

**Zeitschrift:** Acta Tropica  
**Herausgeber:** Schweizerisches Tropeninstitut (Basel)  
**Band:** 26 (1969)  
**Heft:** (10): Parasitic diseases in Africa and the Western Hemisphere : early documentation and transmission by the slave trade

**Artikel:** Parasitic diseases in Africa and the Western Hemisphere : early documentation and transmission by the slave trade  
**Autor:** Hoespli, R.  
**DOI:** <https://doi.org/10.5169/seals-311630>

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# PARASITIC DISEASES IN AFRICA AND THE WESTERN HEMISPHERE

EARLY DOCUMENTATION AND TRANSMISSION  
BY THE SLAVE TRADE

By

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The investigation on which this book is based was supported by the Public Health Service, Research Grant No. AI-05556, from the National Institute of Allergy and Infectious Diseases, United States Public Health Service, to the American Foundation for Tropical Medicine.

1969

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Clichés Steiner & Co., Basel

## FOREWORD

Numerous diseases caused by zooparasites play an important rôle in Africa and occur likewise in the Western Hemisphere, especially in Central and South America and the West Indies. It is of considerable interest to know which of these diseases occurred in pre-Columbian America and which were introduced by the slave trade. Early documentation of parasitic diseases in Africa and the Western Hemisphere and information obtained by the study of the slave trade are means to answer this difficult question.

Africa was since antiquity a great reservoir of slaves for Greece, Rome, the Near East, India, Southeast-Asia, and even China.

The discovery of the New World and the conquests by the Spaniards started the slave trade from Africa to America, which during about 350 years brought millions of negroes to the Western Hemisphere. It was soon realized that these African slaves introduced diseases, so that comparatively soon after the Conquest quarantine regulations were introduced by the Spanish authorities.

The origin and the development of the slave trade from Africa to the Western Hemisphere in as far as it was connected with the introduction of diseases are briefly outlined in Part One of the present study.

The slaves in their great majority came from tropical Africa, especially the West coast, where parasitic diseases are wide-spread.

The author limited his subject to human diseases due to zooparasites, including *Treponema* and *Borrelia* infections.

Three main questions are discussed: Which diseases were autochthonous in each continent, which diseases were carried by the slaves from Africa to the New World where they had not occurred before the Conquest and which diseases were transmitted to America where they already existed. In each case the early documentation of the disease is given.

Two subjects which have aroused special interest and have in the past been discussed by many authors are the question whether the *Bubas* represented Syphilis or Yaws or both diseases and the question whether *Malaria* existed in America before the arrival of the Spaniards. These two subjects are dealt with in somewhat greater detail.

The writer has given a considerable number of quotations in

English in connection with early documentation. A few Spanish, French, and Latin quotations have not been translated in order to give the exact meaning of the original texts. The bibliographic references have been placed at the end of each chapter.

The aim of the author was to present the early documentation and the question of the transmission of parasitic diseases from Africa to the Western Hemisphere as a whole. He realizes that future research will probably necessitate the correction of some of his statements and by providing additional material will enable medical historians to answer hitherto unsolved questions.

Swiss Tropical Institute

Basle, 1969

R. Hoeppli

## ACKNOWLEDGEMENTS

In the first place the writer wishes to express his deep gratitude to the U.S. Public Health Service for having awarded him a Research Grant which made his research and the publication of its results possible. In this connection he wishes to thank Dr. J. ALLEN SCOTT, who took care of the Grant and arranged for additional time to complete the work.

While the writer gratefully realizes that his research could not have been carried out without the financial support of the Grant, he wishes at the same time to thank sincerely Prof. R. GEIGY, Director of the Swiss Tropical Institute at Basle, for his permission to prepare the manuscript in his Institute and to utilize its library facilities.

He likewise thanks Miss R. GRETER, Basle, for having prepared the Index of Names and having typed the manuscript, Mrs. B. BEGELSBACHER-FISCHER, Basle, for having checked the English of the manuscript and Prof. F. MEIER, Basle, who examined and corrected the writing of Arabic names.

The writer's thanks are furthermore due to a great number of persons who by supplying publications, references, photostats, photographs and information of various kinds greatly helped him in many ways. Among them should be especially mentioned:

### *U.S.A.*

J. R. AUDY, San Francisco; W. BASCOM, Berkeley; TH. VON BRAND, Bethesda, Md.; D. J. CROWLEY, Davis, Cal.; E. H. FIFE, jun., Washington D.C.; H. F. HSÜ, Iowa; H. H. LOUCKS, Baltimore; H. NACHELES, Chicago; I. SNAPPER, New York; E. VAN BOMEL, Florida; F. WILLETT, Evanston, Ill.

### *Canada*

M. MILLER, Beaconsfield, P.Q.

### *Mexico D.F.*

G. AGUIRRE BELTRÁN; B. ARTEAGA; M. MARTÍNEZ BÁEZ; E. DÁVALOS HURTADO; M. T. JAÉN; A. ROMANO; G. SOMOLINOS D'ARDOIS.

### *South America*

H. FIGUEROA MARROQUIN, Guatemala City; LUIS A. LEÓN, Quito, Ecuador; J. J. ALVAREZ SAURI; H. PESCE; P. WEISS, Lima, Peru.

*Egypt*

P. GHALIOUNGUI, Cairo (now Kuwait); CH. KUENTZ, Cairo; R. RAHN, Cairo (now Zurich).

*Uganda*

BRYAN LANGLANDS, Kampala.

*Nigeria*

S. LEITH-ROSS, JOS.

*Liberia*

M. ST. C. PEACH; G. VERHAAR, Harbel.

*Sénégal*

TH. MONOD, Dakar.

*Spain*

R. P. JOSÉ LÓPEZ DE TORO, Madrid.

*France*

J. DELANGE, Paris; JEAN-PIERRE DUBOSC, Paris.

*Belgium*

A. MAESEN, Tervuren; H. VAN GELUWE, Tervuren.

*Holland*

D. J. E. DINGER, Leiden; Nederlands Volkenkundig Missie-Museum, Tilburg.

*Germany*

CH. VON OIDTMAN, Bonn; H. VOGEL, Hamburg; W. WESTENDORF, Munich, J. ZWERNEMANN, Stuttgart.

*England – London*

R. S. BRAY; L. J. BRUCE-CHWATT; A. J. DUGGAN; W. B. FAGG; E. GASKELL; L. G. GOODWIN; F. GUERRA; R. JONES; P. K. WACHSMANN.

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*Switzerland – Basle*

A. AESCHLIMANN; G. COLLARD; G. EICHENBERGER; T. FREYVOGEL; L. SAURENHAUS; R. SCHENK; E. STAEHELIN; E. TSCHUDIN.

*Switzerland – Zurich*

E. LEUZINGER.

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## INTRODUCTION

Parasitic diseases discussed in the following are diseases caused by *Protozoa*, *Borrelia*, *Treponemes*, *Helminths*, and *Arthropods*.

In Europe and Asia they have been recorded from antiquity by numerous writers. Hippocrates (c. 460–375 B.C.) for example discussed in detail the various forms of malaria; the Sushruta Samhita (present text about first centuries A.D.) describes elephantiasis; in China Ch'ao Yuan-fang (fl. c. A.D. 610) mentioned small 'worms' (itch-mites) in scabies; among Persian-Arabic authors Rhazes, Abū Bakr Muḥammad ibn Zakarīya al-Rāzī (died 923–924) and Avicenna, Abū 'Alī, al-Husayn ibn 'Abdallāh ibn Sīnā (980 to 1037) dealt with the Guinea worm, *Dracunculus medinensis*, mentioned already by Greek writers. Besides the few mentioned authors, there are others who throughout the centuries up to modern times provided by their works a rich documentation of parasitic diseases and parasites in Europe and Asia. (See also MOULÉ, 1908, 1911.)

In Africa the situation was different. Except ancient Egypt with records of diseases in papyri and the mediterranean coast which was under Roman rule and was referred to by Roman writers, there are no written records up to the Islamic conquest in the seventh century.

The *Rihla* of IBN BATTŪTA; Muḥammad ibn 'Abd Allāh (1304 to ca. 1369) and the *History of North Africa* by IBN KHALDŪN, Abu Zaid 'Abd al-Rahman ibn Khaldūn (1332–1406) as well as the writings of some other authors from Islamic Spain and North Africa have been studied by writers with a knowledge of Arabic; it is, however, probable that there exist still some more Arabic texts which mention parasitic diseases in Africa and which at present are known to Arabic scholars only. Hasan ibn Muḥammad al-Wazẓān al Zayyāti, better known as LEO AFRICANUS (ca. 1485 to ca. 1554), born in Granada of Moorish parents, wrote at the time of the Renaissance his valuable *Descrittione dell'Africa*, published by RAMUSIO in the second half of the sixteenth century<sup>1</sup>.

Beginning with the fifteenth century, the exploration of the African West Coast, the discovery of the New World and the

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<sup>1</sup> The transcription of Arabic names and the use of accents in Spanish names are not following strict rules.

Spanish conquest in America provided new information regarding parasitic diseases.

The slave trade is in this connection of special importance. It drew increased attention to some diseases which were frequent among the slaves, such as dysentery, yaws, scabies, hookworm-anemia and Guinea-worm infection. It also demonstrated the transmission of certain diseases, among them parasitic infections, from Africa to the New World. On the other hand, some diseases which were at first believed to have been imported by the slave trade were found to be autochthonous in the New World (Carate, Mal del Pinto). Furthermore, transmission of a parasitic infection in a reverse sense, from America to Africa and Europe, was discovered (*Tunga penetrans* infection). These various problems are closely connected.

In the first part of the present study the different kinds of 'Early Documentation' are pointed out and a brief outline of the 'Slave Trade' is given.

The second part deals with the main subject: The early documentation of parasitic diseases in Africa and the New World and their transmission by the slave trade. Considered are only early known parasitic diseases and parasites which were reported from Africa and the New World. They obviously only form a very small part of those which are known to-day.

In the third part diseases and mortality of foreigners on the Guinea coast at the time of the slave trade are recorded for comparison. In a final chapter the representation of parasitic diseases and parasites in early African and pre-Columbian art is briefly described, and a conclusion of the whole work is given. This is followed by a subject index, an index of names and illustrations on twenty-three plates.

