MAYA MEDICINE*

by

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THE traditional dependence of the European historian on cultural patterns developed by Mediterranean civilizations tends to disregard pre-Columbian achievements in the New World. Our main cultural stream had its source around the 3rd millennium B.C. in the Nile, Euphrates and Indus valleys, when the oldest civilizations developed an agriculture based on artificial irrigation. Egyptians and Hindus worked metals, used beasts of burden and the plough, and established a system of writing; the Sumerians added to all these technical achievements the principle of the wheel.

New World Civilizations

In that far-off age the American Indians were still migrating southwards and establishing themselves in territories where domestication of maize became possible. To the three great American civilizations—Maya, Aztec and Inca—the wheel, the plough, iron implements, and the use of beasts of burden remained unknown until the arrival of the Europeans, although the Inca made limited use of the llama. A true system of writing going beyond pictographic representation was attained only by the Maya, but the Aztec reached the greatest military and political power without any such advances. Despite these technical limitations the pre-Columbian Americans could claim in a few instances some intellectual superiority over the Old World.

The Maya possessed a philosophical outlook on life, a sense of balance, of architectural perfection and an unquestioned mathematical accomplishment which made them, so to speak, the Greeks of the New World. In the same way, the political enterprises of the Aztecs may be compared with those of the Romans; and carrying the simile a step farther we could find a parallel of agressiveness between Incas and Carthaginians. Like that of the Greeks on the Romans, the Maya culture exerted a moderating influence on both the Aztecs and the other civilizations of Central America.

Maya Medicine

Knowledge of Maya medicine has been extremely meagre; to cite one example, Morley's standard work on the Maya includes only one page devoted to medicine out of 600, and that deals mainly with burial customs. In embarking on a systematic research, medical history has had to resort to many archaeological devices and to apparently unrelated topics. A study of climatic conditions and the resultant flora and fauna may reveal the vector or the host of epidemics; a consideration of dietary habits questions the existence of avitaminosis; some chronological records mark the advent of contagious diseases;

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descriptions of religious ceremonies give a clue to contemporary concepts of disease; a knowledge of the Mayan gods indicates a peculiar approach to the question of suicide; study of the language affords some insight into the diagnostic abilities of the Maya; the interpretation of some enigmatic hieroglyph provides the key to an epidemiological quest; or equally, a study of city planning affords the answer to their sanitation problems. We must, therefore, employ ethnological tools because they provide objective and accurate data. It is for this reason that in offering a preliminary survey of the Maya world we should review in turn every such tool if we wish to arrive at an understanding of the new medical findings.

Ecology

Geographically the Maya civilization has remained in an area which is limited in the south by the highlands of Guatemala near the Pacific Coast, in the north by the coast of the Yucatán peninsula and is bordered by the Gulf of Mexico and the Caribbean sea. In the east their territory covered part of Honduras and extended through the lowlands of Petén in Guatemala to the coast of Tabasco and Veracruz in the west. At an early period some Mayan groups migrated north-west to settle down in the Huaxtec, preserving some cultural trends and affinity of language. The entire area covers some 200,000 square miles.

The Maya land is made up of three different types of country: the Guatemalan highlands are largely of volcanic origin with flora and fauna of the temperate zone; jade and quetzal bird feathers were their most precious commodities. The central area of Petén, some 600 feet above sea level, has a heavy rainfall and luxuriant vegetation. The dense tropical forest includes mahogany, cedar and zapote trees where the mosquito, *Haemagogus*, is rampant and although remaining in the highest branches it may infect human beings when the trees are cut down. Jaguar, parrots and monkeys are plentiful; two species of monkey *Alouatta* and *Atëles*, are highly susceptible to yellow fever epizootics and as they spend most of their time in the higher branches, these howling and spider monkeys die off in large numbers before humans are affected. In contrast to Petén, the limestone lowland of Yucatán is not crossed by a single river and water is only to be found in wells or *Cenotes* which are fed by natural underground currents. The scrub vegetation and limited fauna is a reflection of the thin layer of *humus* which is unsuitable for cultivation by the plough.

History

The Maya area was populated in the 3rd millennium B.C. by some neolithic forbears, without agriculture or pottery, at a time when Egypt was already in the splendour of its dynastic period. During the 1st millennium B.C., and up to the year A.D. 300 the Maya shared with other American peoples the domestication of maize and the so-called Mamon monochrome pottery. At the end of the *Formative Period* appeared the first stone buildings, terraces, low pyramids and a more elaborate pottery known as Chicanel.

The *Classical Period*, generally given the misleading title of the Old Empire,

started in A.D. 320, a date which was found carved, as part of the Maya calendar, on a jade plate now preserved at Leyden. By that time the astronomical year of 365+ days had been reckoned, together with the principles of hieroglyphic writing. The building of ceremonial centres began to flourish in the Petén region with Tikal, Uaxactún and other cities, and also farther west in Palenque, so that a definite system of town planning can be picked out. The pottery became polychrome, during a first phase known as Tzakol, followed after A.D. 633 by the Tepeu style.

