AZTEC MEDICINE

by

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THE discovery of America placed the European nations in contact with three major civilizations, the Aztec in the Mexican plateau, the Maya in the Yucatan peninsula, and the Inca in the Peruvian Andes. The Mayas had been settled for centuries in the same area and developed a civilization with high cultural manifestations, whereas the Aztecs and Incas, in spite of their political power and strong resistance to the Spanish conquest, were actually cultural parvenues among pre-Columbian people.

The Aztecs were the most powerful among Mexican nations at the time of Cortés's arrival, and after a long migration from the north, they had settled in Chapultepec—on the shores of the Lake of Texcoco—around A.D. 1267. Historical sources make it possible to trace the evolution of the Aztecs before the European arrival; nevertheless the field of Mexican archaeology is expanding considerably and many ideas are still sufficiently fluid to be subject to correction, as Krickeberg (1961) has pointed out. On the other hand, there is at present a much more critical attitude in the study of American archaeology and its medical aspects.

AZTEC ARCHAEOLOGY

The earliest Mexican civilization to leave traces in the central plateau around 955 B.C. was the Olmec. However, most of the Aztec cultural achievements were inherited from the Toltecs who arrived at Colhuacan in A.D. 908 and founded their capital Tula in 977. The Toltecs left a deep impression not only on other Nahuatl-speaking tribes but even on the Maya territories which they invaded around 999. The Toltecs were remarkable for city planning, a solid architecture with use of caryatids; the introduction of bow and arrow for hunting and combat; the adaptation of nets for individual transport of goods in the absence of beasts of burden; the beginning of copper metallurgy and a variety of other contributions, from the ring used in the Mexican ball game to the warriors' fraternities. The Toltecs were overrun in the Valley of Mexico about A.D. 1172 by the more nomadic and aggressive Chichimecs, and it was after that date that a number of Mexican tribes around the Texcoco Lake, each representing the original migrating stocks, increased their cultural intercourse.

The Aztec legends assert that their people came from a mythical place, Aztlan, or, like other Nahuatl-speaking tribes, from the seven caves in the north, Chicomoztoc. Only after a migration lasting ninety-nine years were the Aztecs able to reach, in 1267, the Lake of Texcoco; however, it was not until 1325 that their capital Tenochtitlan was built, known after the Spanish conquest as Mexico City. The Aztecs remained all those years subject to the Atzcapozalco tribe until their city Tenochtitlan joined in a league with the nearby cities of Texcoco of Chichimec and Tlacopan of Acolhuac stock, obtaining their independence under the leadership of Iztcoatl in 1427. After the death of their leader in 1440, the Aztecs elected King Moctezuma I, a monarch

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who should not be confused with Emperor Moctezuma II, elected in 1503, and who died during the Spanish conquest of Mexico in 1519. Excellent monographs on the Aztecs have been published by Caso (1959) Vaillant (1947) and Soustelle (1961).

The Aztec area in the Valley of Mexico combined the semi-arid lands of the high plateau surrounded by volcanoes and exposed to extreme variations in temperature, with the agricultural lowlands of the lake shores. Their land was divided in hereditary tribal lots *calpulli*, and the cultivation surface was enlarged by floating in the lake artificial plots or *chinampas*. Beasts of burden and the plough were unknown, a long wooden stick *coa* was used instead for breaking the ground and planting; burning the brush was also used to clear the ground for the *milpa*. Their economy was based on the agriculture of temperate climates supplemented by the produce of tropical lowlands such as cotton cloth, feather, gold, cocoa beans—used not only as food but as currency as well—obtained in market exchange or as taxation revenue from subjugated nations. The problem of nutrition among the Aztecs has been discussed thoroughly by Dávalos (1956) in an attempt to disclaim the belief that they were undernourished. The Mexican staple diet was based on maize, beans and chili, therefore being of low protein intake; however, contrary to expectations, the reports of the chronicles did not indicate the existence of any disease due to malnutrition among the Aztecs at the time of the conquest. Although several sources of animal protein were present, turkey *huaxolotl*, hairless dog *itzcuintli*, fish and game, Dávalos (1956) shows that aminoacid analysis of maize and beans when supplemented by tryptophane and tyrosine from *pulque*, a drink obtained after fermentation from agave syrup, could give a balanced though limited diet. However, anthropophagia—around 20,000 captives were sacrificed every year according to most sources—and vermiphagia, *maguey* worms, still eaten today as a Mexican delicacy, have given Aztec nutrition a poor reputation. But Carcer (1953) in an interesting study on the cultural transfer between Spain and Mexico, has pointed out the important contributions of the Mexican cuisine to our diet.

The Aztecs had an astronomical calendar extending over the solar year of three hundred and sixty-five days divided into eighteen months of twenty days each, plus five complementary unlucky days *nemontemi*. In addition there was the astrological or religious calendar *Tonalamatl* of two hundred and sixty days, divided into thirteen months of twenty days, each under a god. The role of the *Tonalamatl* in medical matters cannot be overemphasized, as the fate of the individual, health, disease, its prognosis, length of life, besides profession, trade or plain luck was determined by it. The Aztecs were usually named after their birth day, and their horoscopes established according to astrological predictions. The names of days and months were represented by ideograms. Although the Aztecs did not possess hieroglyphic writing, their pictographic characters or rebus writing reached great perfection and they recorded events, taxation and ideas in beautiful codices made of vegetable paper or deer skin folded like a screen. Writing was also extended to represent mathematical symbols according to a vigesimal system, the units represented by points, twenty by a flag, four hundred by a pine, and eight thousand by a bag. An oral literature of great beauty and sophistication is known to have existed among the Aztecs and other Nahuatl groups. In architecture the civic centres had among the Aztecs the design and

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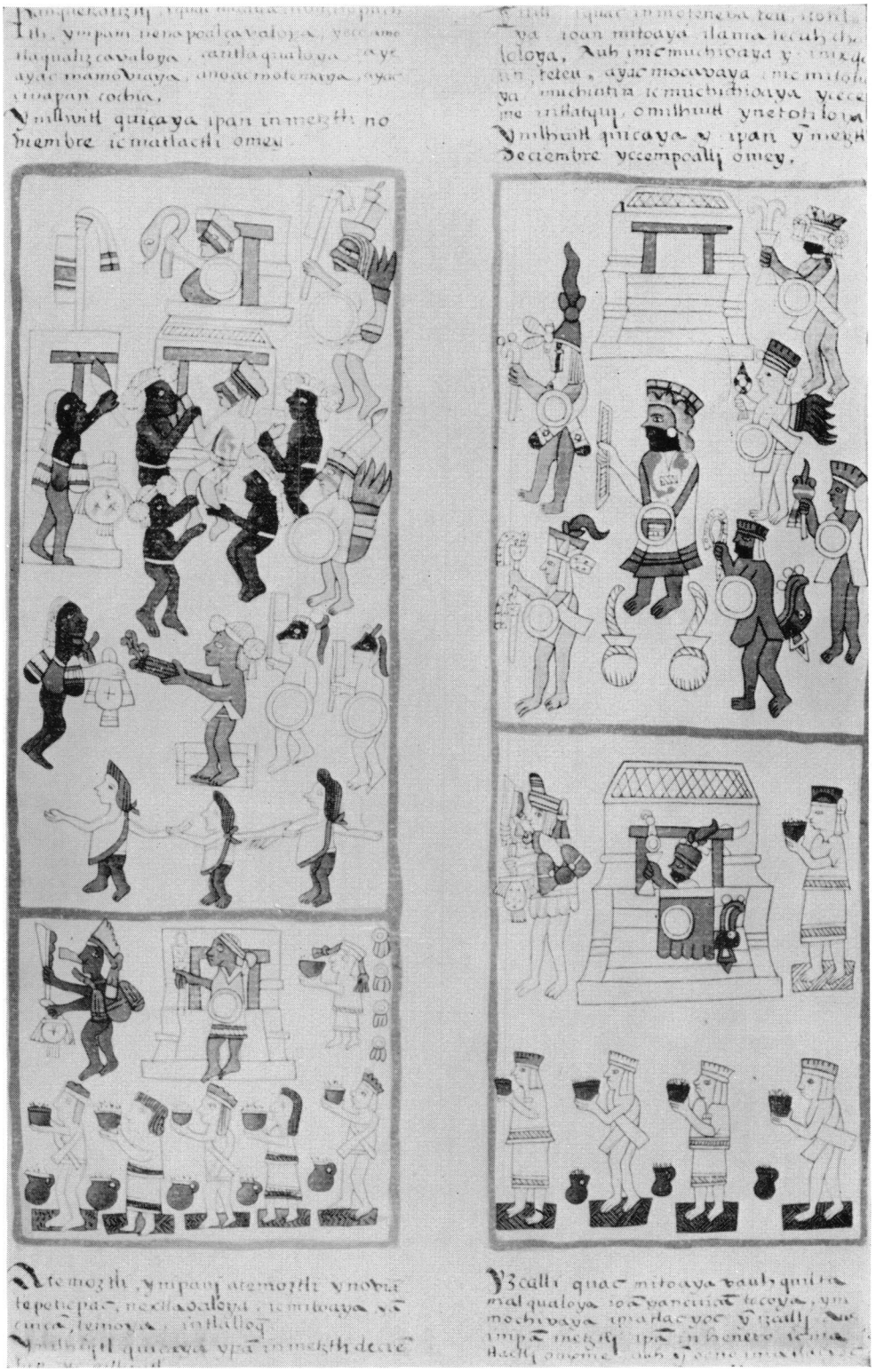

Figure 1. Codex Sahagun, f. 4. Ritual extraction of the heart.