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# PART ONE



## A Different Kinds of Early Documentation

1. Skeletal remains and remnants of parasites: Bones with lesions due to yaws or syphilis, *Schistosoma haematobium* eggs in the kidneys of two Egyptian mummies of the twentieth dynasty (ca. 1200–1075 B.C.); lice on the scalp of three prehistoric Indian mummies from the southwestern United States, nits of lice on the hairs of a mummy from the Páracas caves in Peru (circa 200 B.C.); nits on the hairs of an Egyptian mummy of the fourth century A.D.; eggs of *Trichocephalus trichiurus* from the intestinal contents of the corpse of a boy of the late Inca period (circa A.D. 1500) buried on a mountain near Santiago de Chile.

2. Inscriptions and reports of authors of classical Antiquity and the Middle Ages: Hieroglyphic inscriptions in the temples of Denderah and Edfu (middle of the first century B.C.) referring to diseases which possibly included malaria; description of Guinea-worm infection among the population on the shores of the Red Sea by Agatharchides (under Ptolemy VII Alexander, second century B.C.); report by Ibn Khaldūn (1332–1406) on the death of Mari Djata (Jaza), sultan of Mali in the Western Sudan from sleeping sickness in A.D. 1373–74.

3. Reports from the 15th to the 19th century by captains of the merchant marine and naval officers, by physicians and naval surgeons, by traders and explorers. These reports and journals were published individually and in collections of voyages and explorations (note).

4. Old beliefs indicating the early knowledge regarding certain parasitic diseases, for example the old widespread assumption of a connection between mosquitoes and malaria, tsetse flies and sleeping sickness, tick bites and tick-fever (relapsing fever), minute insects (sand-flies) and uta.

5. Early works of art representing parasitic diseases and parasites: Statues of different periods, dating from ca. 500 B.C. to the twentieth century found in Nigeria, and an Ashanti goldweight showing elephantiasis of the scrotum; a terracotta head (about

14th century) and Nigerian masks with lesions due to gangosa (tertiary yaws); terracotta heads found in Esmeraldas (Ecuador) and pre-Inca Peruvian Mochica anthropomorphic vessels with signs of leishmaniasis; Peruvian Mochica vessels representing *Tunga penetrans* infection; early representation in clay and stone of fleas, lice and ticks in African, Mexican, and Peruvian art. Pictures of a man and a dog discharging large worms (*Ascaris*) in Sahagún's *Codex matritense* (16th century). A mural painting in a ruined building at Atetelco (Teotihuacán) Mexico showing a man with an exanthema possibly representing syphilis, yaws or exanthematic typhus, A.D. 200–300 (see Part III: Representation of parasitic diseases and parasites in early African and pre-Columbian American art).

### Note

Among the numerous authors of interesting publications mentioning parasitic diseases the following may be listed: JOHN ATKINS, GOMES EANNES DE AZURARA, BAJON, SAMUEL BAKER, JOHN BARBOT, HEINRICH BARTH, ANTHONY BENEZET, WILLEM BOSMAN, JAMES BRUCE, ALEXANDER BRYSON, RICHARD FRANCIS BURTON, HUGH CLAPPERTON, O. DAPPER, B. DAVIDSON, J. B. DU TERTRE, G. A. HOSKINS, J. B. LABAT, JAMES LIND, DAVID LIVINGSTONE, JOHN LOK, JOHN MATTHEWS, FRANCIS MOORE, NICOLAS OWEN, W. F. W. OWEN, MUNGO PARK, ANTONIO PIGAFETTA, FILIPPO PIGAFETTA, G. PISO, POUPPÉ DESPORTES, GABRIEL SOARES DE SOUSA, JOHN HANNING SPEKE, HENRY MORTON STANLEY, THOMAS MASTERMAN WINTERBOTTOM.

Besides these few mentioned authors there are many others whose publications were reprinted completely or in abstracts in 'Collections of Voyages', which were quite popular from the second half of the sixteenth to the first half of the 19th centuries.

Among the older collections are those by G. R. RAMUSIO, 1550–1559; R. HAKLUYT, 1598–1600; S. PURCHAS, 1625–1626; CHURCHILL, AWNSHAM and JOHN, 1704; THOS. ASTLEY, 1745–1747; A. F. PREVOST, 1746–1768; JOHN PINKERTON, 1808–1814.

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## **B The Slave Trade**

### **I**

#### *Slavery in general, kinds of slaves, transmission of diseases by slaves to different parts of the world*

Slavery existed already in remote antiquity, the earliest slaves were prisoners of war. Snefru, the first pharaoh of the IVth dynasty (ca. 2580–2553 B.C.) brought back from Lower Nubia 70,000 prisoners of war who became slaves. A relief in the tomb of Haremheb of the XVIIIth dynasty, about 1346–1321 B.C., shows negroes driven into captivity (see THORWALD, 1962, p. 89). In the time of Ramses II (ca. 1304–1238 B.C.) leprosy was reintroduced into Egypt by negro slaves brought from the Sudan (teste SCOTT, 1943).

There were several other reasons why a person might become a slave. Many were born to captivity, others sold themselves or their children in times of famine, others were enslaved for not paying their debts or as punishment for some crime.

The slave trade developed very early.

Slave markets were established in many places in Europe, Asia and Africa. Slaves of many races were sold and were used for different purposes. In Africa slavery was an old widespread institution.

The rise of Islam greatly stimulated the slave trade (note 1). After the Moslem conquest of large parts of northern Africa, slaves were brought on the old caravan routes (note 2) from the Sudan, Abyssinia and by sea from the Zanzibar coast to northern Africa, Turkey, Arabia, Persia and India (COUPLAND, 1961).

During the Middle Ages slavery continued in Europe, especially in the southern parts and there, just as in Islamic countries, slaves represented an accepted part of society. The Hohenstaufen emperor Frederick II (1194) 1202–1250 had at his semi-oriental court in Palermo numerous black slaves (note 3). Lisbon and Sevilla were among the main centers of the slave trade. Negro slaves were transported from North Africa to Portugal, Spain and Sicily.

In consequence of the Moslem conquest in Africa, Arabs became the principal slave dealers who carried African slaves over great

distances within Africa and across the sea (note 4). As long as they controlled the Indian Ocean (up to the first part of the sixteenth century), their ships transported African slaves to the East, especially to India (note 5). Some Arabic vessels sailed even before the rise of Islam to Malaya, Java and China, where there was a large Arab settlement at Canton. The introduction of African slaves into China, however, was comparatively small (note 6).

A new development of the African slave trade followed the discovery of the Western Hemisphere by Columbus; it will be discussed below.

The slave trade was responsible for the spread of diseases to different parts of the world (SCOTT, 1943). Within Africa slaves carried yaws, endemic syphilis and leprosy over the old caravan routes. The existence of the Guinea-worm in very distant regions such as the shores of the Red Sea and the Guinea coast is most likely due to the slave trade. Oriental sore, frequent on the mediterranean shores, was carried by slaves to the interior of Africa. The existence of *Schistosoma haematobium* infection in Gimvi near Bombay is probably due to a similar cause (HACKETT, 1963; KYNSEY, 1881; SPITTEL, 1923).

As the transmission of parasitic diseases from Africa to the New World will be discussed in the main part of this study, it may only be mentioned here that among important *non*-parasitic diseases smallpox was introduced into the American mainland in 1519–20 by a negro slave (note 7). It had been carried already earlier to some islands of the West Indies. It is certain that smallpox, measles and other epidemic diseases which were introduced into the New World during the conquest, when the Indians had no immunity and died in very great numbers, contributed considerably to the success of the Spaniards<sup>1</sup>.

### Notes

1. Neither the Koran nor the Bible asked for abolition of slavery, but whereas the Bible mentions slaves only in a general way – letters by Paulus to Titus and to Philemon – the Koran deals with slaves in a number of Suras (Sura II, IV, V, IX, XXIV, LVIII, IC). It enjoins the Moslem to treat the slaves with kindness and encourages manumission. A believer who has committed a serious

<sup>1</sup> People said about these diseases:

Sarampión toca la puerta,  
viruela dice: quién es?  
Y escarlatina contesta:  
aquí estamos las tres! (LASTRES, 1951, vol. II, p. 75.)

crime can atone for it by giving freedom to a slave (BLACHÈRE, 1957; ARBERRY, 1963; JUYNBOLL, 1910)<sup>2</sup>.

2. Among the old caravan routes leading to the north African coast, three main routes may be mentioned: In the West, one went from the Niger near Timbuktu to present-day Morocco (DAVIDSON, 1959); farther to the East, one led from Lake Chad via the oases of the Fezzan to Tunis, Tripoli and Libya. Between these two routes there was another one leading from the Niger bend to Algeria (HUDSON, 1964).

In the 14th and 15th centuries there existed an important slave trade from Timbuktu to Egypt and Asia Minor (HERRMANN, 1954, p. 421).

3. Frederick II used his negro slaves for very different purposes. Some young ones of the 'servitelli nigri' formed a band of musicians. They played, richly dressed, on silver trumpets during meal hours (KANTOROWICS, 1964, Hauptband pp. 287–288).

4. The conditions of Christian and negro slaves in eighteenth-century North Africa, especially Morocco, are described with a rich bibliography by N. R. BENNETT, 1960. See also A. TOURMAGNE, 1880, G. MACNUNN, 1938, and the *ENCYCLOPAEDIA OF ISLAM*, vol. I, 1960, 'abd' (slave) pp. 33–34.

5. In Islamic countries there were slaves of many races, occasionally some of them as freedmen rose to a high rank in the army or became ministers of a ruler.

6. DUYVENDAK, 1949, gives some information on the Arab trade with China and slaves. He quotes (p. 22) from the *Ling-wai-tai-ta*: "K'un-lun Ts'eng-ch'i is in the south-western sea. – There is an island in the sea on which there are many savages. Their bodies are black as lacquer and they have frizzled hair. They are enticed by (offers of) food and then captured and sold as slaves to the Arabic countries, where they fetch a very high price."

