. The monographs section includes all official articles; compounds of a natural origin, chemical products and pharmaceutical forms in alphabetical order. Once again it should be noted that the first are still declining in number. From this point on, the products of animal origin have also disappeared, at least in its original form. The 5th Edition was

published in 1988 and changed its name to the one the text uses to this day: *Farmacopea de los Estados Unidos Mexicanos* (FEUM). The first fact that draws attention is its size; it almost doubles its predecessor. When we read the foreword we can see that there has been a restructuration, as this was the first Pharmacopoeia published after the promulgation of the General Health Act in 1984. In this same year, and at the initiative of the Secretary of Health and Assistance, the Permanent Committee of the Pharmacopoeia (CPFEUM) was formalized. It would operate as a collegiate advisory entity responsible for the elaboration, permanent revision and updating of the text and its supplements; duties its members perform to this day.

In regards to its structure, the edition of 1988 has completely changed the distribution of its contents, which are now spread across fifteen chapters. This number will increase dramatically in subsequent editions. In the section dedicated to the drug monographs; only 6.5% are from plants or products that come from them, such is the case of essential oils, whose analytical requirements include some new parameters such as the index of saponification, iodine and acetyl content. In 1994 the next edition of the Pharmacopoeia was published, the

quantitative and qualitative profiles about the medicinal plants are maintained in comparison with the previous edition, to summarize, very few medicinal plants were included in the text, and just one of them has a Mexican origin (*Chenopodium ambrosioides* var. *Antihelminthicum* Linné). This fact is quite

shocking if we consider that it is a known fact that more than six thousand different species of medicinal plants are in use in Mexico. The text presents basically processing and quality control procedures. The initial goal to generate a therapeutic model based on Mexican materia medica was lost.

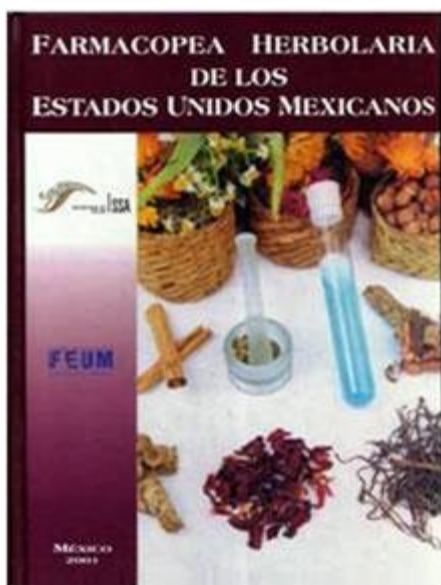


Source: SCHIFTER, Liliana, *Evolución histórica comparada de la Farmacopea Mexicana; análisis de su papel en el contexto internacional*, PhD Thesis, Universidad Complutense de Madrid, 2006.

The next edition of the pharmacopoeia was published in the year 2000; a year later, the digital version on CD-ROM was also available. This work was divided into three separate volumes; the first one is simply called *Farmacopea de los Estados Unidos Mexicanos* and contains all the monographs of official drugs, excipients,

and allopathic medicines along with the validated methods of analysis for their study. On the other hand the second volume of the 2000 edition contains the materials of the *Farmacopea Herbolaria de los Estados Unidos Mexicanos* and the third corresponds to the *Farmacopea Homeopática de los Estados Unidos*

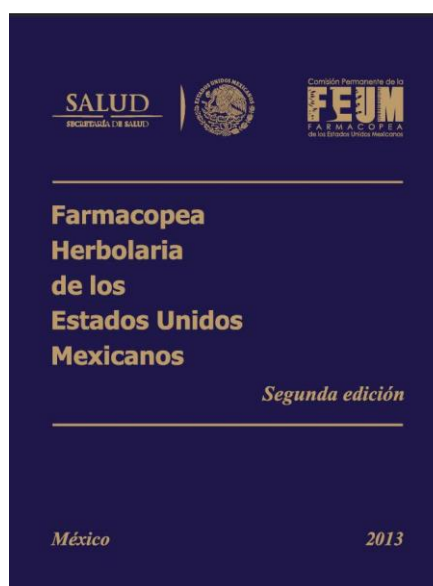
Mexicanos 2nd Edition (the first edition appeared in 1998).