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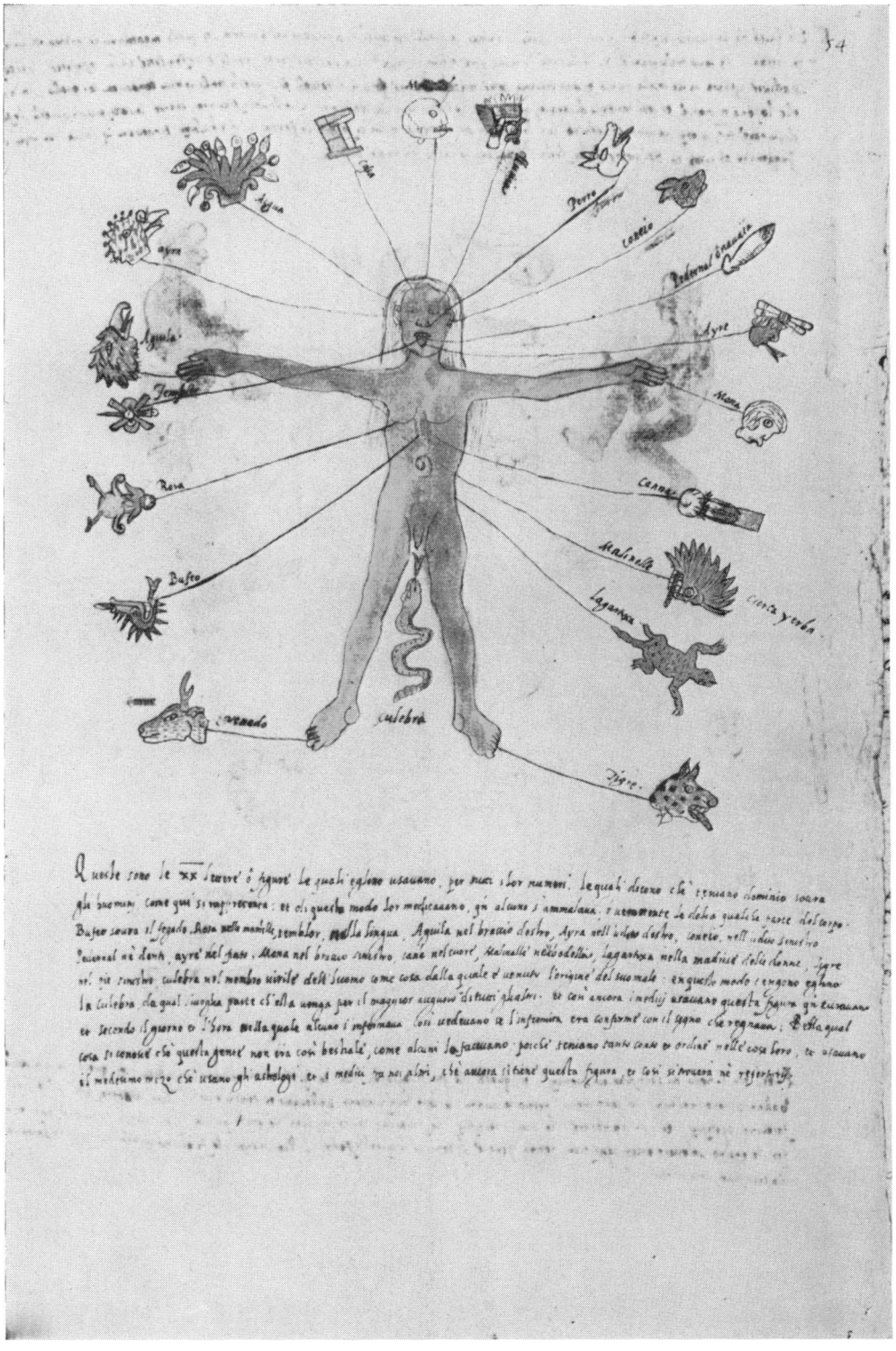

Figure 2. Codex Vaticanus lat. 3738, f. 54. Medical astrology

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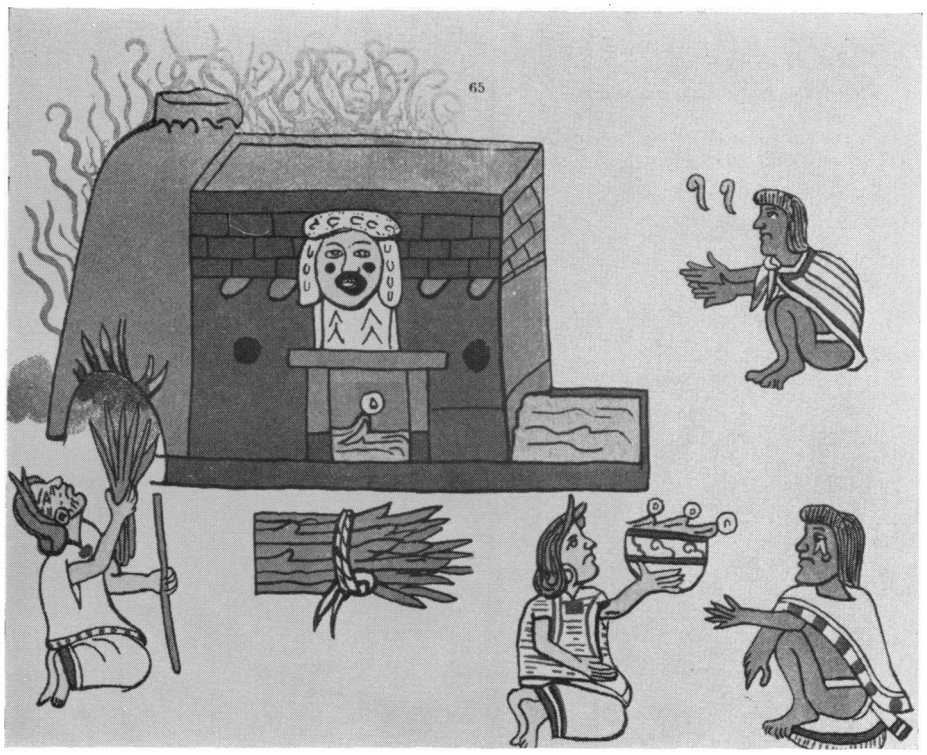

Figure 3. Codex Magliabecchi, f. 77(65). Temazcal, steam bath.

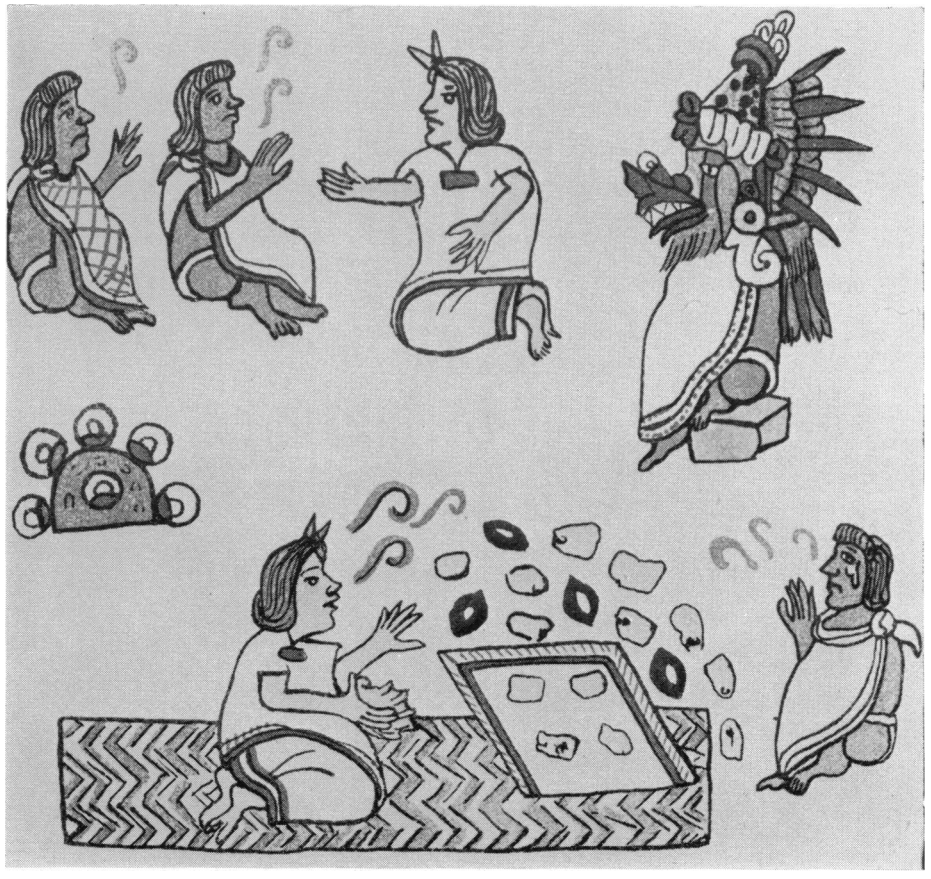

Figure 4. Codex Magliabecchi, f. 78(66). Ticitl, medical diagnosis.