7. The negro who brought smallpox<sup>3</sup> to the American mainland (Mexico) in 1519–20 was Francisco Eguia (BUSTAMANTE, 1958, p. 43), a grumete<sup>4</sup> in the fleet of Pánfilo de Narváez on his expedition against Cortés (HERRERA, *Hist. General*, dec. 2, lib. 10, cap. 6; BERNAL DIAZ DEL CASTILLO, *Hist. verdadera*, cap. XXIV). He suffered from smallpox and went on shore at San Juan de Ulua (Veracruz) and transmitted the disease to the Indians with disastrous

<sup>2</sup> The author wishes to thank Mr. Ch. von Oidtman, Bonn, for the information.

<sup>3</sup> Different from the majority of authors HORACIO FIGUEROA MARROQUIN (1957, pp. 49–67) is of the opinion that the negro of Narváez introduced sarampión (measles) and not viruela (smallpox).

<sup>4</sup> A slave who had to work on ships.

consequences (see also FRANCISCO LÓPEZ DE GÓMARA, JUAN DE TORQUEMADA).

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## II

*The slave trade from Africa to America*

## 1. Development

The beginnings: Prince Henry 'the Navigator' (1394–1460) was the driving force for the various Portuguese enterprises to extend the sea routes southward on the West coast of Africa. Portuguese expansion started after the conquest of Ceuta in 1415 (for details see DUFFY, 1959, 1962). In 1483 Diogo Cão reached the mouth of the Congo (Zaire), and in 1497–99 Vasco da Gama crowned the various explorations by sailing up the East African coast to India and back.

In 1441 Antam Gonçalves exploring the western shore of Africa captured some Moors and carried them as slaves to Lisbon. He was ordered to return them but received instead 10 negroes and some gold dust<sup>1</sup>. *This started the Portuguese slave trade by sea from equatorial Africa to Europe.* Before the discovery of the New World these slaves were shipped chiefly to Lisbon and Spain.

One should keep in mind that for centuries before that time negro slaves were carried by Arab slave dealers from equatorial Africa on the old caravan routes to the mediterranean coast and from there were sent to Portugal, Spain and Sicily.

In order to protect their trade, the Portuguese built a number of forts 'castles' on the Gold coast of the Gulf of Guinea, the strongest was São Jorge da Mina (Elmina, 1482). Among other strongholds of Portuguese power were the island of São Tomé and Luanda in Angola. During the greater part of the sixteenth century Portugal had more or less a trade monopoly on the African West coast.

From 1580–1640 Spain and Portugal were under one sovereign. From the later sixteenth century on, the Portuguese power and trade on the African West coast gradually declined, due to the competition of other nations, especially the Dutch, French, and English.

The French built in 1626 the Fort St. Louis in Senegal and gradually a whole chain of fortified places was built by different

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<sup>1</sup> In the 15th century, negro slaves worked already in the sugar plantations of Madeira (VERLINDEN, 1924, 1961).

In all probability Phoenicians already visited the Canary Islands. The Carthaginian admiral Hanno sailed about 460 B.C. on a voyage of exploration beyond Gibraltar and found Phoenician settlements on the west African coast.

nations on the Guinea coast. Some of these 'castles' changed hands several times (LAWRENCE, 1963)<sup>2</sup>.

In the middle of the seventeenth century the Dutch were firmly established on the Guinea coast.

From about 1623–1660 the Dutch also held parts of Brazil which, however, they could not keep. In the second half of the 17th century their influence on the Guinea coast was replaced by that of the English.

Several trading companies were formed by the English, Dutch, and French with national monopoly rights of trade with the Guinea coast. In 1618 James I gave a Charter of Monopoly to the 'Company of Adventurers of London trading into Parts of Africa'. The Dutch formed in 1621 the 'West India Company' combining trade to the West Indies with African trade (VAN ANDEL, 1931; DAVIDSON, 1961, p. 55). There existed besides others the 'English Royal African Company' chartered in 1672 and the French 'Compagnie du Sénégal' of which John (Jean) Barbot, who wrote interesting descriptions, was an agent<sup>3</sup>.

In the 17th century when Portugal lost its leading position on the Guinea coast, Spain lost its monopoly of the West Indies. The English took the Bermudas in 1609, Barbados in 1625. The French established themselves in Guadeloupe and in Martinique in 1635, while the Dutch took Curaçao in 1634.

By their acquisition of colonies in the West Indies the English became still more interested in the slave trade, as they needed manpower for their sugar plantations. By the treaty of Utrecht, 1713, England, which by now controlled the greater part of the Guinea coast, obtained in place of France from Spain an Asiento which allowed her to supply 4,800 slaves yearly to the Spanish possessions. Gradually more and more slaves were also shipped to North America.

Slave trade on the Bights of Benin<sup>4</sup> and Biafra, where foreigners were not allowed to build fortified places, was carried out in official cooperation between the captains of the slave ships or their middlemen and the local 'kings'. Whydah, Lagos, Benin, Bonny, Old and New Calabar played at different times a prominent rôle as slave markets.

<sup>2</sup> Much of the trade of the Guinea coast was for a considerable time carried on in cowrie shells (money cowrie: *Cypraea moneta*).

<sup>3</sup> He designated himself as 'agent-general of the Royal Company of Africa and Islands of America at Paris'. John Barbot, a Huguenot emigrant in English employ, had a brother James and a nephew likewise called James who also wrote interesting accounts of their voyages to Africa.

<sup>4</sup> The Portuguese Ruy de Siqueira was the first white man who in 1472 landed in the Bight of Benin.

The twenty negroes brought in 1619 by a Dutch warship from the Guinea coast to Jamestown, Virginia<sup>5</sup>, were regarded as the first negro slaves introduced into the English colonies of North America (for the slave trade to North America see E. DONNAN, 1930–35). Actually negro slaves arrived in North America nearly one hundred years earlier. They were introduced in 1526 by Lucas Vásquez de Ayllón, who attempted to found a colony in what later probably became Virginia (or Georgia).

*The twenty slaves which were sold in 1619 in Jamestown, Virginia, marked the beginning of the slave trade in North America.*

It was the last one to develop and began to flourish after the Royal African Company was chartered in 1672. The slaves were mostly imported into the southern colonies. They were partly carried directly from Africa, more from the West Indies.

About 1790 the several European countries engaged in the slave trade exported from Africa: The British 38,000, the French 20,000, the Portuguese 10,000, the Dutch 4,000, the Danes 2,000. Total 74,000 (quoted from Encycl. Britannica, 1964 edition 'slavery'; see also MANNIX & COWLEY, 1962, and POPE-HENNESSY, 1967).

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<sup>5</sup> "About the last of August came in a Dutch man-of-Warre that sold us 20 negars."

John Rolfe's report of the landing of the first negro slaves in the English colonies, 1619. (See letters of John Rolfe in *Works of Captain JOHN SMITH, 1910*.)

Slavery was introduced into New York in 1625.

## 2. The Spanish possessions and the slave trade

The first negro slaves who were brought to the New World accompanied the conquistadores. They came from Spain and were in part the descendants of the negro slaves carried for centuries from North Africa to southern Europe and since 1441 by the Portuguese from the Guinea coast to Lisbon and Spain before Columbus had discovered America.

In the early period of the slave trade, slaves came to the American mainland, the 'Tierra Firme', either from the West Indies or from Europe, especially from Sevilla (see AGUIRRE BELTRÁN, 1946, cap. I)<sup>1</sup>. The first slaves from Spain were sent in 1502. Only for a short period, slaves came also from Mauretania, the northwest coast of Africa and the Levante. The importation of these slaves was soon prohibited for religious motives in the newly occupied territories.

More and more requests for negro slaves were received in Spain, as manpower was needed and the Indians proved unable to do the hard work. HERRERA wrote that one negro worked as much as four Indians (note 1).

The situation changed when BARTOLOMÉ DE LAS CASAS (1474–1566), the 'Apostle of the Indies', realized that within a comparatively short time the Indians would die out, whereas the negro slaves, who so far had been brought already to Espaniola, worked hard and seemed to be healthy. Las Casas had accompanied Ovando to the West Indies and had seen how the Indians were treated under his administration. He returned to Europe and begged Charles V to import more negroes as an act of mercy towards the Indians. Charles granted the request and in 1518 gave one of his favorites, Laurent de Gouvenot, the privilege of 4,000 'licencias' (licences) to import 4,000 negro slaves annually during ten years. Gouvenot sold the 4,000 licencias to three merchants from Genoa residing in Sevilla for 25,000 ducats.

*The selling of the 4,000 licencias to Genoese merchants, who in cooperation with the Portuguese shipped the stipulated number of negroes to the Spanish West Indies, represents the beginning of the systematic slave trade from Africa to the New World.*

*Evolution of the 'trata negrera':* In 1513 the Spanish Government issued regulations by which a 'licencia' had to be obtained before the introduction of a negro slave into the Western Hemisphere. At the beginning the price of a licencia was two ducats.

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<sup>1</sup> During the early period negroes took part in the Spanish explorations (BROWNING, 1930; WRIGHT, 1902).

In general the licencias carried no monopoly rights, they were controlled by the Casa de Contratación and the Universidad de Mercaderes in Sevilla.

From 1532–1589 no licencias with monopoly rights were issued (teste MELLAFE, 1964, p. 32).

In the last quarter of the 16th century the Spanish Government changed the situation in a sense that the very many licencias to private persons and the licencias issued as a *concesión graciosa* were greatly restricted with the intention to abolish them gradually. Instead of licencias 'asientos' with monopoly rights were issued, first to the Portuguese as they were at that time in a position to supply large numbers of slaves and furthermore were united from 1580–1640 with Spain under one monarch.

When Portuguese power declined, the French and later the English obtained asientos.

The Dutch tried to replace the Portuguese in the slave trade and also relied on contraband shipping from their island of Curaçao. They were in their turn driven from the Guinea coast by the English. Then followed a period during which great international trading companies obtained asientos. One of the last ones was the English South Sea Company (flourished about 1719). At about 1789–1793 the slave trade became free (AGUIRRE BELTRÁN, 1944; MELLAFE, 1964, p. 49); see also MUÑOZ, 1793, and SACO, 1938).

It should be kept in mind that from the beginning up to the abolition of the slave trade a very important clandestine trade existed.

The Spanish ports of entry in the Western Hemisphere were gradually increasing in number. There was also in addition an extensive trade between the islands of the West Indies and from them to the mainland.