The *Mexican Period* started in A.D. 987 when the Itzá people invaded Yucatán from the southwest, conquering and settling in its most important cities. The invaders introduced many new elements in religion, philosophy, architecture and even weapons, and the Maya began to use the bow and arrow as well as the spear. The Mexican Period ended in A.D. 1204 when the Itzá tribes were overthrown from Chichen Itzá, and there followed a process of Mexican assimilation, wrongly known as the New Empire. For two centuries a short renaissance of cultural manifestations and a new architecture evolved in the northern area, marking the *Neo-classical Period* of the Maya before their final decline. It is erroneous to believe that the Maya ceased as a cultural unit with the Spanish Conquest of 1539. The Petén, whither the Itzá tribes had withdrawn, did not surrender to the Spaniards until 1697, and the Maya, as a self-contained group, found enough energy to rise in 1847–54 during the War of Castes, and aimed at the complete annihilation of the white population of Yucatán. Even today there remain isolated groups such as the Lacandon of Chiapas—around two hundred of them—who live in aboriginal conditions and without any contact with our civilization. One of the great mysteries of Maya history was their migration before the tenth century, when they completely abandoned the great cities of Petén. Although agricultural exhaustion has been suggested, the sudden spread of epidemics—yellow fever in particular—has more foundation in fact, and this supports the statement that Maya civilization was destroyed by a mosquito.

Ethnology

Maya was the basic language of the area at the time of the European arrival, and it is still used by roughly two million Indians of that stock. The Maya were organized by family clans in city states, rather similar to those of classical Greece. A noble class, assisted by the religious hierarchies, *ahkin*, governed the common people; slaves were either captured in war, or were criminals sentenced to slavery. The hereditary family head, *halach uinic*, delegated the administration of the small villages to the *batabs*, controlling taxation, the distribution of communal lands and labour. The peasants worked on the land and also provided building labour although specialized crafts were also common.

Maya physician

The physician *ah-men* was, and has remained, a member of the priestly hierarchy, and a product of inherited position and training. It is known through Bishop Landa's writings that . . . 'the sciences which they taught were

the reckoning of the year, the omens of the days, methods of divination, prophecies of events, remedies for sickness, their antiquities and the art of reading and writing.' In our educational system this context shows that Maya education of a physician covered the three Rs, reading, writing and 'rithmetic, to which were added history, chronology as applied to the agricultural cycle, astrology and therapeutics. When the training of the physician was completed his final acceptance in the profession was celebrated by participation in a ceremony during the month *Uo*. Priests, and doctors prepared by fasting for a festivity called *Pocam*, gathering with their wives in the house of one of them, and, after casting out the devil, they opened their medicine packs, in which they carried small idols and certain little stones with which they cast lots. The ceremony concluded with prayers and invocation to the gods of medicine.

Agriculture

Beans, squash and other produce, such as cotton, were cultivated, but maize represented more than mere food to the Maya; it was a god—depicted as a young man holding the plant—and the basis of their life. They believed that man had been created by their gods from maize. The plots where corn was cultivated were reclaimed from the jungle by clearing trees and burning the ground. Maize was then sown with a stick, and the hole afterwards covered by hand.

The whole world of the Maya revolved around this cycle—the seasonal burning of the jungle, the sowing of maize and the harvesting of corn. The work had to be accurately calculated within the rainy and dry seasons of the tropical climate in that porous limestone terrain. Maya diet consisted almost entirely of maize, which unfortunately does not offer the aminoacid variety of wheat. Protein supplements were obtained from domestic fowls, turkeys, pheasants and hens, hairless dog, deer and fish; the *Calkini* MS. mentions these foods among the taxes, together with honey and cotton fabrics. Low iodine intake has been mentioned as the cause of pre-Columbian goitre; the question of the existence of avitaminosis, and of pelagra in particular, has already been mentioned.

Religion

Quite early in their evolution the Mayas identified their gods with natural phenomena controlling the agricultural cycle. The world had been created by *Hunab*, and his son *Itzammá* was the lord of heaven; *Ixchel*, his wife, was the goddess of floods, pregnancy and medical matters. *Ah Puch* was the god of death and accompanied *Ixchel* in the omens of pestilence found in the codices. Suicides by hanging came under the protection of another god, a fact which is of considerable importance in any study of mental health. The four points of the compass were also under the influence of a different god, and each was associated with a characteristic colour. North, white, *zac*; south, yellow, *kan*; east, red, *chac*; and west, black, *ek*. From the medical point of view these are very important, as the hieroglyph of *chac*, red, east, also means great and as a prefix to a glyph for a disease means severe. On the other hand, *zac*, white,

north's hieroglyph, means false or pseudo, and next to *cimi*, death, it means false death, a fainting spell, or epilepsy.