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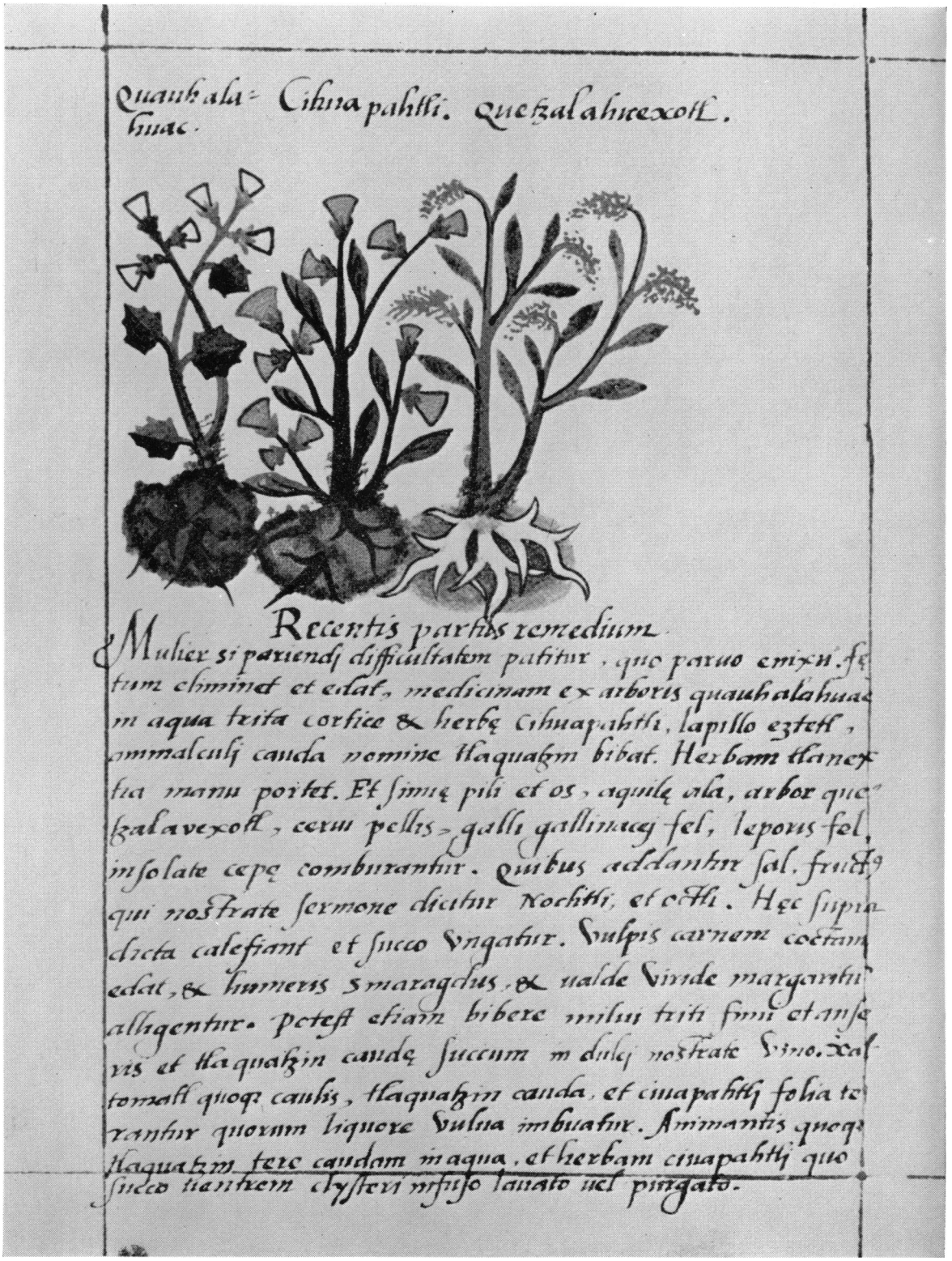

Figure 5. Codex Badianus, f. 57v. Drugs used in parturition.

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character they so much admired in the Toltecs, and at the time of the European arrival their capital Tenochtitlan was the largest and most beautiful in America, with pyramidal temples, streets, water supply and gardens.

MEDICAL SOURCES

Among the historical sources of pre-Columbian civilizations, those pertaining to the Aztecs are probably the most numerous, and some of them provide medical information; but there are two documents, the *Badianus codex* and the *Sahagún codices*, so outstanding in this respect that, up to a point, every study of Aztec medicine must rely on them.

The *Badianus codex* was the work of Martín de la Cruz, an Indian physician, who was a student at the Franciscan Convent of Tlatelolco. The codex has been wrongly named after Juan Badiano, the Mexican scribe and Latin teacher at Tlatelolco who in 1552 prepared the Latin version of the medical information given in Nahuatl by de la Cruz under the title *Libellus de medicinalibus Indorum Herbis*. The original of this manuscript, with beautiful pictographic reproductions of medicinal herbs, was unearthed in the Vatican Library by Clark (1929) and Thorndike (1929); a later copy of the seventeenth century, probably by Cassiano dal Pozzo, exists at the Royal Library, Windsor. Gates (1932) published an English translation soon afterwards superseded by the facsimile edition and study by Emmart (1940); another edition, with a Spanish version and ethnobotanical analysis by Guerra was published in 1952. Unfortunately, the other four illuminated manuscripts on medicinal herbs of the Indies in Philip II's library, described by León Pinelo (1629), are not extant.

The *Sahagún codices* are the group of manuscripts on the Mexicans written by the Franciscan friar, Bernardino de Sahagún O. F. M. (1499–1590), who arrived in Mexico just eight years after the conquest (1529) and devoted the greater part of his long life to writing an exhaustive anthropological study of the Aztecs. His *General History of the things of New Spain* was prepared by obtaining data direct from Indian informants and stands even today as an accurate and reliable work; in point of fact, most of our information on the Aztecs stems from Sahagún's writings. Three manuscript texts have survived of the original study—known by the locality they were written in—which texts complement each other. These were preceded by Sahagún's draft of 1541 at Tehuacan published by Kingsborough (1848) which until now has been ascribed to an anonymous hand. Sahagún wrote at Tepepulco between 1558 and 1560 a first draft of his own work known as *Primeros Memoriales* or *Tepepulco MS.* Its chapter IV *Tlacayotl* (Earthly Things), has an outline of Aztec medical matters in Nahuatl with three sections: No. 5 The external organs of man; No. 6 The interior organs of the body; and No. 9 A list of ailments and their remedies. These sections were recently translated into German and published by von Gall (1940). After Sahagún was transferred to Tlatelolco between 1560 and 1565 a more extended version in Spanish was prepared, a copy of which constitutes the *Codices Matritenses* or *Tlatelolco MS.*; here the medical section was considerably enlarged and takes up Book X, chapters xxvii and xxviii. Curiously enough, Sahagún inserted a religious tract under the anatomical heading of chapter xxvii, omitting the anatomical text, but in chapter xviii he gave an enlarged Spanish version of ailments and remedies.

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When Sahagún moved to Tenochtitlan or Mexico City between 1565 and 1568 another extended Nahuatl version was prepared which is known as the *Florentine Codex* or *Tenochtitlan MS.*, in which the anatomical section takes up chapter xxviii. Translations of both sections into German were also published by von Gall (1940) and in English by Dibble and Anderson (1961) with certain variants. It is most important to mention that there are considerable differences in the text of Book XI, chapter vii on medicinal herbs between the *Tlatelolco* and *Tenochtitlan Mss.* because the informants and their material were entirely different. Notable differences also occur in the text of these MSS. for Book X chapter xxviii.

It becomes clear that the *Tici-amatl* or 'Doctrine for Physicians' mentioned by Torquemada (1615) as an independent work of Sahagún on Aztec medicine is the medical section of chapter iv, No. 5, No. 6, No. 9 in the first draft or *Tepepulco MS.* which became Book X chapters xxvii and xxviii in the much enlarged later versions of the *Tlatelolco* and *Tenochtitlan MSS.* The information gathered by Sahagún differed in certain details according to the localities, but the underlying ideas are the same. At Tepepulco the informants relied on pictographic codices still extant at that time, and in the *Tlatelolco MS.* the scribe recorded the given names of the Indians: Gaspar Mathias, Pedro de Santiago, Francisco Simón, Miguel Damián, Felipe Hernández, Pedro de Requena, Miguel García and Miguel Motolinía . . . 'old physicians of Tlatelolco much experienced in medical matters'. As for the *Tenochtitlan MS.*, Sahagún's medical data [X No. 28] 'was examined by the [Tenochtitlan] Mexican physicians whose names follow': Juan Perez, Pedro Perez, Pedro Hernández, José Hernández, Miguel García, Francisco de la Cruz, Baltasar Juarez and Antonio Martínez. A partial knowledge of Sahagún's medical material had been available since early in the nineteenth century, in the publications by Bustamente (1829–1830) and Lord Kingsborough (1831) of the Spanish version of the *Tlatelolco MS.* There were several editions in Spanish (1890–1895), one facsimile by Francisco del Paso y Troncoso (1905–1908) of great importance; others in Spanish have been published recently (1938 and 1956) besides editions in French (1880), English (1932) and German —this by Seler (1927); but it would seem that the English version from the Nahuatl made by Dibble and Anderson (1950–1963) from the *Florentine codex* or *Tenochtitlan MS.* is the most valuable for medical research, though it contains a number of errors in the transcription and translation.

The *Badianus* and *Sahagún codices* are direct sources from Mexican informants gathered within the framework of the late medieval culture in Europe and deep Catholic indoctrination, as represented by Sahagún's background. The Renaissance interpretation of Mexican biological and medical knowledge was crystallised during Francisco Hernández's expedition (1570–1577), exhaustive for the Mexican area in respect of natural history as applied to medicine but less profound than Sahagún on anthropological matters. The influence of religious beliefs upon medicine may be studied in the 1629 report by Ruiz de Alarcón published in 1892, and to a lesser degree in La Serna's work of 1656. There is another primary course of great importance, unfortunately dispersed among several institutions, namely the historical studies on Aztec science prepared by A. León y Gama (1735–1802) from original pictographic documents and ancient materials.