The possessions on the Pacific coast were supplied with negroes chiefly by the slave trade through Panama. Panama received negroes who had disembarked in Cartagena de Indias and Portobello. They were reshipped by boats which went from Panama southwards to Guayaquil, Callao and Valparaiso. In the course of time slaves were also carried from Africa to Buenos Aires and forwarded by land to the interior of the continent and to the West coast.

Manila gradually became a center for the trade with slaves from various Asiatic countries to the American West coast (note 2).

It was inevitable that with the constant arrival of ships, which brought large numbers of negro slaves from Africa, infectious diseases were introduced. Yaws and dysentery are mentioned in early

reports as very frequent on slave ships; the most dreaded diseases, however, were smallpox, measles and yellow fever. In consequence, the Spanish authorities in various ports of their vast dominions introduced quarantine regulations.

The first quarantine measures were put into effect in Espaniola in 1519–20 following the outbreak of smallpox in Mexico. An alcalde and a notary public had to visit all arriving vessels. The Viceroy of Nueva España (Mexico), Martín de Enríquez, ordered on the 22nd of November 1571 that a physician of the Island San Juan de Ulua (Veracruz) had to examine every slave upon arrival of a slave ship.

In Peru in 1622 the Marqués de Guadalcázar ordered that all newly arrived negro slaves had to be kept in quarantine, two always chained together until they were sold (LASTRES, 1951, vol. II, p. 74). In March 1630 the Viceroy Luis Gerónimo de Cabrera y Bobadilla, fourth Count of Chinchón, ordered that all negroes bozales (negroes shipped directly from Africa) had to stay before entering Lima at a league's distance outside the city and that three physicians had to examine them for the existence of smallpox and measles which the negroes might introduce into the city.

In Martinique quarantine measures were prescribed in 1686 to prevent the introduction of diseases by slave ships. These quarantine measures were reinforced by a royal decree in 1708.

In 1621 the authorities in Buenos Aires ordered that newly arrived negroes should be lodged in the furthestmost houses of the town or in tents (teste MOLL, 1944).

Physicians were sent from Caracas to La Guaira to inspect slave ships from Trinidad and Margarita.

In São Paulo quarantine inspection of newly arrived negroes was in force since 1733.

In Haiti in 1766 all slave ships were ordered to Port Morel to prevent the importation of Yellow fever from the Guinea coast.

In Surinam, after a smallpox epidemic had occurred in 1763 and 1764, supposedly introduced by imported negro slaves, the Government ordered that all newly arrived slaves had to be carefully examined by a government physician (VAN ANDEL, 1931).

The slaves, before embarking in an African port, were examined by the captain or the physician of the slave ship and the slave dealer regarding their physical condition. As swollen neckglands were well known to the slave dealers as a sign of sleeping sickness, slaves with enlarged neckglands were rejected (see VAN ANDEL, 1931).

When the system of licencias was replaced by that of asientos, an official physical examination, the 'palmo', of each slave was

required to ascertain that a slave could be officially regarded as a 'pieza de Indias' for which the asientos were issued. A 'pieza de Indias' had to be a person of a certain age (15–36 years), about 1.70 m high and in good health. When the slave had successfully passed the palmeo, he was subjected to the 'carimba', the making of a small mark with a letter of the respective asiento by burning the skin with a red-hot iron.

At the place of destination a further rather careful examination in the slave market by a slave dealer and the prospective buyer was carried out before the sale<sup>2</sup>. The documents often mention specifically that the slave who was sold had not the habit of eating earth. Although the cause of this habit (hook-worm-infection) was not known, experience had shown that slaves who were eating earth became anaemic, hydropic and weak and ultimately died, not from earth-eating but from their hookworm-infection (see besides those mentioned in the text, the following authors: VAN ANDEL, 1931; BARRERA y DOMINGO, 1798; HUBER, 1966; ORTIZ, 1916; SACO, 1938; SCELLE, 1906; VERLINDEN, 1958).

### *Notes*

1. HERRERA states: "Porque como iban faltando los indios, y se conocía que un negro trabajaba más que cuatro, por lo cual había gran demanda de ellos."

HERRERA. Decada II, libr. II, cap. 8.

(Quoted from MELLAFE, 1959, p. 15).

2. The 'Manila Galleons' provided a communication between Manila and Acapulco for 250 years, from 1565–1815. Notwithstanding numerous restrictions by the Spanish Crown, the Manila Galleons carried on a considerable transshipment of Asiatic slaves from Manila to Mexico (see W. L. SCHURZ, 1939, *The Manila Galleon*).

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<sup>2</sup> Before the sale, the slaves were often treated by the slave dealers in various ways, in order to make them appear younger and free from diseases (see VAN ANDEL, 1931).

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### 3. Origin of African slaves carried to the New World

The slaves carried to the Western Hemisphere belonged to many different tribes, the majority came from the coastal areas of West Africa. An exact determination of their origin is difficult, as slaves were often called after their port of embarkation and as furthermore the names of some tribes were changed in the slave trade<sup>1</sup>. In addition many documents which could have proved the origin of slaves were lost or, as in the case of Brazil, were intentionally burned (in 1890) to remove all traces of the stigma of the slave trade.

Following AGUIRRE BELTRÁN, 1945, 1946; HERSKOVITS, 1958; MANNIX & COWLEY, 1962; RAMOS, 1946, a few tribes and the

<sup>1</sup> B. DAVIDSON, 1961, p. 103, gives some examples: The Nupe who were sold by the Yoruba in western Nigeria were delivered as Tapas to the markets of the New World. If Yoruba people themselves were enslaved by the Fon of Dahomey, they were known as Nagos. The Susu were registered in the Mexican records as Xoxo. Tribal names which were not changed are the Kissi and Senufo.

regions where they lived are briefly mentioned: Senegambia furnished the Fulah or Fulani (Peuhls), the Wolof, the Serer in the north and the Felup south of the Gambia.

The Fulah had a comparatively light complexion, they were strict Moslems and the sons of many families of the higher class could read and write Arabic. The Wolof were very black, powerfully built with long slender legs. The Mandingo lived in wide parts of the interior of Senegambia and on the coast of Upper Guinea; they were farmers and traders.

From the territories which became later Portuguese and French Guinea came the Baga and Susu; Sierra Leone furnished the Chamba.

The inhabitants of the Gold Coast were in the slave trade called Coromantees after the port of Cormantine. They may have belonged to different tribes but were in their majority Fanti and Ashanti; the latter lived at some distance from the coast.

From Dahomey came the Ewe, from the Bight of Benin the Yoruba, from the Bight of Biafra the Ibo<sup>2</sup>, Ibibio and Efik. The territories further south, the Congo and Angola, furnished Bantu with many tribes; Caffirs<sup>3</sup> came from Mozambique.

DAPPER in the 17th century had already stated that slaves of Mozambique were sold in the Congo. There are indications that slaves were sometimes brought from the African East coast across the continent to the West coast. This, however, happened not often and occurred especially in the nineteenth century during the Arab slave trade from Zanzibar (DAVIDSON, 1961, pp. 105–106).

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<sup>2</sup> The Ibo had the reputation of being inclined to suicide; they believed that after death they would return to their homeland.

<sup>3</sup> Slaves carried from the Mozambique coast were called Kaffrarians after the Arabic word *kāfir*, meaning 'pagan' (teste DAVIDSON, 1961, p. 104).

#### 4. Number of slaves carried from Africa and loss of lives

The inhuman treatment, the suffering and the death of very many slaves who died on the 'path', the march from the interior to the coast have been described by a number of authors, some of whom like Mungo Park had personally travelled with a slave coffle (PARK, 1799, *Travels in the Interior Districts of Africa*, 2nd edit., London). The subsequent stay in the barracoons near the coast and waiting for sailing caused many more deaths on account of dysentery and other diseases. On the ships the overcrowding was incredible. Only some larger slave ships carried a physician whose work was hampered by the general conditions on board (see M. A. VAN ANDEL, 1931; G. J. DOW, 1927; D. H. GALLANDAT, 1769; D. P. MANNIX & M. COWLEY, 1962). MELLAFE (1959, p. 177) lists the medicines carried on a slave ship between Peru and Panama; the supply was apparently rather good and probably much better than on many other slave ships.

David Livingstone estimated that at least 10 lives were lost for each slave who reached the coast. One has to add the numbers of slaves sent from the North African ports and those used for the internal African markets. The 1964 edition of the *ENCYCLOPAEDIA BRITANNICA* and numerous publications by different authors state that on the average 12½ per cent of the slaves died during the 'middle passage'.

The loss of 12½ per cent during the middle passage represents an average figure. In case of epidemic diseases such as smallpox and dysentery the loss might be 50 or 80 per cent, and when the slave trade was officially prohibited, the captain of a slave ship which was chased by a British cruiser might order all slaves to be thrown into the sea to prevent seizure of his ship, if slaves would be found on board. There are also cases on record that drinking water gave out and the captain ordered a number of slaves to be thrown overboard to have sufficient water left for the crew and the remaining slaves (for details see MANNIX and COWLEY, 1962, and for the 18th century slavery 'MINUTES OF THE EVIDENCE', 1791).

According to the estimate of many modern authors between 12–15 million slaves were carried from Africa during the three and half centuries of the slave trade <sup>1</sup>.

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### 5. Circumstances which favoured the African slave trade to America

In the foregoing we have shown that slavery and slave trade existed since antiquity. There can be no doubt that Egypt in pharaonic times, Carthage, imperial Rome, Persia, India, the different Islamic countries, Europe of the Middle Ages and many parts of Africa carried on a flourishing slave trade. The number of slaves taken during these long periods must have been extremely high, especially when in some wars large parts of the defeated armies were sent into slavery (note). Even considering this, the observer is impressed by the number of Africans who after the discovery of the New World were carried during the comparatively short period of about 350 years to the West Indies and the American continent.

DAVIDSON, 1961, has rightly pointed out that the period of about 350 years during which Europeans carried out the slave trade from Africa and treated negroes as low grade human beings, was preceded, at least in some parts of equatorial Africa, by a brief period in which Europeans and Africans regarded and treated each other with mutual respect as equals. He gives as example the Congo and the relations of King Manuel of Portugal and the Mani-Congo Nzinga Mbemba, who after baptism was known as Dom Affonso. In their correspondence these rulers addressed each other as 'Royal Brother'<sup>1</sup>. This feeling of equality soon disappeared, the power of the Congo rulers declined, and after the Portuguese had become the masters of the country, the slave trade in its usual way delevoped.