The Maya believed that their world had been preceded by other ages, the first occupied by dwarfs, the second by giants, *dzoloobs*, and finally the third by the Maya themselves; they believed those worlds and their own would end by a deluge. The Maya universe was divided between heavens formed by thirteen superimposed layers *Oxlanhuntiku*, of which the earth was the lowest one, and hell, *Bolontiku*, which was divided into nine underworlds. To heaven went good people, warriors, women dying in childbirth and those who committed suicide by hanging. It is quite interesting to find among the Maya the practices of baptism and the confession of their sins; as a matter of fact, physicians imposed the confession upon the patient prior to any treatment, as it was customary in the Aztec civilization. In their religious ceremonies we do not encounter the blemishes of sodomy and human sacrifice until the period of Mexican invasion, which saw the introduction of the extraction of the heart and the flaying of the victim. Together with all American nations the Maya habitually burned *Copal pom* and performed self-inflicted mutilations. The Maya induced cranial deformities during childhood by progressively flattening the frontal and occipital bones between two flat pieces of wood. In this way the round-headed Maya obtained the retracted profile which is so characteristic of archaeological paintings and bas-reliefs. Another ideal in beauty was cross-eyes, and mothers used to hang an object on the forehead of their children until cross vision was obtained. Dental inlays of jade, turquoise and pyrites were frequent and there are many instances of burials showing special filling of the teeth. Other mutilations involved blood letting in the ear or limbs, transfixion of the nasal wall for a jade pendant, passing a cord through a hole in the tongue or an even more painful ceremonial rite, being the same operation performed through the cavernous body of the penis in a group of initiated neophytes standing in a circle.

Architecture

The great Mayan religious centres which capture our imagination are characterized by temples on stepped pyramids, and comparatively recently these have been found to contain burials, like those of Egypt. The adjacent palaces for the priests were built on terraces and their rooms, which seldom had windows, received light directly through the doors. The ceiling was obtained by the typical corbeled vault, and the heavy walls required for that purpose were balanced by a unique blend of sculptural motives and bas-reliefs which lightened the heavy appearance of the structure. The Maya also used stucco, and developed cements by calcination of stone. Another feature was the use of mosaics and the technique of mural painting in fresco, the best examples of which are to be found in Chichen Itzá and Bonampak. The Mayan architecture with its serene bas-reliefs deserves even more admiration when it is realized that the carving was carried out only with tools made of other harder stones, the Mayan area being devoid of metal. Other buildings were ball courts for the

great Mayan sport, where rubber balls were used for the first time, astronomical observatories and sweat houses where dry heat and steam perfumed with aromatic plants were used in the treatment of disease. In Palenque are to be found baths with adjacent lavatories with a disposal unit connected to a system of stone sewerage which is difficult to improve on under present rural conditions. The cities built during the Classic Period in Petén had an adequate water supply, but this must have been a problem in the lowlands where water was obtained from *Cenotes* and house reservoirs, providing ideal conditions for mosquito breeding; these reservoirs were responsible in the seventeenth century for the epidemic outbreaks of yellow fever in urban areas when the *Aëdes-aegypti* brought by Spanish ships settled in Yucatán. One puzzle in Mayan cities is the existence of causeways, such as that running between Cobá and Yaxuná, sixty miles in a straight line, six feet above ground level and about five yards wide, in which smooth stone rollers were used to level the surface, when no vehicles were known and no animal traction existed!

Chronology

The identification of religion with natural phenomena resulted in the priest having to keep up a continuous observation of nature. This provided him with astronomical references that made it possible accurately to determine the seasons and to establish the length of the tropical year. There is epigraphic evidence that, during the Classical Period [A.D. 320–909] the Mayan cities erected every period of twenty years *Katún*, a stele dated according to their chronological system. This chronology is known as the *Initial series*, meaning that they give the date elapsed since the beginning of the Maya count or zero year, which computed in our Christian era goes back to 3113 B.C. There is no other nation in history where the concept of time produced a stronger impact, nor a people who measured passing time so accurately as did the Maya. Their unit was the day, *kin*; every twenty days made a month, *uinal*; eighteen months, *uinals*, made a year, *tun*, which was completed with another *uinal* of five unlucky days, *uayeb*, to make up a year of 365 days like ours. Every twenty years made a *baktun*, and twenty *baktuns* one *pictun*. In addition to the astronomical year of 365 days the Maya had a liturgical year, *Tzonkil*, of 260 days which was superimposed on the astronomical calendar in order to regulate their religious ceremonies. Each day, *kin*, of the month, *uinal*, had a name and was represented by a hieroglyph, and every one of the eighteen months, *uinals*, of the year, *tun*, also had its special name and hieroglyph.

Mathematics

The recording of time called for mathematic formulation quite early. Numbers between 1 and 20 were represented among the Maya by dots and bars, five dots being equal to one bar; their system was based on the numbers of fingers and toes and therefore it was vigesimal. The most important aspect of this Maya system was the establishment of the value of a figure according to its sequence, such as is used in present-day computation; there was also a sign for zero. The figure to the left is ten times higher in our decimal system, but among

the Mayas the figure placed above was twenty times higher because they used a vigesimal system.