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Research on semantics, as pointed out elsewhere (1964), may enlarge the avenues of research in pre-Columbian cultures; the recent use of Molina's large Mexican vocabulary (1571) for anatomical terms is just one example. Molina even had in mind its possible use by physicians when he wrote in the prologue, ' . . . it will be difficult for a physician to cure a sore or hidden ailment if he does not know what the patient is saying'. Alonso de Molina O.F.M. (1513–1585), due to his arrival in Mexico (1524) as a child immediately after the conquest and to his upbringing and education with Aztec children, mastered Nahuatl like a native, and when he eventually became a Franciscan friar he published (1555 and 1571) the best contemporary dictionaries ever made. Although in the case of the *Badianus* and *Sahagún codices* it is easy to make an appraisal of the information and the medical tenets of the Aztecs, most of the historical studies so far have relied too heavily on the Nahuatl lexicon, taking for granted that the interpretation by the European mind of a particular Mexican term expressed the same cultural idea. An example of this is Ocaranza's (1936) statement of the Aztec idea of the circulation of the blood, based exclusively on the Nahuatl terms for pulse and heart beat. Mexican literature, furthermore, is extremely rich in ancient chronicles, some of them referring to the medical practices of the Aztecs; in some cases their sources were actual pre-Columbian documents. That apparently was the case with Clavigero's *Ancient History of Mexico* (1780), containing several chapters on medicine, surgery, medical botany and hydrotherapy among the Mexicans which may be read with benefit, and no doubt influenced León y Gama's studies.

Modern studies on Aztec medicine began with Francisco A. Flores (1852–1931) who devoted to this subject the first of his three folio volumes on the *History of Medicine in Mexico* (1886–1888). This colossal doctoral thesis presented, in a well-planned study, most of the material collected by Molina and Sahagún during the sixteenth century, and still retains considerable merit notwithstanding the fact that neither medicine nor historical studies offered in Flores's day the critical techniques of today. Francisco del Paso y Troncoso (1842–1916) published almost simultaneously (1886) a first part of a mature work on medicine among the Nahuatls covering medical botany, but no subsequent parts of this work ever appeared. Other studies published after that date have been condensed versions of the previous works by Flores and del Paso y Troncoso; such is the case of Raffour (1900), Gerste (1909), the excellent synthesis by Ocaranza (1934), and the monograph by Martínez (1934). A bibliography of these and other publications appeared in 1949. Finally, Martínez Cortés (1965) has recently reviewed magic and religious ideas in Aztec medicine, relying heavily upon Sahagún.

MEDICAL HAGIOLOGY

The medical doctrines and practices of the Aztecs were permeated by profound religious elements. The Aztecs believed in the hereafter, with a heaven *Tonatiuh* in the sun reserved for the heroes, another heaven *Tlalocan* on the earth, and the abode of rest, the underworld *Mictlan*, reached by the dead after a dangerous journey. Other religious tenets were the creation of the universe by a god under a dual principle, [*Ome* or] *Tonacatecutli* male and [*Ome* or] *Tonacacihuatl* female, and the rule of

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major gods *Huitzilopochtli* for war, *Tlaloc* for agriculture, *Quetzalcoatl* for wisdom, *Mictlantecutli* for death, besides many others connected directly with medical matters. The mother of the gods, *Teteoinam* or *Toci*, was, according to Sahagún [I No. 8], 'the goddess of medicine and medicinal herbs, worshipped by physicians, surgeons, phlebotomists, midwives and those women using herbs for abortions'. The owners of bathing houses, *temazcalli*, always kept her image in view. The medicinal goddess was *Tzapotlatena* [I No. 9], credited with the discovery of *uxitl* or a pine resin used in rituals. The religious and psychological factors involved in Aztec medicine have been thoroughly discussed by Aguirre (1947) who emphasizes that many characteristics arise from the social structure of the Mexican civilization, their stern discipline, and the ultimate dependence of children upon parents, particularly well depicted in the *Mendoza codex*. The Aztec personality developed, furthermore, according to a complex obedience—reward and disobedience-punishment which created a dependence of the individual on the parents, the tribal leaders and, in particular, on the gods, a fact of great importance in the understanding of their anxieties, *netepalhuiliztli* sickness due to dependence, and their idea of disease. Dietschy (1937) has also expounded the complex sin-disease, because the Aztecs considered sickness the punishment inflicted by their gods for their sins. A close relationship existed between a god and a specific type of disease as far as cause and treatment were concerned. *Tlaloc*, the god of waters, was responsible for rheumatic ailments, the gout and syndromes related to dampness and cold. The same god punished those abusing the drinking of *pulque*, by sending them generalized tremor, delirium, fluxion of the eyes and twisted mouths—a fair description of the final stages and sequels of alcoholism. The *Tlalocs* inhabited mountains and rivers, and presents were offered there by patients to please these gods and obtain relief. *Xipe Totec*, the flayed god [I No. 8], so-called because he was covered by the skin of one of his victims, was responsible for exanthematic diseases, boils, scabies and eye ailments. Patients with exanthema and skin infections used to march in the front of the processions during the god's festivities *tlacaxipehualiztli* in the second Aztec month, also covered with skins from human sacrifices, to appease the god and obtain a cure. *Titlacahuan* [III No. 2] or *Tezcatlipoca*, when displeased by a breach of fasting, vows or sexual behaviour, induced contagious and incurable diseases and buboes. In this respect it may be mentioned that though bitter arguments have been exchanged on the American origin of syphilis, no proper appraisal of the Aztec gods related to that disease has been made. Many were the gods connected with venereal diseases and their number and significance cannot be overlooked because the syndromes given by Sahagún's informants clearly leads to the belief that syphilis-like lesions existed in pre-Columbian America. *Macuilxochitl*, god of pleasures, sent the breakers of his rules diseases of their hidden parts, not only haemorrhoids but boils and buboes and corruption of the penis. *Xochiquetzal*, goddess of love, also sent incurable buboes, scabies and skin exanthemata and other infections.

MEDICAL EDUCATION AND PRACTICE

Aztec medicine enjoyed considerable prestige among Middle American civilizations because it had absorbed many positive contributions from neighbouring areas and

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conquered peoples. However, the medical profession—practised by both men and women alike—did not have the social standing that could be expected as a result of their special training and their religious and astrological associations. *Ticitl* is translated by Molina (1570) not only as the medical practitioner but also as the witch doctor dealing with horoscopes and fortune tellers. Sahagún [X No. 8 and No. 4] placed the male physician on a par with the carpenter, mason and scribe, and classed the female physician with the cook, the seamstress and the spinner, though above the whore. The explanation is quite subtle and from his description of the medical profession for women the reader may infer the reasons for its bad reputation.

Medical art *ticiotl* was believed by the Aztecs to have been developed among the Toltecs by four wise men, *Oxomoco*, *Cipactonal*, *Tlatetecui* and *Xochicaoaca*. Sahagún also recorded [X No. 39] that these scholars knew the nature and qualities of herbs, which were good, bad, harmful, deadly or medicinal; in addition these Toltec men of science had developed the astronomical calendar *Tonalamatl*, were familiar with the influence of the stars upon the body and were able to interpret dreams. These two elements, one attached to medical botany and the other supernatural, shaped Aztec medicine.

There were among the Aztecs the *tepatiani* or *ticitl*, physicians experienced in diseases occurring in a particular locality, who examined the patient and applied remedies or administered medicinal herbs in the treatment; others were *nahualli*, physicians who used horoscopes, predictions and religious ceremonies, in addition to secret ingredients for a cure. Most historians have mentioned that a degree of specialization existed in the Aztec medical profession, the surgeon *tetecqui* or *texoxotla ticitl*, the phlebotomist *tezoc* or *teximani*, the midwife *tlamatqui* or *temixintiani ticitl*, and the apothecary *papiani* or *panamacani*; omitted until now has been a practitioner mentioned by Molina (1571) who was devoted to the curing of turkeys *totolpixqui*.

The Aztec concept of the scientist overlaps in Sahagún's MSS. [X No. 8] with that of a physician, therefore the education and professional practice in both cases must have been extremely close. The loftiness of the ethical values expressed by the Mexican informants indeed deserves to be quoted; due to literary variants between Sahagún's Castilian and Nahuatl versions an amalgamation of their concept is advisable. For the Aztecs,

> . . . the wise man or scholar *tlamatini* is exemplary, like a beacon, a shining mirror, learned, well-read, keeper of books, bearer of tradition and responsibility, a guide. A good scientist is like a good physician, who takes good care of things, he is a counsellor, a teacher of the true doctrine, worthy of confidence, a confessor, reliable. He shows the way, establishes order, he knows about the land of the dead, he is dignified, unreviled, confided in and trusted, he is very congenial, reassures, calms, helps, satisfies, gives hope, favours with his knowledge, he makes one whole. A bad scientist is a stupid physician, silly and vain, pretending to be trustworthy and wise, he is a sorcerer, soothsayer, a deluder, a deceiver, a public robber, he confounds, causes ills, leads into evil, destroys people and kills.
>
> The physician *ticitl* is a curer of people, a restorer and provider of health. A good physician is a diagnostician, experienced and well versed in the virtues of herbs, stones, trees and roots. He is moderate in his acts, cures people by setting bones, providing splints, knows how to purge and to give emetics and potions, he knows how to bleed, he stitches wounds, makes incisions and revives the sick. A bad physician is a fraud, a half-hearted worker, unskilled, a killer with his medicines because of overdosage, he worsens the condition of the sick, endangers others'

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lives, he pretends to be a counsellor, adviser and chaste. He bewitches, is a sorcerer, a soothsayer, a caster of lots, he seduces women and bewitches them.