<sup>1</sup> There are some twenty-two letters by Dom Affonso to King Manuel for the years 1512–1540 preserved in the Archives of Portugal (DAVIDSON, 1961, p. 122).

There were several circumstances which favoured the African slave trade:

Regarding the African background, a circumstance of great importance was the successive decline and the breaking up of the once powerful negro-empires, Ghana, Mali, Songhai and Bambara followed by the establishment of a number of smaller states which were at constant war with each other. This state of affairs made an effective resistance against foreign aggression impossible and, on the other hand, provided an opportunity of purchasing prisoners of the tribal wars as slaves.

For foreigners one of the most important reasons of the slave trade was the need of manpower in the newly conquered territories of the West Indies and the American mainland with their gold- and silver-mines and their sugar-, tobacco-, coffee- and later cotton-plantations.

A further very important reason which stimulated the slave trade and kept it alive for years in numerous countries after it had been officially abolished, was the very great financial profit gained by those who backed the trade. The profit was so great that even very highly placed persons participated. Examples are Queen Elizabeth I and King Charles II of England (MANNIX & COWLEY).

A circumstance which greatly intensified the slave trade was the introduction of fire-arms by foreigners which they exchanged for slaves. This introduction had disastrous results. The African tribes and nations soon realized that they needed fire-arms for protection against slave raids and on the other hand were able to attack their neighbours and obtain prisoners whom they could sell as slaves for arms and spirits.

#### *Note*

After the victory of Lucius Aemilius Paullus Macedonicus in 168 B.C. 150,000 captives were sold.

Caesar sold on a single occasion in Gaul 63,000 captives (quoted from Encyclopaedia Britannica, 1964 edit., p. 775 'slavery').

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## 6. Revolts of negro slaves

There have been numerous slave uprisings in different parts of the world since antiquity. Among revolts of negro slaves the following may be mentioned:

In Iraq in A.D. 850, the negro slaves rose in revolt led by a negro called 'Lord of the Blacks'. In 869 a rebel Persian adventurer caused thousands of black slaves to revolt and in 871 he captured and sacked Basra (MASUDI, 1897, pp. 471–472).

In Bengal (India) still worse atrocities were committed in the 15th century by negro slaves (for details see COUPLAND, 1961, pp. 32–33).

The negro slaves shipped to the New World showed from the beginning a strong determination to regain their liberty. Already in the first years of the Spanish conquest of Mexico, many who had escaped, lived with the Zapotecas. On the islands of the West Indies there were slave revolts since the early days of the occupation. Probably the first large one was the revolt in Espaniola in 1522, followed by an uprising in 1546. The city of Mexico likewise had slave uprisings, one occurred as early as 1537. Between 1555–1556 there was a great revolt in Panama. In San Pedro, Honduras, a revolt occurred in 1548 (MELLAFE, 1964; WIENER, 1920). For additional information about slave insurrections, see SACO, 1938; HERSKOVITS, 1958; MELLAFE, 1964, p. 82; DAVIDSON, 1961, p. 47; and regarding Brazil, CARNEIRO, 1946.

The Spanish Government realized the great danger of these revolts and issued 'ordenanzas para los negros huidos'. They changed regarding punishment in the course of time, but were always of extreme severity (MELLAFE, 1959, 1964).

In order to capture fugitive slaves the Spaniards used especially trained dogs. With their help they were often successful. Nevertheless, quite a number of slaves reached the forests in the mountains, where they lived with local Indians or in negro communities. They were the 'cimarrones' of the Spanish colonies who, whenever possible, helped other negro slaves to escape.

When the English took Jamaica in 1655, many former slaves of the Spaniards escaped to the hills. They were known as 'Maroons'.

In Haiti (Espaniola) there were slave uprisings in 1679, 1691 and 1704 before the outbreak of the great, extremely cruel revolt toward the end of the eighteenth century after the French Government in Paris on 16 Pluviose II (4th February, 1794) had proclaimed the abolition of slavery.

In Surinam, Dutch Guiana, numerous revolts broke out during

the first part and the middle of the eighteenth century. The escaped slaves, called 'bush negroes' or 'Djukas' have remained independent until to-day.

Brazil had many revolts. Slaves revolted in Bahia at intervals from 1807 to 1830 and caused a very great insurrection in 1835.

For slave revolts in North America see APTHEKER, 1943.

The fact that in some countries negro communities formed by escaped slaves succeeded in keeping their independence and existed without contact, separated from the white population, is of considerable medical and cultural interest; as in these communities there occurred or even still occur diseases which the negroes had brought from Africa and which they had transmitted to the Indians with whom they came in contact.

The often horrible, inhuman treatment of the slaves by their masters obviously stimulated the revolts. It can be explained but not excused by the constant fear from the part of the foreign population which was in many places numerically much inferior to the slaves and for the sake of security felt that they had to keep the negro slaves in permanent terror (note). For examples of the atrocities committed by the slave-owners, see MANNIX & COWLEY, 1962, and JAMES POPE-HENNESSY, 1967.

The argument which was occasionally advanced that slavery had always existed among Africans and that therefore the enslavement of negroes by the Spaniards and Portuguese represented merely the continuation of an old custom, is not justified.

Slavery as practised among African tribes was very different from slavery as practised by the Spaniards in the Western Hemisphere. In many African tribes as in Islamic countries, slaves were regarded as a part of society, many were also born as slaves and therefore slaves, as far as they were not prisoners of war, were in general not treated too badly<sup>1</sup>. Furthermore, even the latter ones, although taken from their homes, remained in Africa in a familiar environment (see also RODNEY, 1966). On the other hand, slaves carried to the Spanish possessions in America and to Brazil were completely uprooted and had to work excessively, often under most degrading unhygienic living conditions.

#### *Note*

In Barbados there were in 1684 46,000 negro slaves and only 20,000 whites (MANNIX & COWLEY, 1962, p. 51). In 1798 much

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<sup>1</sup> One has, however, to keep in mind that in numerous African territories slaves often became victims of religious ideas, requiring human sacrifices or were killed when a powerful chief died whom they were supposed to accompany and to serve in another world.

more than half of the Brazilian population were negroes (RAMOS, 1946).

The vast majority of the population in Haiti were negroes (RAMOS, 1946).

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## 7. Abolition of the slave trade

“...and it will still continue true, that never can so much misery be found condensed into so small a space as in a slave ship during the middle passage.”  
 Wilberforce, Letter, 1807<sup>1</sup>.

The rôle of slavery during the eighteenth and nineteenth centuries in the Western Hemisphere showed dissimilarities in different countries. In some of them, for example Mexico, the ever-increasing mulatto and mestizo population, being free labourers but poor and willing to work at a very low pay, replaced the slaves.

AGUIRRE BELTRÁN (1944) states that during the entire eighteenth century and the first years of the nineteenth century until Mexico obtained independence, not more than 20,000 slaves entered New Spain.

The official abolition of the slave trade in Mexico took place on December 19, 1817, but in reality it had been already suspended for years. Toward the end of Spanish rule there existed according

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<sup>1</sup> Quoted from THOMAS FOWELL BUXTON, *The African Slave Trade and its Remedy* (p. 122). London, 1840.

to Baron Alexander von Humboldt (teste AGUIRRE BELTRÁN) in Mexico only 10,000 slaves, 6,000 of which were negroes and 4,000 mulattoes. These were the remnants of the slaves who had been introduced into the country during about 300 years. By unions with Whites and Indians they had been absorbed and contributed to form the new Mexican nation (AGUIRRE BELTRÁN, 1944).

Not only in Mexico but in various South American countries slave labour was gradually replaced to a large extent by the work of a free, very poorly paid mestizo and mulatto population.

In Brazil already in the first period of the slave trade, the famous Jesuit Manuel da Nóbrega (1517–1570) had the courage of speaking strongly against slavery and the slave trade. His efforts, however, were unsuccessful (RAMOS, 1946).

Conditions were different in the southern states of North America where such a large mulatto population did not exist. There the number of cotton plantations increased and in order to get manpower, slaves were needed (note).

When Spanish possessions in the Western Hemisphere obtained their independence, nearly all of them officially proclaimed the abolition of slavery and forbade the slave trade. Nevertheless, it continued often for years in a clandestine way. In England slave trade was made illegal by Act of Parliament in 1807, in the English colonies it became illegal in 1833. English public opinion was widely aroused by the reports of physicians, travellers and explorers who had penetrated into parts of the interior of Africa and described the way how slaves were obtained and the cruelties connected with the slave trade.

Already in the second half of the 18th and at the beginning of the 19th century many people in England, and also in America, criticized the slave trade and pointed out the evils of slavery; among them was THOS. M. WINTERBOTTOM. Two outstanding figures of the abolitionists in England were THOMAS CLARKSON and William Wilberforce, 1759–1833 (for details see DAVIDSON, 1961; MANNIX and COWLEY, 1962). The 'Society for the Abolition of the Slave Trade' was founded in 1787 and after years of bitter struggle the abolitionists succeeded.

In France 'LA SOCIÉTÉ DES AMIS DES NOIRS' addressed the National Assembly in 1790 to have slavery abolished. In the last quarter of the 19th century when the slave trade, although officially long abolished, still existed in many places, the cardinal Charles Lavigérie (1825–1892) organized antislavery societies to protect the natives of Central Africa; the creation of the 'White Fathers' is also due to him.

In North America, Harriet Beecher Stowe's well-known novel

Uncle Tom's Cabin, first published in 1851, highly praised and bitterly criticized, helped abolition by drawing attention to the living conditions of the slaves in the southern American States.

England, which before had been a most active and important representative of the slave trade, became in the nineteenth century the champion in the fight for suppression of the trade.

Partly by substantial bribes, partly by diplomatic pressure and also by her then great naval power England gradually, but with great difficulty, succeeded. In 1849 a British squadron destroyed every slave ship which it found on the Brazilian coast. In this way the slave trade to Brazil was essentially destroyed, although it had in later years a small temporary revival.