Hieroglyphs

The highest cultural sophistication of the Maya was hieroglyphic writing. The Aztecs, Mixtecs and Zapotecs of Mexico used an entirely different pictographic system of reproducing their idea. Mayan hieroglyphs appear in the stelae, on some pottery, and on lintel wood which has been preserved because the zapote—the tree from which chewing gum derived—is extremely resistant. However, the finest records from the bibliophile's standpoint are those found in the three Maya Codices still extant, one in Dresden, another in Paris, almost destroyed, and another in Madrid. These were made from the inner bark of a fig tree, *amatl*, by macerating and glueing the fibres together as in the Egyptian papyri, and then treating the surface with a smooth white finish. Once the surface was polished the scribe painted the hieroglyphs in colour with a thin brush; the codices were then folded like a Japanese screen. As all codices had some religious content they were destroyed by the Catholic missionaries after the arrival of the Spaniards. Bishop Landa burned twenty-seven of them at Maní in 1562. Despite this heinous bibliophilic crime we should be grateful to Landa, because he left an 'Account of the matters of Yucatan' which represents almost 95 per cent of what we know about the Maya. He gave the hieroglyphs of the days and the months, and left also half a page, where every Maya scholar has turned at one time or another with the hope of finding there the new Rosetta stone of Maya hieroglyphs. In spite of the tremendous amount of work on the subject very little has been added to Landa's information.

Maya hieroglyphs are made of a basic sign, sometimes with infixes drawn inside, and also with prefixes and suffixes which modify the basic glyph. In some cases the interpretation of the glyphs has been approached assuming that they represent ideas, and in other cases as if the signs had a phonetic value instead. Without becoming involved on either side of the fence it is pertinent to recall that Maya language has a structure similar to that of the hieroglyphs, with many monosyllabic words and others built from a main root to which some particle is affixed, before or after the stem. Notwithstanding this phonetic approach, medical studies in the Maya codices tend to obtain quicker results if the material is considered to be ideographic. Written medical information, prior to European arrival, if any, must appear in the Codices, which are concerned with chronicles, calendars, rituals, agricultural seasons, or the priests' greatest occupation, the forecast of events. The common element in all these records is that they are dated according to the Mayan concept of time. Periodical occurrence in medicine is related to the cycles of epidemics and connected in some way with natural phenomena. An example of these are the appearance or disappearance of contagious diseases where the survival of a vector, such as the mosquito, follows seasonal variations. This has considerable bearing both theoretically and practically upon the Maya.

The ideographic and phonetical solutions coincide in the interpretation of a

hieroglyph of basic importance in Maya medicine. Death in Maya is *Cimi* which is also the name of a day; this hieroglyph was given and identified in Landa's MS. shortly after the Conquest following the instruction of Maya priests who mastered hieroglyphic science. With that hieroglyph as a guide it is possible to follow in the Codices the occurrence of evil omens, disasters and death associated with the representation of *Ah Puch*, the death god. Without elaborating further and just on the confirmatory evidence of later documents, it is possible to state that some sections of these codices forecast epidemics.

Manuscripts

Shortly after the Spanish Conquest some educated Maya priests learned European handwriting and produced a literature in which Maya language was phonetically written with the Latin alphabet, apart from some additional vowels. These books, originally written in the sixteenth century and afterwards copied by different hands, are called of *Chilam Balam*, that is pertaining to the priests, and given the names of the localities where they were discovered, *Chilam Balam* of *Chumayel*, *Ixil*, *Calkiní*—there were eighteen such books, but only a few have survived. In addition to these books in Yucatec Maya there are two in Quiché Maya, one of them being the *Popul Vuh*. All have been studied now for medical material. Some are indeed devoted to recipes and botanical materia medica which are still popular in the Maya area today.

Disease

The idea of disease among the Maya was always related to religious and ethical concepts. In their aboriginal texts repeated references are found to their belief that sexual abuse, sin and disobedience were responsible for the appearance of epidemics. In the *Popul Vuh* it is asserted that disease is caused by external actions by enemies or the evil eye. One early text, the *Ritual of the Bacabs*, gives nearly fifty medical incantations for use by the priest-physician while invoking the gods for the cure of a patient.

Anatomy

The anatomical knowledge of the Maya was necessarily extended after the Mexican invasion when human sacrifice and the ritual extraction of the heart became frequent. A native Franciscan, Fr. Pedro Beltrán, published in 1746 a vocabulary free from European contamination, in which he gathered what may be considered to be a cross-section of Mayan anatomical knowledge at the time of the Spanish Conquest; this vocabulary includes over 150 terms, most of which refer to surface anatomy. This lexicon compares well with the Nahuatl language of the Aztecs whose practice of human sacrifice provided an intimate knowledge of human anatomy, and the average pre-Vesalian anatomy. The Maya had several names for parts of the brain, thoracic and abdominal organs. Brain, *Comél*; heart, *Puczikal*; stomach, *Ichputzikal*; lungs, *Zacol*; bile, *Kah*; spleen, *Pek*; liver, *Tamnél*; intestines, *Hobnél*; bladder, *Tem ix* and pericardium, *Nactám* among other internal organs. The general functions of the body—gastric, pulmonary, and renal—were well known to them and it is worth

Fig. 1

Codex Dresden [Maya] section 15, which has been reproduced by Kingsborough, vol. III, pl. 15, containing the *cimi* [death] hieroglyph in the middle and lower portions marked by arrows, forecasting epidemics