Sahagún's texts [X No. 14] on the women physicians differ in the Castilian and Nahuatl versions, the latter being more extensive:

A woman physician is knowledgeable in herbs, roots, trees and stones; she has experience in them. She can make prognoses and can be trusted because of her professional skill. The good woman physician restores and provides health, revives and relaxes, makes people feel well, covers one with ashes. She can cure people, she lances them, bleeds them in various places with the lancet. She gives potions, purges and medicines. She cures disorders of the anus. She anoints them, rubs, massages, provides splints, sets their bones, makes incisions, she treats festerings, gout, and cuts the growth from the eye. A bad woman physician pretends to have professional knowledge. She has a friction-loving vulva. She does evil, bewitches, makes drink potions, kills people with drugs, endangers the sick. She deceives people, seduces them, perverts them, blows evil upon them, removes objects from them, sees their fate in water, reads their fate with cords, casts lots with grains of maize, draws worms from their teeth. She draws paper, stones, worms from them.

It is difficult to understand how this ethical doctrine has escaped being quoted by Flores (1886), Ocaranza (1943) and Vargas Castelazo (1956) in their eulogies on Aztec medicine when the Sahagún records were already printed and widely known; only León Portilla (1963) has expounded these concepts with philosophical insight.

Flores (1886), followed by Ocaranza (1934), has quoted Alva Ixtlixochitl chronicles asserting that the Chichimecs at Texcoco, like the Aztecs at Tenochtitlan, required the medical practitioner to pass an examination and obtain permission to practice from one of the four Councils of Government. However, no statement of this nature can be found, and Alva Ixtlixochitl [chapters xxxvi and xxxviii], writing in the sixteenth century, mentions only that during the reign of his ancestor, Emperor Netzahualcoyotl, a Council of wise men watched over witchcraft. On the other hand Sahagún [X No. 39], though crediting the Chichimecs with a broad knowledge of medicinal herbs, mentions that when one of them was sick and showed no sign of recovery after three days they would kill him by shooting an arrow through the throat.

The internal evidence in Aztec primary sources points to a medical training by apprenticeship, mainly within the family tradition, and whole families were devoted to this art; the roles of the scholar *tlamatini* and the teacher *temachtiani* must have been similar. The specialized knowledge of the astronomical calendar and prognostication in some cases, or the identification of medicinal herbs, their use and application, and the training in some surgical interventions was passed on to the student *momachti*, usually by his father who was the scholar and the teacher. According to Clavigero (1780) training began very early in life and men started to practise much younger than women; the latter engaged in medicine only after the menopause when they were not subject to menstruation or parturition, these being considered as bodily impurities.

ANATOMY AND PHYSIOLOGY

Flores (1886) was the first historian to deal with the anatomical lexicon of the Aztecs, and his text has been followed by Ocaranza (1934) and Vargas Castelazo (1956). Martín del Campo (1956) has been critical of the preceding works and of the

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Spanish chronicles which gathered the Mexican information after the conquest, but he himself, ignoring Sahagún's anatomical lexicon in the *Tepepulco MS.* and the more extended version in the *Florentine codex*, turned to another Spanish source, the Mexican-Spanish dictionary by Molina (1571). However, it should be remembered that Molina compiled only a fraction of the anatomical terminology collected by Sahagún.

The anatomical terminology of the Aztecs, showing a detailed nomenclature and knowledge of the exterior and much less of the interior parts of the human body, seems to have been the result of the extensive practice of human sacrifice by the priests *teopixquis*. The extraction of the heart and flaying of the victim with the distribution of parts of the body after cutting in pieces and carving for the ritual banquet, made the priest and communicants familiar with muscles, joints, bones, arteries, and veins, and the main viscera. As a reminder of this it could be mentioned that at the coronation of Moctezuma II, shortly before the Spanish conquest, five thousand Otomí captives were sacrificed. The number of human bones piled up in the *Huetzompan* or skull depository of the great temple at Tenochtitlan was considerable. Tezozomoc (*c.* 1598) mentioning over sixty-two thousand skulls.

A collation of the three main original sources, Sahagún's *Tepepulco* and *Tenochtitlan MSS.* as studied by von Gall (1940) and Dibble and Anderson (1961), and the terms in Molina's large vocabulary (1571) selected by Martín del Campo (1956), shows that there is an abundance of Nahuatl names for the external parts of the body, but the nomenclature for internal parts is poor. In referring to the human body, the term—wrote Molina (1571)—was preceded by the possessive pronoun *to* meaning our, and when this prefix was omitted it indicated the same term for an animal. The *Tepepulco MS.* by Sahagún contains fifty-four main terms for the exterior parts of man and only seventeen for interior organs, a figure similar to Molina's; however, in the *Tenochtitlan MS.* the anatomical lexicon of Sahagún, as collated by von Gall (1940) and Dibble and Anderson (1961) with indications of variable characters in the appearance and texture of the organs, the colossal number of almost four thousand is reached; this makes Martín del Campo's statement groundless. It is also pertinent to correct an error common to all writers dealing with this subject, that is, claiming on occasion the existence of several Nahuatl names for the same Castilian synonym. This is the result of the variants given by the different informants at Tepepulco, Tlatelolco and Tenochtitlan for Sahagún, and practically the same localities for Molina; Chichimec Nahuatl was spoken in Tepepulco whereas in Tenochtitlan the language was Aztec Nahuatl, and Molina (1571) makes a point of it. There are appreciable differences in the Nahuatl terms for anatomical parts depending on the source utilized, Molina or Sahagún, and even between the manuscript versions of the latter. Discrepancies in Nahuatl spelling between von Gall (1940) and Dibble and Anderson (1961) are also noticeable. Examples of the anatomical lexicon in Nahuatl are as follows: skin *coatl*, flesh *nacatl*, fat *suchiotl*, hair *tzontli*, bone *yaoquizque*, joint *toniltecca*. The parts of the body were, head *tzontecomatl*, neck *toquechtla*, thorax *elpantli*, abdomen *ititl* or *xilantli*, leg *icxitl*. In the head, the occiput *tocuezco*, forehead *ixquatl*, face *ixtli*, eyelid *ixquatolli*, eyebrow *ixquamolli*, orbit *ixcallocantli*, eye *ixtelolotli*, pupil *tixtotouh*, nose *iacatl*, nostrils *iatomolli*, mouth *camatl*, lip *tentli*, palate *copactli*, tongue *nenepilli*, tooth *tlantli*, molar *tlancochtli*, chin *tenchalli*, ear

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nacaztli. In the neck, oesophagus *cocotl*, windpipe *cocotl*, gullet *tlatolhoaztli*. In the arm, shoulder *aculli*, armpit *ciacatl*, forearm *matzotzopaztli*, elbow *molicpitl*, wrist *maquechtlantli*, hand *macpalli*, *maitl*, finger *mapilli*. In the chest, torso *tlactli*, breast *chichioallic*, rib *omicicuilli*, sternum *eltepicicitl*, lungs *tomimiaoaio*. In the abdomen, waist *topitzaoaia*, loins *tomimiluihca*, spine *cuitlatetepontli*, hip *tocuitlaxaiac*, navel *xictli*, buttocks *tzintli*, anus *tzincamactli*, penis *tepolli*, vulva *tepilli*. In the leg, crotch *maxactli*, groin *quexilli*, thigh *metztli*, knee *tlanquaitl*, calf *cotztetl*, shank *tlanitztli*, ankle *xoquechtlantli*, foot *xocpalli*, heel *quequetzolli*, toe *xepilli*. Other parts of our anatomy were, skull *quaxicalli*, brain *quatextli*, heart *yoyollotli*, liver *eltapachtli*, testis *cuitlapanatetl*, stomach *totlatlaliaia*, intestine *cuitlaxculli*, womb *conexiquipilli*, uterus *cioatl*, bladder *axixtecomatl*, blood *eztli*, blood vessel *ezcocotli*, nerve *toaloatl*.

INTERNAL MEDICINE

The repeated observation of disease among the Aztecs led to a pathology made up of a collection of symptoms and regional syndromes. The primary sources do not offer any all-embracing theory nor a mechanism of disease such as the humoral pathology so prevalent among the Europeans of those days. Disease, particularly those of a serious nature, were thought to be sent by the gods as a punishment for sin, occasionally it was believed that they had been induced by enemies, and only in certain instances were natural causes given as the true origin of a disease.

The description of ailments in the *Sahagún* and *Badianus codices* follows the characteristic medieval order, *de capite ad pedem*, which groups under the same heading pathological entities of the most opposite etiology. For instance, dandruff appears next to fractures of the skull among head ailments, the anatomical arrangement indicating that there was no clear idea about the cause and mechanism of disease, at least in the case of the compilers, which has led Aguirre Beltran (1963) to believe that both sources show traces of European influence. There is a definite idea of the pathological nature of some excretions, ' . . . the rottenness, the filth, which issues from the body' in the *Tlatelolco MS*. [No. 27 (14)] which includes not just the excrement *cuitlatl*, but diarrheic evacuation *apitzalli*, flux *tlahelli*. bloody flux *eztlahelli*, purulent flux *iztac tlahelli*, rheum of the eye *ixcuitlatl*, mucus of the throat *tozcaiacacuitlatl*, dental tartar *tlancuitlatl*, coated tongue *nenepiltextli*, smegma *teoplquatextli*, urethral secretion *tepoltemalacatl*, pyuria *temalaxixtli*, hematuria *eztlaxixtli*, phlegm *alaoac*, pus *temalli*, humour *tzonqualactli*. Nahuatl terms for pathological secretions are formed by joining the organ word to that denoting their aspect or nature, i.e. *temalli* for purulent or *eztli* for bloody.