An effective English method to curb the slave trade was the search of non-English suspected ships for slaves. This, however, could not be done without special permission of the respective government, which was not always easy to obtain.

In the first half of the nineteenth century the slave trade shifted more and more to the African east coast, especially to Zanzibar and Mozambique, as the British cruisers which were used against the slave ships operated for a number of years only on the African west coast. At about 1840 Zanzibar had become the world's greatest slave market; the population, which in 1807 had been about 5,000, rose to 60,000 in 1856. From Mozambique slaves were carried across the continent and were smuggled to Brazil and the Spanish possessions in South America, especially Cuba. The majority of the slaves shipped from Zanzibar were carried to the Persian gulf. American ships sailing under Portuguese or South American flags and Arabian dhows played an important rôle in the slave trade from the African east coast.

The Zanzibar slave trade was suppressed in several steps, and in about 1873 the trade came to an end.

The danger for the slaves on ships was greatest when the trade was officially prohibited, as especially the Arabs were very ruthless and killed them without mercy if there was any risk that the dhow with slaves be caught by a British cruiser.

A considerable difficulty arose from the question about what to do with the liberated slaves. England created several depots of liberated slaves, some were in Sierra Leone, the Cape Colony, the Seychelles and St. Helena.

The fight for the abolition of the slave trade was very long and complicated, especially as some South American countries which at the time of their liberation had officially condemned the slave trade were for various reasons (financial gains and need of manpower) not so eager to put the law into effect, so that in some

countries the slave trade some how continued for many years up to the last decades of the nineteenth century.

The United States abolished slavery and the slave trade in 1865. Spain was reluctant in prohibiting the trade, even after the Spanish Cortes had made a law of suppression in 1871. At last in 1880 the Spanish slave trade came to an end. Cuba abolished the trade in 1880, Brazil in 1888.

### *Note*

In the late period of the slave trade, when Canada had only few slaves left, as by law of 1793 all children of slaves became free at the age of 25 years, many slaves of the American States fled to Canada and helped other slaves to escape to the country where they were free.

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## PART TWO

### THE EARLY DOCUMENTATION OF PARASITIC DISEASES IN AFRICA AND THE WESTERN HEMISPHERE AND THEIR TRANSMISSION BY THE SLAVE TRADE



## A Diseases Caused by Protozoa

### I

#### *Sleeping sickness of man – Trypanosomiasis of animals*<sup>1</sup>

##### *Africa*

*Trypanosoma gambiense* was discovered only at the beginning of the twentieth century, the clinical symptoms of sleeping sickness, however, were known in endemic regions of West Africa for hundreds of years before the discovery of the causative agent. The fatal trypanosomal disease of horses and cattle as well as that known as *mbori* in dromedaries at Timbuktu were likewise known for a very long time. This is supported by numerous indications.

A very early description of what was evidently sleeping sickness was given by two Arabic authors. One is the celebrated historian IBN KHALDŪN, who died in Cairo in A.D. 1406, and who wrote a comprehensive history of North Africa (note 1). The second is SHIHĀB AL-DĪN AHMAD AL-QALQASHANDĪ, an Egyptian official, who died in Cairo in 1418 (note 2). As AL-QALQASHANDĪ was a younger contemporary of IBN KHALDŪN and lived with him in Cairo for nearly 20 years, he may have taken his narrative from IBN KHALDŪN's famous historical work (note 3).

The case in question concerns Mari Djata (Jatah), sultan of Mali (Melle) in the Western Sudan. The respective paragraph was translated from IBN KHALDŪN's Arabic into French by Baron DE SLANE (1st ed. 1863, 2nd ed. 1927) and into German by BECKER 1910. His translation was retranslated into English by MEYERHOF 1941. This retranslation corresponds in every respect with the French translation of Baron DE SLANE and runs as follows:

“He (the sultan) was overtaken by the sleeping sickness, which is a disease that frequently befalls the inhabitants of these countries and particularly their chieftains. The sufferer is attacked repeatedly and at any time by profound sleep, so that it is hardly possible to awake him but for a short time only. It is harmful to

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<sup>1</sup> This chapter is based on an article by R. HOEPLI and CHR. LUCASSE in *J. trop. Med. Hyg.* vol. 67, 1964, pp. 60–68. The author wishes to thank Dr. A. J. Duggan, Co-editor of the *Journal*, for his kind permission to reprint parts of the former article.

the sufferer, and his disease continues until he dies. He (the judge) said: His (the king's) disease remained in his constitution for two years until he died in the year 775 (A.D. 1373/74)." AL-QALQASHANDĪ repeated IBN KHALDŪN's narrative in nearly the same words, he calls the sultan Mari Jazah (Lion Prince) and sleeping sickness *illat al-nawm*.

From the remark that the disease frequently befalls the inhabitants of these countries, one may draw the conclusion that it was a disease which had existed in this region for some time and was well-known regarding its symptoms.

IBN KHALDŪN and AL-QALQASHANDĪ are according to our present knowledge the only two early Arabic authors who refer doubtless to sleeping sickness (note 4). It is possible and even likely that a future intensive search in the early Arabic literature will provide more references to sleeping sickness. Such an investigation may advance our knowledge of the existence of sleeping sickness in early centuries, which so far have yielded no information.

We have not found a reference to sleeping sickness during the 360 years following Mari Djata's death (note 5).

JOHN ATKINS, a British naval surgeon who had visited the Guinea coast in 1721, gave in his book *The Navy Surgeon* (1st ed. 1734, 2nd ed. 1742) the first brief but definite report on the clinical symptoms of sleeping sickness. He writes:

"The sleepy Distemper (common among the Negroes) gives no other previous notice than a Want of Appetite two or three Days before; their Sleeps are sound and Sense of Feeling very little; for pulling, drubbing or whipping, will scarce stir up sense and Power enough to move; and the Moment you cease beating, the Smart is forgot, and down they fall again into a State of Insensibility; driveling constantly from the Mouth, as in deep Salivation; breath slowly, but not unequally, nor snort."

"Young People are more subject to it than the Old; and the Judgement generally pronounced is Death, the Prognostick seldom failing. If now and then one of them recovers, he certainly loses the little Reason he had, and turns Idiot."

"The Cure is attempted by whatever rouzes the Spirits, bleeding in the Jugular, quick Purges, Sternutories, Vesicatories, Acu-Puncture, Seton, Fontanels, and sudden Plunges into the sea; the latter is most effectual when the Distemper is new, and the Patient is yet not driveling at Mouth and Nose."

THOMAS MASTERMAN WINTERBOTTOM in 1803 furnished a more detailed account of sleeping sickness as observed in Sierra Leone and on the Gulf of Benin. He drew attention to the enlargement of the posterior cervical glands, subsequently called 'Winterbottom's

sign'. This swelling of the neckglands had been already known to the slave dealers as an indication of sleeping sickness which always ended with death. They therefore refused to buy slaves with enlarged neckglands. WINTERBOTTOM states:

"The Africans are very subject to a species of lethargy, which they are much afraid of, as it proves fatal in every instance. The Timmanees call it *márree* or *'nluoi*, and the Bulloms *Nagónlôe*, or *Kadeera*: it is called by the Soosoos, *Kee Kóllee Kondee* or sleepy sickness, and by the Mandingos, *Seenoyúncaree*, a word of similar import."

"This disease is very frequent in the Foola country, and it is said to be much more common in the interior parts of the country than upon the sea coast. Children are very rarely, or never affected with this complaint, nor is it more common among slaves than among free people, though it is asserted that the slaves from Benin are very subject to it. At the commencement of the disease, the patient has commonly a ravenous appetite, eating twice the quantity of food he was accustomed to take when in health and becoming very fat. When the disease has continued some time, the appetite declines and the patient gradually wastes away."

"Squinting occurs sometimes, though very seldom in this disease and in some rare instances the patient is carried off in convulsions. Small glandular tumors are sometimes observed in the neck a little before the commencement of the complaint, though probably depending rather upon accidented circumstances than upon the disease itself. Slave traders, however, appear to consider these tumors as a symptom indicating a disposition to lethargy, and they either never buy such slaves, or get quit of them as soon as they observe any such appearances. The disposition to sleep is so strong, as scarcely to leave a sufficient respite for the taking of food; even the repeated application of a whip, a remedy which has been frequently used, is hardly sufficient to keep the poor wretch awake. The repeated application of blisters and of setons has been employed by European surgeons without avail, as the disease under every mode of treatment, usually proves fatal within three or four months. The natives are totally at a loss to what cause the complaint ought to be attributed; sweating is the only means they make use of, or from which they hope for any success: this is never tried but in incipient cases, for when the disease has been of any continuance they think it in vain to make the attempt."

"The root of a grass, called by the Soosoos *Kallee*, and the dried leaves of a plant, called in Soosoo *Fingka*, are boiled for some time in water in an iron pot; when this is removed from the fire, the patient is seated over it, and is covered over with cotton cloths, a

process which never fails to excite a copious perspiration. This mode of cure is repeated two or three times a day and is persisted in for a considerable length of time, until the disease be carried off, or appears to be gaining ground. No internal medicines are given in the complaint" (note 6).

Among later physicians who paid special attention to sleeping sickness were R. CLARKE, 1840, 1842, 1860; W. F. DANIELL, 1849 (note 7); GORE, 1875, and a number of French physicians, mostly naval surgeons, some of whom reported cases of sleeping sickness from the French Antilles. Among them were: MOREAU DE JONNÈS, 1808; NICOLAS, 1861; DANGAIX, 1861; CHASSANIOL, 1865; SANTELLI, 1968; GRIFFON DU BELLAY, 1864; GUÉRIN, 1869; CORRE, 1876, 1877; BORIUS, 1882; ABBLART, 1883.

### *Names for Sleeping Sickness used by Africans*

African names sometimes indicate characteristic clinical symptoms. They may also express certain beliefs regarding the assumed cause and nature of the disease. From the many names for sleeping sickness used by different tribes in various areas only seven have been selected as they seemed of some interest. The great majority of African names have the same meaning as the English 'Sleeping sickness'<sup>2</sup>.

*Kemborn* 'nut' – Kissi, Northern Liberia, Sierra Leone (WINTERBOTTOM, 1803). Enlarged lymph glands.