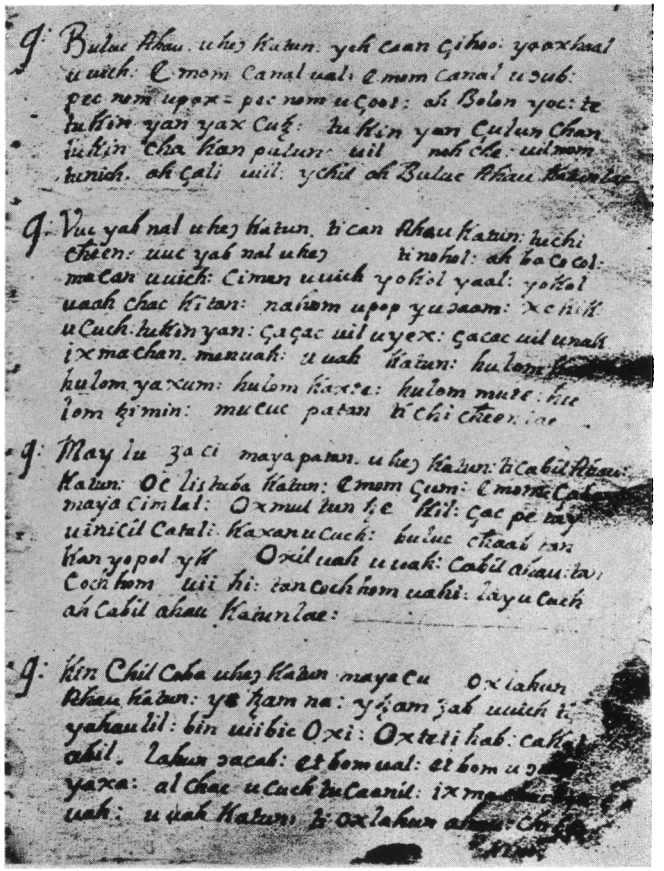

Fig. 2

Book of the Chilam Balam de Chumayel Ms [Maya-Yucatec] folio 40, reproduced by Gordon, pl. 40 r., where *cimen* [death] due to *xekik* [blood vomit] is forecast during the period of the *Ahau Katun*

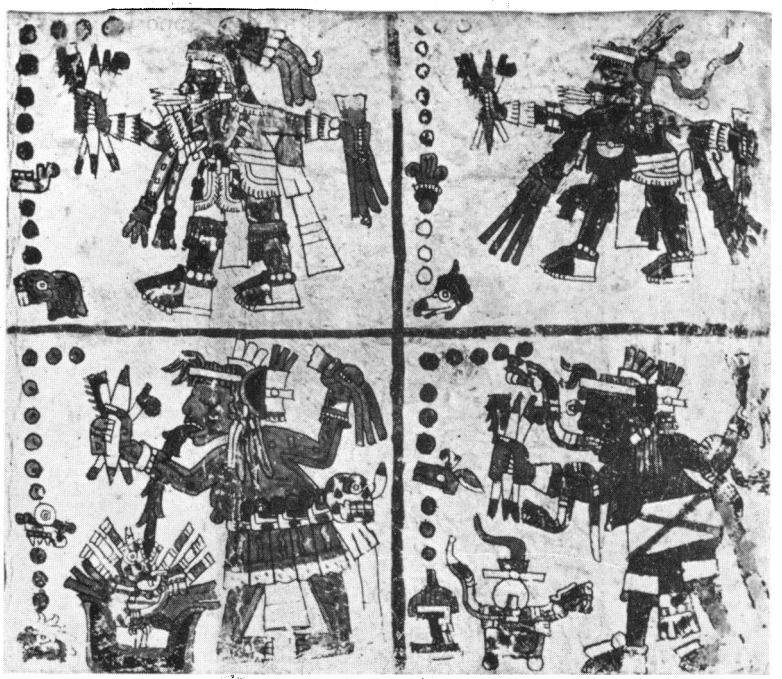

Fig. 3
Codex Vaticanus B3773 [Mixtec] section 79, reproduced by Kingsborough, vol. II, pl. 18, where the goddess *Tlazolteotl* is vomiting blood, forecasting epidemics, and evil omens