The process of diagnosis among the Aztecs included the professional gift in identifying the pathological syndrome of the patient together with the supernatural influences affecting his case. The latter was the result of the religious concept of disease, and therefore involved practices related to horoscopy as much as religious ceremonies alongside sound medical exploration. Pre-Columbian codices portray a human figure showing the influence of certain signs upon specific parts of the body. This idea of supernatural influences upon the human being was not exclusive to the Mexican Indians, but was such a common element in medieval medical literature that astrological influences, as depicted in the Zodiac signs and their relation to phlebotomy and

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prognosis, are still currently favoured by a considerable public. The glyph for *cipactli* alligator, earth symbol, is related to the liver, *ehecatl* wind to the lungs, *calli* house to the right eye, *cuetzpallin* lizard to the buttock, *coatl* serpent to the reproductive organs, *miquiztli* death to the head, *mazatl* deer to the right leg, *tochtli* rabbit to the left ear, *atl* water to the hair, *itzcuintli* dog to the nose, *ozomatli* monkey to the left arm, *malinalli* a twisted herb to the intestine, *acatl* reed to the heart, *ocelotl* jaguar to the left leg, *cuauhtli* eagle to the right arm, *cozcacuauhtli* vulture to the right ear, *ollin* sign of movement to the tongue, *tecpatl* flintstone to the teeth, *quiahuitl* rain to the left eye, and *xochitl* flower to the breasts.

The magic element in diagnosis has been clearly described by Sahagún [X No. 14] and La Serna, and even the *Magliabecchi codex* depicts the procedure carried out by the *nahualli*. Certain female physicians used shells *ticicaxil* for this purpose, others threw grains of maize into a pot filled with water and gave a bad prognosis if the corn dispersed in the water, a good one if they remained grouped together. La Serna (1656) mentioned a variant of the ceremony by using nineteen or twenty-five grains—always an odd number—and watching the way in which the grains fell when thrown on a solid surface. The prognosis was favourable if they were grouped in lines or if they stood on end. Sahagún also mentioned a trial by knot in which a knotted rope was stretched tight, if the knot became undone of its own accord the patient would recover. As in other cultures the hoot of the owl *tecolotl* was a bad omen. Furthermore Ruiz Alarcón (1629), among others, described in detail the use of hallucinogenic plants such as *ololiuhqui* and *peyotl* in order to ascertain the cause of the disease and its prognosis, or to point out the person or evil influence responsible for the ailment, a practice which has lasted until the present day.

Both the Sahagún MSS. and Molina's lexicon offer several instances of medical practice, including the initial question in a case history: Where are you having pain? *Campa ymmitz cocoa*? to the point of prognosis. Fatal prognosis—quoted by Molina (1571) *nite ixnauatia*, a patient beyond recovery—constitutes one of the finest pages in the *Badianus codex* [13], very much in the best Hippocratic tradition, as pointed out elsewhere (1952).

> The wise physician foretells from the eyes and nostrils of the sick man whether he is going to live or die. According to his prognosis, if the eyes are bloodshot it is doubtless an indication of life, if they are pale and bloodless recovery is uncertain. The signs of death are a certain sooty colour found in the middle of the eyes, the top of the head becoming cold or contracting and depressing, the eyes darkening and losing their brightness, the nose appearing thin and pointed like a rod, the jaws becoming rigid, the tongue cold, the teeth dusty with tartar and incapable of movement or of opening. The clenching of the teeth and the flowing of dark or very pale blood after incision are the warnings of approaching death. In addition, the face turning livid or ashen or its expression changing constantly. Finally if he should roll about and unintelligible words pour from him, such as a parrot would utter.

SURGERY

Surgical practice among the Aztecs has been highly praised by Flores (1886), through Ocaranza (1934), after using Flores's material freely, has shown the considerable limitations of a practice without proper pathological basis, or adequate control of haemorrhage or infection. Flores's main evidence seems to have been the Nahuatl lexicon taken from Molina (1571) which indicated at least a certain degree

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of surgical specialization: *texoxotla ticitl* general surgeon, *tezoc* or *tezoani* phlebotomist, *texiuhqui* or *teximani* barber surgeon, *tezalo* or *teomiquetzani* bone surgeon, *tlacopinaliztli* dentist, and *teixpati* eye surgeon. In a short monograph on Aztec surgery prior to the Spanish conquest, Ocaranza (1936) has offered chapters on hagiology and some surgical treatments, but a survey of the sources shows the Aztecs to have had a rational approach only in respect of dental ailments, wounds, luxations and fractures. Their technical ability resided in a fair knowledge of external anatomy, little internal anatomy, practically no physiopathology, and a few flint and obsidian instruments, knives *iztli*, lancets *tecouani*, suture materials made of human hair *tzontli* or vegetable fibres from *metl*, and needles made of human or animal bone.

The Aztecs appear closer to our ideas in dental techniques, described by both the *Sahagún* [X No. 28] and the *Badianus codices* in similar contexts, and studied at length by Fastlicht (1950). Rinsing the teeth with water was recommended after every repast and also the removal of food particles or foreign substances between the teeth by means of thorns or small toothpicks *netlancuicuiuani*. The cleaning and brushing of the teeth was done with a dentifrice made of ashes, acting as a gentle abrasive, and white honey which was applied with a root *tlatlauhcapatli* serving as a brush. The tartar was removed by the use of charcoal in salted water, or a mixture of salt, alum, chili and cochineal. Swollen and abscessed gums were pierced with thorns and scarified, cleansing them of pus; a magic element was somehow introduced into this rational procedure by the use of a dead man's tooth for that purpose. Decayed teeth were treated locally by certain vegetable juices but there is no record of cavity drilling in dental caries, though the Aztecs made excellent use of dental drills and cements for ornamental inlays of gold and semi-precious stones. In odontalgia with caries extraction was recommended and salt applied to the bleeding gum afterwards.

In the treatment of burns the affected surface was treated with a poultice made of *nopal*, *teamoxtli*, *texiyotl* and other plants, their sap blended with honey and the yolk of egg which gave a binding texture to the plaster and protected natural healing. A similar idea existed in the treatment of wounds; the wound lips were first sewn with hair by interrupted suture and the stitches covered by a dressing made of warm *metl* sap and other ingredients which was repeatedly changed if inflammation occurred, but no change was made in the dressing if healing proceeded satisfactorily. In the case of nasal wounds, when the organ was cut off and suture failed, Sahagún's text recommended the application of a prosthesis made of convenient materials, to cover the fault. No record of other prosthesis is mentioned. This source also leaves the impression that a vague idea existed among the Aztecs in respect of primary and secondary wound healings and of the advantages of their occlusive treatment by application of latex *ulli* to form an adhesive dressing, '. . . quickly wrapped in order that the air will not enter [the wound after suture] and healing may proceed in that way'. *Ulli* was used with similar purpose in the treatment of keloids by previous scarification and burning of the deformed scars. The type of stitch used by the Mexicans was the interrupted suture, examples of it may still be seen in the *Xipe totec* sculptures and drawings, depicting how a flayed human skin was sewn over another person to cover and cure skin diseases.

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In the treatment of pterygium the Aztecs show understanding of conjunctival growth, and dissected with a long thorn from *metl* the fleshy part from the eyeball and, once isolated, the growth was cut off; some drops of woman's milk with the juice of *chichicaquilitl* or an infusion of *iztalquiltic* were applied to the eye to prevent further conjunctival growth. However, in the treatment of corneal opacities, cataracts and other ocular complaints the Aztecs resorted to scatological procedures which were bound to produce violent infections and accounted for a considerable amount of blindness.

Tumours, independently of their nature, were treated in a similar manner. A knee swelling, probably due to synovial fluid, was sectioned, unfortunately, with a lancet and a poultice of *toloa* was applied to the joint. A similar procedure was followed in purulent abscesses of the breast and the enlargement of lymphatic glands either in the neck or in the groin, and poultices made of the herbs *chichicquahuitl*, *yapaxihuitl* and *itzcuinpatli* were applied to the wound after sanies had been removed.

The *Sahagún codex* [X No. 28] deals twice with fractures and luxations and offers a separate section on 'the setting of broken bones', but the *Badianus codex* [No. 1] refers only to the fractures of the skull and the drugs used in their wounds. The mechanical cause of luxations and fractures and the aesthetic, functional, and pathological changes brought about in the joints and the bones were readily apparent to the Aztec surgeons who followed a logical treatment aimed at the restoration of the limb shape and function. In dislocated joints the part affected was first pressed, then stretched, and afterwards a poultice made of the herb *cococpatli* and fine charcoal was applied. If the limb became too inflamed, bleeding was advised to avoid excessive swelling. In the case of a wrenched neck, as in torticollis, the neck muscles were massaged, relaxed and straightened; a drink made of *coaxihuitl* was prescribed 'to cool the blood', and the patient was bled in the veins of the neck.

Whatever the location of a fracture the outline in treatment was to press the area, stretch the bone to its original length and position, and join its broken ends; then a poultice made of pulverized *cacacili* root was applied to the surface of the fracture. Indeed a certain degree of sound observation existed in the Aztec treatment of fractures because immobilization was recommended, using wooden splints pressed and bound tightly around the fracture with cords; the Sahagún *Florentine codex* even carries some colour drawings of how to perform this technique. The immobilization period recommended was only twenty days, an Aztec month, which probably nowadays would be considered too short to promote a solid callus and bone healing for certain leg fractures. However, some scatological compounds when applied to open fractures, bleeding a closed fracture, or certain surgical manipulation of the affected area could not improve the fracture prognosis. There is mention of the powder of the herb *xipetziuh* mixed with the root *iztac zazatic* applied locally in fractures of the spine and ribs, or hot baths, but more important was the use of obsidian knives to perform periosteotomies in the exposed fractures or the heroic measure of foreign grafting in the bone by the application of a very resinous stick to be inserted within the bone, bound inside the incision and covered after suture with the vegetable remedies mentioned. Farill (1952) has touched slightly on this technique of intramedullary fixation and reproduced some cases of club-foot deformities portrayed in frescoes in

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Teotihuacan. Freeman (1924) and others (1961) have reported evidence of cranial trepanation among the Aztecs but occurring with less frequency than among the Incas.