*Kpatsungi*, *Kpatsun* – neck; *gi* meaning small, also child. *Kpatsungi* therefore: little ones of the neck. – Nupe, Niger valley, Nigeria. The Nupe disease term, *Kpatsungi*, may mean sleeping sickness, but includes all diseases in which the presence of enlarged cervical glands is noticed (MCLETCHIE & DUGGAN, 1954).

*Konje-Kira*, 'ball sickness' (enlarged lymph glands) – Vai, Western Liberia (STRONG, 1930).

*Moryor*, 'swollen body' – Kissi, Northern Liberia, Sierra Leone (pers. comm., 1962) refers to patients who during the very early stage eat excessively and in consequence become temporarily fat.

*Yeesegebei*, 'water disease' – Kpelle, Sheansue clan in Gbanga district, Central Province, Liberia (pers. comm. 1962). Suspicion of a connection between the disease and water.

<sup>2</sup> See also the previous quotation from WINTERBOTTOM's publication.

*Dudduru*, name used for sleeping sickness, an alternative meaning of which is a 'river or stream with shady banks', indicating some suspicion of the whereabouts of infection. – Inhabitants of riverside areas in the Lake Chad Basin (DUGGAN, 1962).

*Fukufenkor*, name for sleeping sickness; originally the name of a wide open country pot as is used for the treatment of sleeping sickness. – Kissi and Loma in Western Province, Liberia (pers. comm. 1962).

### *Names for Sleeping Sickness used by Foreign Physicians*

#### *a) English authors*

ATKINS, 1734; sleepy distemper; WINTERBOTTOM, 1803; lethargus, negro lethargy; CLARKE, 1840, 1842, 1860; lethargus, sleepy dropsy, narcotic dropsy, sleepy sickness.

#### *b) French authors*

Maladie de Gorée, maladie de Neaning (both places had a very bad reputation regarding sleeping sickness), somnolence, lethargie, narcotisme des Nègres, hypnose, hypnosie. A name frequently used by French authors was *Névalane*, an African name, originally used by the Wolof north of the Gambia river. A corresponding name is *Dadane*, applied by the Serer, south of Cajor (CORRE, 1877).

### *Symptoms*

In endemic areas people were familiar with the symptoms and the course of sleeping sickness. In the Eket district in south-east Nigeria the inhabitants differentiated two stages of sleeping sickness (MACFIE, SCOTT & GALLAGHER, 1914). In the first stage there is an enlargement of lymph glands, it is called *insip itong*, the second is the somnolent stage, *odono idap*. The rash over the body was known (MACFIE, SCOTT & GALLAGHER, 1914).

If the enlarged glands are not removed, the patient gradually becomes somnolent and ultimately succumbs. Many tribes held similar views. It was known that the incubation period might be very long, therefore in Gorée a person was not regarded safe before he had been absent from an endemic area for seven years (CORRE, 1877).

### *Various early assumed Causes*

Many different causes were considered because the real cause remained unknown until the beginning of the twentieth century.

Most of the assumed causes need not be discussed, they include: sexual intercourse in day-time; eating bad food; poisoning by a plant; magic influence; sleeping sickness being a primordial disease, the germs of which are in every man and woman. This opinion was held by the Nupe on Jebba Island, Nigeria; standing and working in stagnant cold water, the Sheansue clan in the Gbanga district of Liberia called sleeping sickness *Yeeseqbei* or 'water disease'.

Many West African tribes, e.g. the inhabitants of Rio-Nunez, the Mandingos (Malinke) and the Loma regarded enlarged cervical glands as connected with the cause of sleeping sickness.

"Enlarged cervical glands or kernels are called *Kwea weagi* by the Loma. They say: If they get to the stomach, the patient dies. If not cut out they make him sleepy' (HARLEY, 1941, p. 45; SCHWAB & HARLEY, 1947).

An 'impaired condition of the brain' was suspected as cause of sleeping sickness by DANIELL, 1849 (note 7).

Here may be mentioned the suspicion temporarily held by MANSON that *Acanthocheilonema perstans* might have some relation with sleeping sickness. The adult filaria was discovered by DANIELS in 1898 in Demararan aborigines in British Guiana. It was first described by MANSON, who had already in 1891 identified in London the microfilariae in the blood of two negroes from the Congo, one of whom died of sleeping sickness. Later he found again the same microfilariae in the blood of negroes from Old Calabar and the Congo and also in blood films from British Guiana. It became evident that *A. perstans* had no relationship with sleeping sickness as in British Guiana where this filaria is common, there is no sleeping sickness while on the other hand among the Kavicondo on the north eastern shore of Victoria Nyanza, where sleeping sickness was frequent, *A. perstans* does not exist.

### *Sleeping Sickness attributed to the Bite of Tsetse Flies*

Before dealing with this question, it may be stated that by some tribes, for example the Peuls in former French Guinea, tsetse flies are only exceptionally incriminated (RISTORCELLI, 1939).

On the other hand, a connection between tsetse flies and sleeping sickness was long recognized or at least suspected in certain parts of West Africa (e.g. in the Lake Chad Basin). MACFIE, SCOTT

& GALLAGHER, 1914, reported that in Ikotobo in Southern Nigeria some Africans attributed sleeping sickness to the bite of a fly known as *nsung idap*, or sleeping fly. This fly is commonly known in towns of the Eket district as *ung obio*, or town fly, and has been identified as the tsetse fly.

In 1945 a physician who had studied sleeping sickness in the Gambia, stated that the Mandingo (Malinke) were so well acquainted with the disease that they not only realized that it was carried by tsetse flies, but were able to distinguish between species of tsetse. *Glossina palpalis* was known to be dangerous to man, while *G. morsitans* was regarded as innocuous. Such detailed knowledge suggests that sleeping sickness has existed in the Gambia for many centuries (A. J. DUGGAN, pers. comm.).

The inhabitants of the Lake Chad Basin realized the need to protect themselves against the bite of tsetse flies (DUGGAN, 1962).

### *Tsetse Flies and Diseases of Horses and Cattle*

A connection between a fatal disease of horses and cattle and tsetse flies was widely recognized for centuries. DUGGAN, 1962, refers to Mahmud ben Zergun, who in 1592, while fighting along the Niger north of Jebba, had to report to the Sultan of Morocco that his horses had been killed by tsetse flies so that he was compelled to return to Timbuktu.

In East Africa tsetse flies likewise apparently influenced military operations. Francisco Barreto, who in November 1571 led a strong Portuguese expedition up the Zambesi valley to occupy the Manica goldfield, lost his horses and camels at Sena. Suspecting that the local Arabs had poisoned a well, he had all Arabs and Swahili of the Arab settlement at Sena killed (see H. H. JOHNSTON, 1899; COUPLAND, 1961, p. 50; DUFFY, 1962, p. 84).

Finally D. Bruce in 1895 demonstrated that nagana is due to trypanosomes transmitted to domestic animals by tsetse flies. Wild game serves as reservoir host. The result of this investigation contributed considerably to the subsequent successful work on human sleeping sickness.

### *Prevention*

The Fulani of Northern Nigeria knew that there exists a relation between tsetse flies and a fatal disease of horses and therefore kept away from the Niger and Benue valleys (DUGGAN, 1962).

There are indications that such a relation was not only recognized in West Africa. LIVINGSTONE, 1857, p. 527, reported that

while travelling along the ancient bed of the Zambesi, they moved only at night when passing a tsetse-infected area.

LIVINGSTONE, while fully realizing the great danger of tsetse flies for domestic animals, believed that they were perfectly harmless to man (note 8).

He was shown a root at Moyara which when pounded and sprinkled over the oxen was believed to cause the flies to make off without sucking blood. Another method of protection consisted in mixing dropping of animals, human milk and some medicines together and rubbing the animals with the mixture before they passed through a tsetse district.

According to AUSTEN, 1903, several writers have referred to the feeding of tsetse flies by Africans to their animals in order to protect them.

MAUCH (1874) used this prophylactic treatment in the case of one dog. Although the animal had to pass through a tsetse district, it did not become sick. This experiment is, however, without value, as there was no means of knowing whether the dog, while passing through the danger zone, had, in fact, been bitten by infected flies.

### *Treatment by Africans*<sup>3</sup>

Based on their experience, Africans in regions where sleeping sickness was endemic, knew that the disease was nearly always fatal. Therefore in many instances no treatment was given and the patient was abandoned. If treatment was attempted, it was applied to early cases only. Purgation, inducing strong perspiration and washing with infusions and decoctions of leaves, roots and bark were used by many tribes. Ointments of herbal origin and pastes made of triturated roots were applied to the neck. In certain areas vesicatories were used. Multiple incisions in the region of the neck glands were widely practised, for example in the Benue valley of Nigeria. In the Central Congo, among the Basakata, multiple incisions were made all over the body to remove larger amounts of blood, which was supposed to contain a pathogenic principle introduced by a ghost.

Excision of the cervical glands, exceptionally also of glands in axilla and groin, was widely practised among different tribes. There was a widespread belief in the preventive and curative value of the excision of the neck glands.

Besides excision, cauterization of the neck glands was also practised.

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<sup>3</sup> For an excellent general discussion of treatment in Primitive Medicine, see SIGERIST, 1951.

Non rational treatment using special kinds of medicines, amulets and fetish need only be mentioned (see plate I).

### *Treatment by Foreign Physicians*

There existed the general opinion that sleeping sickness did not respond to any treatment and always terminated fatally.

Among the therapeutic methods which have been – unsuccessfully – tried were: Bleeding, purgation, vesicatories, acupuncture, sudden plunges into the sea (ATKINS, 1742); various stimulants, strychnine, coffee, quinine sulphate (NICOLAS, 1861). CORRE, 1877, used in addition cauterization, moxibustion, potassium iodide, mercury ointment, cold-water treatment. He undertook special studies regarding the climate, the geological formation and the flora and fauna of the endemic areas of sleeping sickness. These studies, although valuable in themselves, gave him no indication as to the cause of the disease.

### *America*<sup>4</sup>

Negro slaves carried sleeping sickness to the West Indies and South America. They were all cases in the early stages which had not been recognized before shipment. As mentioned before, the slave dealers knew that enlarged cervical glands were a sign of the disease which always proved fatal and they refused to buy negroes with swollen neck glands.