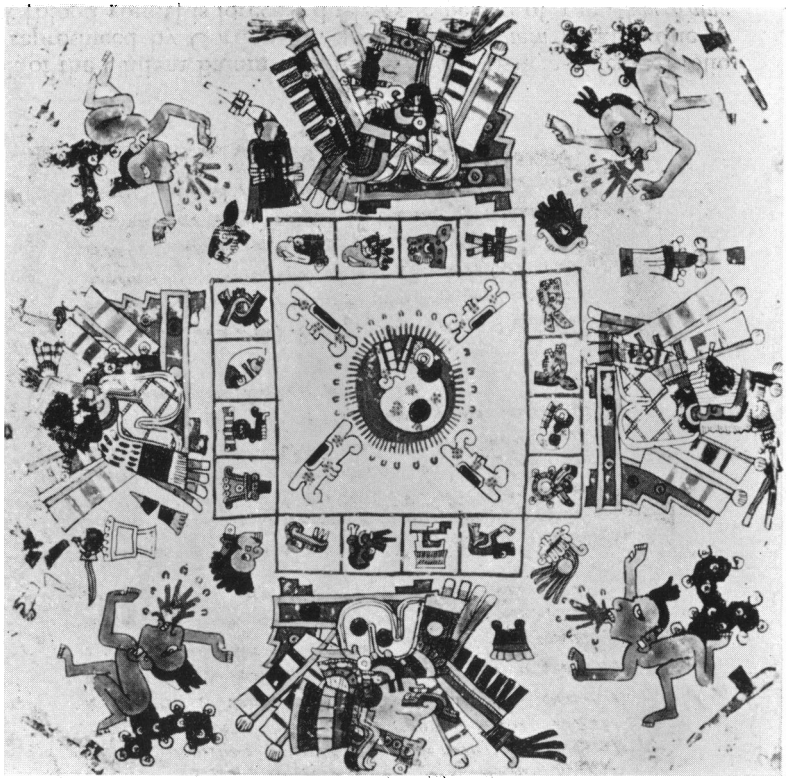

Fig. 4
Codex Borgianus I [Mixtec] section 51, reproduced by Kingsborough, vol. III, pl. 13, with a year cycle of blood vomit and melaena epidemic

mentioning their name for the pulse, *Cil*. The functions of generation were under the patronage of goddess *Ixchel*; they had terms for the uterus, *Ƶayomal*; vaginal secretion, *Lul*; menstruation, *Ilmah* and the placenta, *Ɣbin*, among others, thus indicating a certain knowledge of female anatomy.

Pathography

Beltrán's lexicon grouped over two hundred terms describing organic syndromes, which, coming from a lay source, reaches a higher standard than texts of mediaeval Europe. Among the ailments of the digestive tract are identified dental affections, *Chaenich*; gastric acidity, *Chuhual*; indigestion, *Balbuthil*; colic, *Tabnakil*; constipation, *Ƶuuɔnakil*; and diarrhoea, *Hubnak*; but the incidence of intestinal disorders among the Maya is indicated by the variety of terms used for dysentery, *Hubnak puuch*, a cholera syndrome *Pu taa*, which was accompanied by straining typical of amoebic dysentery, *thun*, and various types of dysentery with blood in the stools, *kikchoch*, *kiknak* and *kiktaa*. There is even a description of intestinal pain accompanied by pulsation, *Tiptec*, which could be appendicitis. There was no confusion about diagnosis between these intestinal ailments and the nephritic colic *Tabnakil*.

In the respiratory system the laryngeal cough, *Ƶen*, was considered to be of a different origin to the deep bronchial coughing, *Thuhuzen*. The common catarrh, *Izkab*, is a minor complaint when contrasted with the prolific terms for consumption, *Nachbacil*, phthisis, *Ɣumulkabil* or pulmonary tuberculosis, *Tzemil*. Attention should be paid to the term for blood vomit, *Xekik*, that expresses just that symptom; it is found in the earliest Maya text as applied to pulmonary ailments, but, nevertheless it has also been used in descriptions of yellow fever, where it constitutes one of the main signs in the epidemics. Other symptoms such as asthma, *coc*, *coczen* may proceed from the circulatory system as well, and dropsy, *zot*, *chupil ppuluxtaail* seems to have several contexts. Heart attack, *Chibil*, *tzemil*; haemorrhages, *xaankik*; haemorrhoids, *kabak* and many others are easily recognizable.

The student of mental disease has a broad field of research in Maya medicine. They identified more clinical syndromes than probably any other culture, for instance, madness, *cooil*; melancholia, *tzeniolal*; delirium, *coothan*; hallucinations, *Oxkokoltzeck Okomolal*; frenzy, *Tamacazil* and many others. Furthermore they also described hemiplegia, *Chich*; facial paralysis, *Ɔuyul* and clearly differentiated several types of fainting spells, *zaccimil zatalol* from epilepsy, *citam tamcaz*, *canchapahal*.

It seems that the Maya had a clear idea of the mechanism of infection because they grouped the contagious diseases, *Kamyaah* separately; their main symptoms fever, *chacanil*; malaise, *cunulba*; headache, *kuẋpolil*; chills, *yaxcél* are easily identifiable. The exanthemas are known with such a variety of terms that it is not always possible to ascertain the diagnosis, itching, *zakil*; boils *ppool*, *choolax*; scabies, *Ueez*; leprosy, *naycan*; the measles, *uzankak*; varicella, *ix thuchkak* and smallpox, *kak*, *ek peɔ kak*, the latter were infectious diseases imported from Europe to which the Mayas adapted descriptive terms. There are, however, three medical entities which the Mayas were the first to identify, pinta, *zac*

hauay; leishmaniasis or *chiclero sore*, *chech* or perhaps, *taacan*, and of course syphilis in its different stages, sore, *yaah*; bubo, *zal* and syphilides, *ɔob*. There is also a group of terms referring to throat ailments which could be applied to angina, *ɔonkoch*; diphtheria, *ɔippcal* and sore throat, *yacalil*. In the field of obstetrics it is important to notice their idea of puerperal fever, *Zayaomcan*, and as a natural sequel to mutilation of the penis strangury, *hunae haa*, *hul*, must have been rather frequent, but they reserved another term for gonorrhea, *kazay* and hematuria, *thunkik*. Beltrán's lexicon mentions malaria, *camɔackin*, *yaxceel*, and indicates that typhus may be *auatmó*; and to describe an epidemic they used at least three terms, *banbancimil*, *takcimil* and *nohyaahil*.