Closely related to surgical practice were the human mutilations performed among the Aztecs as a result of religious ceremonials or military and social standing. Their type and extent have been surveyed by Dávalos and Romano (1956), who find cranial deformation by progressive flattening from childhood, pressing the forehead and occiput of the infant between two pieces of wood, more frequent than the cylindrical deformation obtained by bandaging the same area in the child. Fastlicht and Romero (1951) have published a detailed study of dental mutilation among the Mexicans which developed precisely in the Aztec area and spread among other groups. The upper incisors were usually filed to offer a sawing edge, or drilled and inlaid by jade, turquoise or gold. The ear lobe, the septum and nose wall, and the lower lip were also frequently perforated and jade, turquoise or gold pieces inserted. For these purposes, and ritual sacrifice, a certain degree of vascular control was necessary.

OBSTETRICS

Mexican obstetrics have been the subject of an excellent study by León (1910) who surveyed in detail the available sources of information known in his day, particularly the *Sahagún codices*. In them can be found quotations pertaining to the folklore of Aztec marriage and childbirth [VI Nos. 24 to 38] which have also been used by Flores (1886) and Ocaranza (1934). León (1910) mentions that women of quality were married between fourteen and sixteen years of age, and among the common people even earlier; other writers give twenty as the usual age for the woman's marriage. The midwife *tlamatqui ticitl* seems to have been one of the four old wives who carried the bride in the marriage ceremony. As soon as the pregnancy was announced there was an exchange of long-winded and elaborate speeches between the family, midwife and the expectant mother—*ichpuchpihua* if it were her first pregnancy—expressing the joy and reverence her condition demanded. It was customary for the pregnant woman to have, besides the usual cleansing baths, two ritual bathing sessions at the *temazcalli* or steam house, one around four months after conception and the other two months prior to her delivery. The *Sahagún codex* asserts that in the latter the midwife ascertained the position of the foetus by abdominal exploration, and if necessary she carried out an abdominal version by external manipulation aimed at securing a normal delivery.

Pregnancy, as in other civilizations, was a topic of curious beliefs, and the women were advised not to warm the abdomen to excess by getting near the fire or by exposure to the sun because that could 'toast' the child; napping during the day could deform the child's face, and chewing *tzictli* or chewing-gum would induce in the child hardening of the palate and gums with consequent suckling difficulties. The midwife also advised sexual moderation in the early months of pregnancy to avoid miscarriage, and abstinence at the final stages, but at the same time they believed that lack of sexual activity with the husband would produce sickly and weak children. To look at something red would induce an abnormal podalic or shoulder presentation of the foetus, to look at a man who had been hanged would induce intrauterine strangulation of

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the foetus by the umbilical cord, and to deny the pregnant woman her whims would mean damaging the child. Sound commonsense advice about good food, gentle exercise and work is found in the primary sources, also avoidance of food taste perversion because it is hinted that whatever the future mother eats becomes part of the child; but the fact remains that the Mexican expectant mother continued her pregnancy under considerable hardships with regard to work and food. It was part of the midwife's duty to stay with the pregnant woman during the days immediately preceding parturition, to start the fire which lasted four days after, cleanse and bathe the patient and be in attendance as soon as the pains started. León (1920) holds the opinion, based on the archaeological evidence of some sculptures and the scenes depicted in *Codex Nuttall* and *Codex Borbonicus*, that the Aztec woman adopted a squatting position during parturition. The *Sahagún* [VI Nos. 27 and 30, and XI No. 5] and *Badianus* [XI] *codices* recommended the stimulation of labour by several drugs; some, such as a potion made of opossum tail *tlacuatzin*, were magic elements, but others such as the *cihuapatli* infusion have been confirmed experimentally to possess oxytocic action. After parturition a number of ceremonies were carried out by the midwife. She first cut the umbilical cord and, if the child were a boy, gave the placenta to a soldier to be buried on the battlefield, or, if a girl, she buried the placenta near the fireplace. Afterwards she bathed mother and child and attended to the baptism of the child, a ritual very similar to the Christian ceremony. Within four days the child was given a name, usually that of his birthday, but for the unlucky days of the Aztec calendar and on certain occasions the name of an outstanding event occurring on his birthday, for example a comet, was selected. The horoscope of the child was of great importance and also certain beliefs about twins *coatl* and triple childbirth *tenamatzin*, which announced the imminent death of one of the parents. Visitors to the new-born child used to rub its bones and joints with ashes with the idea of promoting strong bone structure.

But underneath all these folk practices the primary sources indicate the keen clinical observations of the Aztec midwife. She recognized the great value of preserving the amnion intact during labour in order to obtain smooth and progressive dilation of the cervix and delivery with the minimum of trauma. As Sahagún points out, only a clumsy midwife allowed a premature breaking of the amnion. The same author [VI Nos. 27 and 28] mentions that embriotomy of the dead foetus was performed by Mexican midwives: 'The midwife well experienced and knowledgeable in her craft, as soon as she realized the foetus was dead in the mother's womb because there was no movement and the mother was in great distress, readily inserted her hand through the channel of generation and with an obsidian knife cut the body of the creature and took it out in pieces'. For this operation the consent of the patient's parents was required, otherwise the suffering woman was left alone to die and was regarded very highly as a goddess *ciaopipiltin* in the hereafter. There is a section [VI No. 27] in which certain gynaecological diseases are clearly described. The secretion of a purulent exudate of the vagina, '. . . like white atolli . . .', after sexual intercourse late in the pregnancy is given as the cause of uterine infections and puerperal fever leading to the death of the mother.

Women's sterility, as in other civilizations where agricultural labour was supplied

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by the children of the family, was regarded with aversion and barren wives *tetzacotl* were easily divorced; Juan Bautista (1600) mentions a medicine *tlanechicolli* used to promote pregnancy. However, this author, as well as Sahagún (1565), López de Gomara (1551) and several others indicate that induced abortions were quite common and carried out by some women with special knowledge of herbs and manipulation for that purpose. Nursing of the child went on for over three years, the *codices Fejervary-Mayer* and *Mendoza* [58] portraying interesting examples of it and of pediatric practices, but it should be borne in mind that the Aztecs lacked domestic animals, providers of milk.

EPIDEMIOLOGY

Pre-Columbian records suggest that the early Mexican migration from the north in the year *ce acatl* (A.D. 583) was not entirely due to famine but to epidemics; furthermore, León (1919) has pointed out Toltec chronicles indicating that the fall of the Tula kingdom in the year *ce tecpatl* (A.D.1116) immediately preceding the Aztec hegemony, was also due to epidemic disease. Notwithstanding the slow progress in pre-Columbian hieroglyphic interpretation, any identification of diseases in the American codices, however, fragmentary has momentous consequences in the history of epidemiology. It was pointed out (1964) that evidence of Aztec pre-Columbian epidemics are found in three Mixtec and Cholultec codices. The *Selden codex* (Roll A^2) depicts two years of disease with blood vomit and death in section 18, the *Borgia codex* depicts another cycle of one with blood vomit, diarrhoea and melaena in section 13, and the *Vatican codex* B3773 also includes bad omens with blood vomit in section 18; all three, therefore, give data in favour of yellow fever epidemics in the Aztec area. Jarcho (1964) has surveyed other sources complementing this data, describing excavations with gummatous and proliferative periostitis which are sufficient proof of syphilis in pre-Columbian times, and American fossils of certain anthropods supporting the existence of vectors for certain *Rickettsia*, although he is in doubt about evidence for vectors of malaria and yellow fever. On the other hand, Bruce-Chwatt (1965) has discussed in detail the arguments favouring the existence of malaria in America prior to European arrivals, including Molina's (1570) word *uiptlatica atonauiztli* fever with shivering which Flores (1886) previously identified with tertian fever.

Aztec epidemiology revolves around two aboriginal entities of considerable importance in population movements: the *matlazahuatl* and the *cocolitztli*. Documentary analysis leaves no doubt they were the great killers of the Aztec in pre-Columbian times, though after the Spanish arrival exposure to new diseases, smallpox, influenza, measles and, much later, cholera, overshadowed the persistent Indian mortality by these endemic infectious diseases. The identification of both terms *matlazahuatl* and *cocolitztli* has baffled historians so far and marred many otherwise important works.

In Nahuatl language *matlazahuatl* may be derived from *matlatl* net or *matlali* bluish, and *zahuatl* exanthema or boil. *Cocolitztli* however, seems to be a much more generic name and has been translated by Molina (1571) and others as pestilence or a severe widespread disease. Shortly after the Spanish conquest of Mexico in 1519 the descriptions of a pyrexia lasting from one to two weeks, with nose bleeding,

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severe prostration, headache, rash, sphacelus and mental disturbances, characteristic of *matlazahuatl* epidemics, were identified by the arriving Spaniards with the synonym of *tabardillo* or *tabardete*, the traditional Castilian name for exanthematic typhus. The confusion existing until now in historical literature has been in great part due to the similarity between the incubation period of exanthematic typhus and typhoid fevers, and the comparatively recent identification of *Rickettsia* and *Salmonella* as the corresponding pathogenic agents. The semantic analysis of *matlazahuatl* could be stretched to favour typhoid fever by rendering *matlatl* into Spanish not as net *red* but *redaño*, used by Cabrera Quintero (1746), which means not only net but was also the Spanish archaic anatomical name for omentum; this elaborated translation of *matlazahuatl*, as omentum or viscera with boils, comes close to describing the morbid anatomy observed in typhoid fever autopsies. But additional arguments favouring *matlazahuatl* as typhus and *cocoliztli* as a general term for pestilence may be obtained from early clinical accounts and several epidemiological factors. Both *matlazahuatl* and *cocoliztli*, whatever their nature, existed before the European arrival, the terms and the records speak for themselves. These epidemic diseases spread over Moctezuma's empire, which nowadays corresponds roughly with the geographical distribution of the American spotted fevers, including the exanthematic louse-borne typhus and their vectors. The contemporary accounts always agreed on the high mortality of the epidemics which, if they had been typhus and other *Rickettsia* infections, could reach up to 70% of the cases, but could never have gone beyond 20% in enteric fevers. The strongest argument in the identification of *matlazahuatl* as exanthematic typhus can be found in the celebrated Mexican book by Bravo (1570), one fourth of the text being devoted to 'The Universal doctrine of the cruel disease (commonly known as *tabardete*) which ravages the oboriginals of this Mexican province'. Rodriguez Mendez (1902) in his discussion on the similarities between the plague of Athens and *matlazahuatl* also supported the idea of it being typhus, though he was unaware of the existence of Bravo's work.