The *Farmacopea Herbolaria de los Estados Unidos Mexicanos*, 2001

The 2000 edition marks a difference with the ones that preceded it. There is a reversal from the trend that started with the pharmacopoeia of 1930, the text recuperates the prospect of medicinal plants as part of the official drug repertoire and it is the first official Herbal Pharmacopoeia. The text includes 76 monographs of medicinal plants. The fact that most of them appeared in the first edition of the Mexican Pharmacopoeia in 1846 continues to be significant; it means that after more than 150 years, and having been steadily used over the

centuries by a significant share of the population, these plants are once again recognized as elements of therapeutic value. In May 2013 the second edition of the text was issued. Among its innovations it includes 51 new monographs on medicinal plants and 14 others on essential oils with pharmaceutical utility. The publication of the Mexican Herbal Pharmacopoeia, helps narrowing the gaps concerning the lack of official bibliography for medicinal plants in Mexico, it is also a tool for the permanence and dissemination of knowledge about them which ideally will allow this sector certain autonomy and the possibility to fully develop its capacities.



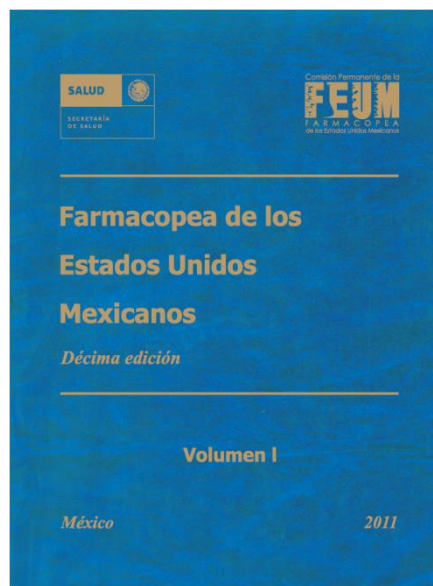
The *Farmacopea Herbolaria de los Estados Unidos Mexicanos*, 2013



The 8th edition of the FEUM was officially presented in December 2004. Among its innovations is the appearance of four new chapters. The first one describes the requirements that a drug must meet to obtain official registration. The remaining three take on good laboratory practices, preparation of specific solutions and reagents and radiopharmaceuticals respectively. Just four years later, the 9th edition of the text was published in 2008. It is divided in two volumes; the first includes general methods of analysis and the monographs of all official drugs, while the second one collects the pharmaceutical preparations and biological products. Among its new features are the inclusion of 3 new methods of analysis, 5 new monographs for radiopharmaceuticals, 35 for drugs and 9 for biological products. Finally we arrive to the 10th and current edition of the text published in 2011. Synthetically, its contents are as follows:

- a) 132 general methods of analysis
- b) 164 monographs of additives
- c) one chapter dedicated to primary packaging
- d) 487 monographs of drugs
- e) 583 monographs of pharmaceutical preparations
- f) 6 monographs of medicinal gases
- g) 59 methods for biological products

- h) 40 monographs of biological products
- i) 27 monographs of blood derived products
- j) 72 monographs with basic tests for pharmaceutical substances
- k) 16 monographs of dissolution profiles.



The *Farmacopea de los Estados Unidos Mexicanos*, 2011

### Final considerations

Pharmacopoeias are the texts of greater hierarchy for the regulation of raw materials and pharmaceuticals products. Their contents provide information about drugs in order to ensure the quality of the products in circulation. However, they are also a reflection of the therapeutic criteria for each country. This fact becomes relevant in the case of Mexico because as a national pharmacopoeia, FEUM takes under consideration the specific

nature and circumstances of the Mexican pharmaceutical industry, which generates needs that are somewhat different to those of other more advanced countries because of economic, technological, social and cultural issues. Therefore, FEUM allows the country to have relative scientific and technological independence in choosing the raw materials and scientific tools to work with. In this context, in the 19th century texts from the Mexican Pharmaceutical Society, there was a clear nationalist motivation to make of the Pharmacopeia an official pharmaceutical code that was inclusive of national plant products that came from the land. This standard changed dramatically in the early 1930's and would remain untouched until the year 2000 when the Mexican Herbal Pharmacopoeia was published. It is so that a new opportunity arises to seriously reassume the systematic study of the plant species of therapeutic interest and make them protagonists of a national plan. At the same, the construction of a national pharmaceutical industry that makes use of these natural products and their derivatives must be supported. This new field would allow the generation of new specialists in professional and academic spaces.

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