Therapy

Therapy was not entirely dependent on religious influences. The texts of medical incantations in the *Ritual of the Bacabs* show the similarity between the physician's invocations to the gods, both among Aztec and Maya. This religious part of the treatment is preserved until the present day and shows little sign of being modified by Catholic influence. The disease-inducer, *ah-pul-yaah*, also had a recognized rôle in Mayan medicine. A greater part of the treatment was based on the administration of prescriptions made up in most cases from medicinal plants. Some sections of the *Books of Chilam Balam* are exclusively devoted to that subject. Over 400 Maya receipts have been collected from various sources to which should be added those included in the book of medicines of the *Chilam Balam de Ixil* which we have covered. In general the cures are arranged according to the ailment and the physician is advised to obtain certain plants, to prepare them by following simple instructions and then to apply or administer them to the patient.

The botanical preparations were elaborated using Galenical procedures of mixing and extraction by boiling to make syrups *Chaabail ɔac*; the emetic syrup was known also as *xebel ɔac*. In other instances ointments, *nabzab nabzahil* were used by rubbing *paɔ*. Some methods of treatment remind us of our mediaeval doctrine of signature, recommending yellow plants for jaundice for instance, or homeopathy curing like with like. Also the Maya doctrine of number applied to the number of days of treatment, usually thirteen for a man and nine for a woman, indeed seems to have similarity to the Pythagorean or Paracelsan systems. It is a matter of great pharmacological interest to encounter among the Maya the same concept of drugs as had the Greeks. Beltrán gives poison, toxic, venom as *uay*, *yaah*, *tenɔac*, *cabil*,

but with this difference, that when the poison or venom comes from some animal, such as the spider or beast it is called *cabil*; because it is a sort of sweat or very noxious excretion. However, when the poison is from some shrub or tree, it is called *uay*, because it is a sort of sap or venomous fluid secreted that produces a boil on contact. But *tenɔac* is a generic name for any poison and *yaah* for any venom, and though some people call the poison *ɔac*, this is to confuse it with the triaca or drug which is called *ɔac*.

In referring to therapy it is important to mention that the Maya used phlebotomy with special lancets, *ta*, as a method of treatment, not just for its physical merit but also as a religious act of penitence. This explains the ready

acceptance of phlebotomy by the Maya after the Spanish conquest, for its use was part of the humoral doctrine then dominating European medicine. Another procedure widely used among the Maya was the sweat-house or *zumpulche* which was a feature of the public buildings in every city; similar to the Aztec *temazcalli*. The typical structure was about 12 by 10 feet and almost 9 feet high with the corbel-vaulted roof beginning 3 feet above the floor. They had only a very low and narrow entrance about 3 by 2 feet. Inside were a fire chamber and a sunken passage or drain below floor level flowing towards the doorway. The sweat-houses were used in other Mexican cultures, particularly as post-partum treatment, but also in a number of ailments.

Surgery

Surgical techniques were, however, rather primitive. Metal instruments, obtained by trade not by local manufacture, were found at the Chichen Itzá well, and some burials, but the instrumental evidence points to the use of flint knives of varying sizes, either small for incisions in phlebotomy, extraction of foreign bodies and mutilations, and fitted in drills for dental filling, or large knives used in the diaphragmatic approach for the extraction of the heart. Carvings on various monuments and drawings in the codices also show surgical instruments made of bone and the jawbone of the sword-fish. It has been suggested that the Maya used certain vegetable and fish bone needles for suture of wounds, but this is difficult to confirm. However, some religious ceremonies involved anatomical areas highly irrigated which must have called for more elaborate haemostasis than plain compression. Bone setting and reduction of fractures was the special field of the bone-binder, *kax-bac*, and in view of the Maya's ability with the stucco, it does not seem unreasonable to assume that they also used plaster for immobilization of the limbs. Dental extractions and surgery were quite advanced.

Obstetrics

Obstetrics were practised by the *x-alanzah* or midwives, who predicted the day and hour of childbirth and through suggestion and ingenious devices, eased the process of labour and delivery. After this the midwife used to massage the patient and help to restore the womb and intestinal organs to normal positions.

Epidemics

This survey of Maya medicine provides the groundwork for a point of historical detection. Many times during the last four centuries the American sphinx has been asked whether she was the source of diseases such as syphilis, yellow fever, leishmaniasis, bartonellosis and others. For instance, with regard to yellow fever a difference of opinion exists between those who believe the disease to have been imported from Africa by Negro slaves, and those who consider yellow fever to have existed in America before the arrival either of Africans or Europeans. The problem is an old one and even Finlay became involved in it at a time when sylvan yellow fever and the rôle of some jungle

animals were unknown. However, proof that yellow fever was rampant in America prior to its discovery by Europeans can only be accepted without question if the information carries a pre-Columbian date. The literature of the Maya can supply the answer, because not only does it provide us with written records which may be checked against European documents, but also offers other records predating the European arrival in America.

Going back over the years we find that during the nineteenth and eighteenth centuries there were many clinical descriptions of yellow fever epidemics in America written by Europeans, and these were accurate enough to warrant proper identification of the syndrome as we accept it today. In the seventeenth century Ferreira da Rosa published an exact description of the yellow fever in Pernambuco, Brazil, in 1685, but the oldest reliable record of yellow fever in America is that published by the Spanish friar Lopez de Cogolludo, faithfully describing the epidemic in Yucatán in 1648. From this account it appears that sylvan yellow fever started in the southern jungle, then advanced to Campeche and Mérida and became an urban entity after two years.