Cocoliztli could be the Nahuatl generic term for pestilence, embracing even the *matlazahuatl*, were it not used in sixteenth century Mexico as a separate entity. The holograph report on the spot by Hernandez first described by Guerra (1956) refers to an epidemic of 'continuous high fever, black and dry tongue, epistaxis, parotiditis, sometimes diarrhoea, weak and accelerated pulse, the eyes and skin tainted yellow, delirium and convulsions, greenish urine, gangrene and sphacelus of the buttocks and extremities. It attacked mostly young people, older people showing greater resistance. In the autopsies the liver was found to be enlarged and pale'. Hernandez's clinical description of *cocoliztli* in 1576 could be one of typhus, but for the icterus ' . . . *oculi universumque corpus lutea*'. In his painstaking account of the 1736 epidemic Cabrera Quintero (1746) used both terms *matlazahuatl* and *cocoliztli*, and mentioned that it was thought by some to be *vómito prieto* or yellow fever, not influenza as had been mentioned. The description by Escobar he quoted, ' . . . sudden illness, intense headache, suffused eyes, deep jaundice, nausea, epistaxis, pain in the abdomen and in the joints, parotiditis, delirium on the fourth day followed by death', reads, indeed, like yellow fever, as Thomas (1885) suggested. The identification of the 1736 and earlier epidemics of *cocoliztli* in the Mexican plateau with yellow fever would

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make necessary a reappraisal of American epidemiology in pre-Columbian times.

THERAPEUTICS

The basic ideas in the treatment of disease among the Aztecs are conveyed in Mendieta's statement (*c.* 1590) that, ' . . . when called to cure a patient the [Aztec] physician used herbs and applied some remedies if the ailment was of minor importance, but if the disease was acute and dangerous he would tell the patient, "you have committed a sin" '. Psychotherapy and religious rituals, therefore, supplemented the use of indigenous materia medica.

In the *Sahagún* and *Badianus* codices treatments are arranged from head to toe; the first has Book X, chapter xxviii devoted to 'Diseases of the human body and medicines against them'; the second, so oustanding for its beautiful representations of medicinal plants, offers thirteen chapters of receipts for ailments of the head, eyes, ears, nose, teeth, throat, lungs, heart, stomach, intestines, urinary tract, limbs, and for remedies to be used for idiocy, and in obstetrics and pediatrics. Some sections refer to unusual syndromes: fear, maleficent airs, the fatigue of civil servants, and perils of travel. Both primary sources make use of vegetable, mineral and animal substances, including scatological material, such as urine and excrement, and certain procedures with distinctly supernatural implications, a cadaver's tooth on the head of the patient, the *coyotl's* eye tied to the arm, flowers round the neck, and the like. As a whole the receipts in these codices resemble the medieval pharmacopoeia, particularly in their generous use of botanical remedies. The treatment of syndromes in the *Sahagún* codices is followed by Book XI, chapter vii, sections 4 and 5 respectively on 'Medicinal herbs' and 'Medicinal stones'. Animal products of medicinal use are also mentioned throughout the text, praising, among others, the virtues of the *tlacuatl's* tail, a marsupial recommended to ease parturition. An example of such a receipt in the *Badianus* and *Sahagún* codices reads as follows: 'The head with scabies should be washed with urine; then covered with a poultice made of *huitzquilitl*, *tezonpahtli*, *tequammaitl*, and *tetzmixochitl* roots mixed with ground *copalquahuitl* and *atoyaxocotl* bark'. There is no indication of the mode of action of drugs in the receipts, nor any apparent connection between the cause of disease and the virtues, if any, of the ingredients.

The *Badianus* codex mentions 251 plants, 185 of these being portrayed in colour; Sahagún mentions only 123; Hernandez's survey (1570–1577) is usually quoted as covering 1,200 medicinal plants, in fact the index of the plant names he recorded includes 4,043 items. Nahuatl botanical nomenclature was sound, the name of the plant always referring to some of their characteristics, properties or attributes (for instance *yoloxochitl* the heart flower) the suffix *xihuitl* in the name meant annual herbaceous, *quahuitl* tree, *xochitl* flower, and *pahtli* drug, with the actual Greek double meaning of poison and medicine. This consistent nomenclature, the sheer number of plants utilized—Hernandez described almost seven times more drugs among the Aztecs than Dioscorides knew of in the ancient world—and their tradition in therapeutics, has bestowed upon the Mexican materia medica considerable prestige, to a point where over 5,000 references can be found (1950) to books or pharmacological studies in this field. The botanical gardens of Netzahualcoyotl and Moctezuma, and the fact that a special market existed in the ancient Tenochtitlan just for medicinal

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herbs were deeply admired by the conquistadores. These became acquainted with new diets of maize, potatoes, beans, cocoa, chili and a great variety of fruit, besides *ichcatl* cotton, *ulli* rubber and *picietl* tobacco, and with their domestic and medical uses. Mexican materia medica included some great drugs of the past such as guiac, jalap, castor oil, sarsaparilla, balm and others now in disuse. However, a whole group of hallucinogenic drugs (1954) has recently been rediscovered, including *teonanacatl* mushrooms, *peyotl* a cactus, *ololiuhqui* a creeper, and *toluah* related to the daturas. In certain cases it has been possible to confirm certain pharmacological activity, the *cihuapatli* woman's medicine, from *cihuatl* woman and *patli* drug, has oxytocic action. More often a potent drug was used for magical effects, the *yoyotli* nuts, a powerful cardiotonic, were carried against haemorrhoids. The apparent wealth of the Aztec materia medica must not be allowed to disguise the fact that few of its natural drugs are still in use. On the other hand, it is a great repository of valuable raw materials, such as diosgenin, which have undergone many processes in pharmaceutical chemistry.

The *temazcalli* or steam bath house, was a therapeutic procedure among the Aztecs, combining the idea of bodily cleanliness with spiritual purification. They were chambers of about six by six feet square and four feet high, made of adobe brick, with a very narrow entrance and a wall section of *tetzontli*, a porous volcanic stone. Next to this section a fire was made and water sprayed over the hot stones from within the chamber which produced steam. The action of the steam and the sweat induced had a strong effect on the patients for at least thirty minutes; after that time the patient was taken out and received a shower of tepid or cold water with invigorating results. The missionaries strongly disapproved of *temazcallis* on the grounds that they were used for sexual orgies by people of the same or opposite sex. Due to the use of sulphurous springs and the location of some *temazcallis*, there is reason to believe the beneficial effects they produced upon so-called leprosies, and certain dermatoses may have been due to the high sulphur content of the waters used in the bath.

The psychotherapeutic procedures used in Aztec medicine have so far been approached under a religious bias. Their proper value in the treatment of disease in that society at large can only be analysed within the context of dynamic psychology. Glimpses of the underlying elements affecting mental health among the Aztecs, family interdependence, aggressiveness towards neighbouring groups, sexual behaviour or religious beliefs may be found in some primary sources such as Sahagún, but the outstanding document is Ruiz de Alarcón's report (1626) written after years of intimate ethnographic and sociological study in closed Indian communities where Aztec culture and behaviour had survived. Ruiz de Alarcón's sixth treatise is 'On the superstitious physicians and their tricks' and contains 32 chapters transcribing the magic formulae, a sort of medical liturgy enunciated by the *ticitl* physician for each disease, from head to toe: 'Treatise on the superstitious cure of the head', *ibid* 'of the eyes', *ibid* 'of the ear-ache', and so on. In the first treatise Ruiz de Alarcón dealt with the use of hallucinogenic drugs, *ololiuhqui*, *picietl* or tobacco, and *peyotl*, in the treatment of ill-health attributed to sorcery (1966). The Fourth treatise, chapter iii, 'On evils and diseases arising from illicit love affairs', and chapter iii of the Sixth treatise,

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'On the remedy they use to so-call reconcile', deserve a much more detailed analysis. The sex urge, sodomy, psychosomatic transfer and many ideas of contemporary psychology can all be found in that important, though neglected study.

COROLLARY

On the eve of the American conquest Aztec medicine enjoyed considerable prestige among pre-Columbian cultures and in the eyes of the European arrivals. The gist of this consensus appears in Cortés's request to Charles V not to allow physicians to come into Mexico because the dexterity and knowledge of the Aztec doctors made it unnecessary. The extent of anatomical and botanical nomenclature, professional ethics, some sound clinical observations, and the importance given to psychological factors in the genesis and treatment of disease were outstanding in the Aztec culture. Some of these elements of dynamic psychology, appreciable only through the study of its medical history, are of considerable importance in the interpretation of contemporary sociological phenomena.

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