The paramount symptom in the text of Lopez de Cogolludo is the vomit of blood, accompanied by severe malaise and in some cases by dysentery. His record of the epidemic of yellow fever in Yucatán during 1648, agrees with the Mayan account in a section of the book of *Chilam Balam de Chumayel*, added by a later hand using Christian dating, '. . . *Uchoi xekik hoppoi cimil toon 1648 años* . . .', which translated literally means: '. . . There was blood vomit, death came in the year 1648. . . .' The context of *xekik* or blood vomit refers to the main syndrome in yellow fever epidemics; medically speaking that is the only meaning of *xekik* when referring to epidemics. This interpretation is confirmed when compared with the texts of other books of *Chilam Balam* which are dated according to the Maya system of chronology. The books of the *Chilam Balam de Chumayel*, that of *Tizimin* and the *Kaua*, all have exactly the same record for the events in the *Katun 4 Ahau*; this period of twenty years extends from 11.14.0.0.0. according to the Mayan Initial series or long count, which in the Christian era covers the years A.D. 1481–1500. '*Katun 4 Ahau* . . . is recorded in Chichen Itzá . . . the face of the lord of the *Katun* is covered; his face is death . . . blood vomit is the charge of the *Katun*. . . .' Another section of the book of *Chilam Balam de Chumayel* known as the *Cuceb*, contains chronological records and for the *Katun 4 Ahau* it reads:

'*Katun 4 Ahau* . . . is recorded in Chichen Itzá . . . it will come *Ah Kantenal* [The one of the Yellow tree], the blood vomit will come for the fourth time. . . .'

These Mayan texts check with records from European sources; Bishop Landa, writing at Yucatán in 1566, just twenty-seven years after the Spanish conquest, confirmed that there were memories among the Maya of a great pestilence which had caused much suffering around A.D. 1480.

The chronological accounts in the books of *Chilam Balam* in Yucatec Maya recording the *xekik*, blood vomit, epidemics in the *Katun 4 Ahau* must be complemented by other sources in Quiché Maya MS. The *Popul Vuk* includes a section pertaining to the ancestry of the Maya in which monkeys

play important rôles. Furthermore it gives the names of some gods definitely connected with yellow fever. They are *Xoquiripat* and *Cuchumaquic* who caused fluxions of blood in men, *Ahalpuh* and *Ahalgauá* who produced pustules in the legs and yellow jaundice in the face *chugonal*, and *Xix* and *Patan* who brought sudden death to man by blood vomit.

The pattern of Mayan chronology must be kept in mind with regard to the omens for *Katun 4 Ahau*, because this *Katun* always carried omens of pestilence as this period, like the *Katun 8 Ahau*, was shrouded by superstition for the Maya, much as were the Ides of March for the Romans.

The records and prophecies included in the books of *Chilam Balam*, with their involved metaphors and awkward syntax, represent transcripts of the Codices. An analysis of the hieroglyphs in these codices should confirm that the texts for *Katun 4 Ahau* forecast pestilence and death.

The books of *Chilam Balam* are copies, of copies, of copies of codices; they were started quite early in the sixteenth century and kept up to date by several hands well into the eighteenth and nineteenth centuries, the *Popul Vuh* also stems from an original of the sixteenth century. These sources are therefore important in referring to the existence of yellow fever prior to the first European description of the 1648 epidemic by Lopez de Cogolludo. But they have an inherent disadvantage in that they were produced in their final form after the European arrival.

Confirmatory evidence of the existence of yellow fever may be given by the three Maya Codices written about A.D. 1350, centuries before European contact. However, the hieroglyphic identification of blood vomit, *xekik*, is open to question at the present stage of deciphering, although the fact that the original codices do include records of periodical pestilence cannot be denied.

There are other written pre-Columbian records which give us pictographic evidence, as opposed to hieroglyphic texts, of epidemic blood vomit, fluxions of blood, and yellow faces which check with Mayan descriptions of yellow fever. In this way a continuous history of the disease can be traced back, from the European accounts, through the native manuscripts to the original pre-Columbian codices. These early pictographic records are not the three mentioned Mayan hieroglyphic codices, but three others, Mixtec and Cholultec codices drawn by scribes whose families came, like the Tlailotlacan and Chimalpan, from Mixtec areas bordering Maya territories infested with sylvan yellow fever.

The Selden Codex (Roll A 2) depicts two years of epidemic blood vomit and death in section 18. The Borgia Codex depicts a one-year cycle with epidemic blood vomit, and diarrhoea with melaena in section 13. Finally the Vatican Codex B 3773 portrays in section 18 the Venus goddess, *Tlazolteotl*, with the worst omens forecasting another epidemic of blood vomit. These epidemics are easily identified from other pictographic representations of mutilation, diarrhoea and other records commonly found in Mexican codices. These pictographic materials, at this stage of Maya hieroglyphic interpretation, offer much better proof for the establishing of yellow fever as an indigenous American disease.