In the Antilles one noticed that the creoles and the white immigrants were never attacked, only 'bozal' negroes who had themselves been shipped from West Africa. Negro children, if born in the Antilles, never got sleeping sickness, not even if one or two of their parents had suffered and died of the disease. It was also observed that sleeping sickness in some cases became evident only many months after the arrival of the negro at the West Indies.

Several French authors reported their observations of sleeping sickness in the Antilles. MOREAU DE JONNÈS saw cases among the slaves in 1808, DANGAIX in 1861. NICOLAS, 1861, found in nine months 5 cases among 1,200 negroes. In his opinion one out of hundred deaths among negroes on the voyage from the Congo to the Antilles was due to sleeping sickness. In his Paris thesis 1869, GUÉRIN of Martinique reported 148 cases among negro slaves imported from the Congo during 12 years.

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<sup>4</sup> Stanley's Emin Pasha Relief expedition in 1888 probably introduced sleeping sickness into Uganda and the region of the great lakes, resulting in very great epidemics.

GORE noticed cases of sleeping sickness among negro soldiers in the Bahamas and Ribeiro in Brazil among negro labourers (teste SCOTT, 1943).

We therefore realize that the slave trade carried cases of sleeping sickness from Africa to the Western Hemisphere but the infection could not spread because there were no suitable vectors.

### Notes

1. Abu Zaid 'Abd al-Rahman ibn Khaldūn, born in Tunis at the end of May 1332, died in Cairo 16th March, 1406. The Arabic text is found in Ibn Khaldūn's Kitāb al'ibar (Bulaq edition, 1284 A.H.) vol. VI, p. 201, teste MEYERHOF, 1941.

2. His reference to sleeping sickness was pointed out by Prince Omar Tusun (Tussim) in the Egyptian Gazette, number of 5th December, 1931, Cairo, and in Sudan Notes and Records, vol. XIV.

3. Al-Qalqashandī's chronicle *Ṣubḥ al-a'sha* was printed in Cairo in 14 volumes in 1915 (see MEYERHOF, 1941).

4. Ibn 'Abd al Hadjala (1325–1375), an Algerian, made a pilgrimage to Mecca and subsequently went to Damascus and Cairo where he became Safi of a monastery. In 1362 he wrote on plague and according to L. BRANDL (1966) also on sleeping sickness. The present writer was, however, unable to trace this publication.

5. We cannot agree with W. R. BETT, 1959, that Aleixo de Abreu, 1623, in his description of 'mal de Loanda' refers to sleeping sickness.

6. In Liberia one of the early reported victims of sleeping sickness was Doala Bukere, the inventor of the Vai alphabet (JOHNSTON, 1906, vol. II, p. 1114; STRONG, 1930, vol. I, p. 497; STRONG, 1945, vol. I, p. 166).

7. "The Ebo's from an hereditary predisposition of melancholy and despondency, are affected with the malady which Dr. Winterbottom has termed lethargus, or sleepy sickness, a disease that possibly originates from an impaired condition of the cerebral apparatus and which has been thought to be one of the sequences of the deranged organic functions of the skin" (W. F. DANIELL, 1849).

8. "A few remarks on the tsetse, or *Glossina morsitans*, may here be appropriate.

Its peculiar buzz when once heard can never be forgotten by the traveller whose means of locomotion are domestic animals; for it is well known that the bite of this poisonous insect is certain death to the ox, horse and dog. In this journey, though we were not aware of any great number having at any time lighted on our cattle, we lost forty-three fine oxen by its bite" (pp. 80 and 81).

“A most remarkable feature in the bite of the tsetse is its perfect harmlessness in man and wild animals and even calves so long as they continue to suck the cows. We never experienced the slightest injury from them ourselves, personally, although we lived two months in their *habitat*, which was in this case as sharply defined as in many others, for the south bank of the Chobe was infested by them, and the northern bank, where our cattle were placed, only fifty yards distant, contained not a single specimen” (p. 81).

“The mule, ass and goat enjoy the same immunity from the tsetse as man and the game. — Our children were frequently bitten, yet suffered no harm; and we saw around us numbers of zebras, buffaloes, pigs, pallahs and other antelopes feeding quietly in the very habitat of the tsetse, yet as undisturbed by its bite as oxen are when they first receive the fatal poison” (p. 82) (LIVINGSTONE, 1857).

LIVINGSTONE'S book shows on the title page a picture of the tsetse fly. Other pictures of it are found in the first edition on page 571: the fly in natural size, enlarged and the proboscis, drawn by I. E. Gray of the British Museum from specimens obtained by Livingstone.

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## II

### *Cutaneous leishmaniasis*

#### *Africa*

Oriental sore was known for centuries under various names to the local population in endemic areas.

ELGOOD, 1934, based on the works of Persian and Arabic medical writers, came to the conclusion that the so-called 'Balkh' sore was Oriental sore, and was probably brought to Baghdad by the conquering Mongols in 1258. The early writers assumed that it was transmitted by mosquitoes.

Oriental sore or *Aleppo boil* was described since the second half of the eighteenth century. RUSSEL (1756) and several later physicians found it endemic in Aleppo and described it under the name *Aleppo boil* (STRONG, 1945).

It exists in endemic regions in different parts of Africa: On the mediterranean coast from Morocco, Tunis to Lower Egypt, in the Sudan, in Abyssinia, Uganda, Mozambique, on the Gulf of Guinea and in the Congo. When in the first half of the nineteenth century the French established their rule in North Africa, French physicians, especially naval surgeons, became familiar with the infection.

It is known that the population in some endemic areas inoculated their children with material from oriental sore on parts of the body which are normally covered by clothing. They knew that an infection gives as a rule a lasting immunity, and by their inoculation they prevented a possible infection at a later age on the face, neck or on the arms which would heal with a disfiguring scar.

James Homer Wright in 1903 gave the first complete description of the parasite *Leishmania tropica*. He obtained his mate-

rial from the Oriental sore of an Armenian child which apparently had acquired the infection in its home country two or three months before departure for America and had been admitted to the Massachusetts General Hospital in Boston (note 1).

Wright's case showed, as might be expected, that a patient with Oriental sore can carry the infection to different parts of the world. The question whether the infection will spread depends on the presence of a *Phlebotomus* species suitable to serve as vector.

#### *America*

There are no records of a transmission of Oriental sore by negro slaves from Africa to the New World. In view of the large number of African slaves who entered the West Indies and the American continent during about 350 years of the slave trade, it is reasonable to assume that occasionally Oriental sore was carried by an infected slave to the Western Hemisphere. Such an introduction, however, had no visible result. In Central and South America there existed already cutaneous leishmaniasis caused by a parasite *Leishmania brasiliensis*, Vianna, 1911, which is morphologically undistinguishable from *Leishmania tropica*<sup>1</sup>. The clinical picture of American cutaneous leishmaniasis is, however, different from that of Oriental sore in the Old World. Generally speaking, the American infection is more severe and destructive and in a certain percentage in South America, especially in Brazil and Peru, involves the mucosa of the mouth, the pharynx and the nose, causing extensive destructions. A form which as a rule only affects the external ear is the 'disease of the Chicleros' occurring chiefly in Yucatán but also in other parts of Mexico. It resembles more closely Oriental sore of the Old World, as also in this form of infection a part of the external ear is usually destroyed.

American leishmaniasis has been recorded from Mexico southwards to the northern part of Argentina with especially numerous cases in Peru and Brazil. Autochthonous cases have so far not been found in Uruguay and Chile (MARTÍNEZ DURÁN, 1964, fig. 14).

Among the people of the different South American countries the infection has nowadays different names, only a few may be mentioned: Brazil: botón de Bahia, ulcera de Baurú, boubá – Dutch Guiana: bosch-yaws – British Guiana: forest yaws – French Guiana: pian bois – Columbia: marranas, puercas – Ecuador: sarna brava – Peru: espundia, uta – Mexico: ulcera de los chicleros.

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<sup>1</sup> Recent studies of immunity in American leishmaniasis indicated the existence of different strains of *Leishmania* in the Western Hemisphere which have been given different names.

The term 'uta' is a comparatively modern word which does not occur in the old Queshua and Aymara dictionaries and which was applied to chronic ulcerations of different aetiology, corresponding to the Spanish term 'llaga'. Nowadays it is used, especially by physicians in Peru, for muco-cutaneous leishmaniasis occurring in the high valleys of the Andes, whereas 'espundia' refers to a clinically somewhat different form of muco-cutaneous leishmaniasis, found in the tropical forest at a low altitude (note 2). The Queshua called cutaneous leishmaniasis of the Andes (nowadays 'uta') 'anti-onccoy' (disease of the Andes).

It is of special interest that the Spanish botanist HIPÓLITO RUIZ, who visited Peru from 1777–1788, pointing out the frequent destruction of the nose and the upper lip, stated: 'Los naturales atribuyen el origen del mal a la picadura de un pequeñísimo y casi imperceptible insecto, llamado uta.' – The natives attribute the origin of the disease to the bite of a very small and almost imperceptible insect called *uta*. (Quoted from LUIS A. LEÓN, 1957, p. 31).

The native population evidently held the correct view regarding the transmission of the disease and called the very minute insects (sandflies) 'uta', a term which was later applied to the disease.

Vásquez de Espinosa who wrote his 'Compendio y Descripción de las Indias Occidentales' at the beginning of the seventeenth century likewise mentions among the great number of troublesome insects some very minute ones.

According to LUIS A. LEÓN (1957) the history of American leishmaniasis may be divided into four periods: 1. The pre-Columbian period; 2. the period of the Spanish historians, naturalists, physicians and travellers from the discovery of the New World to about 1885; 3. the period from 1885 to 1909 during which time American leishmaniasis was regarded as identical with Oriental sore of the Old World and 4. the period from 1909 until our days when American leishmaniasis was recognized as an independent disease. First period. It has been mentioned already that the Queshua called the 'disease of the Andes' 'Anti-onccoy' and that the word 'uta' is not found in the old Queshua and Aymara dictionaries. Its radical, however, occurs in these two ancient languages with the meaning *corrosive* or *to gnaw* or *to eat up*. It corresponds to the Spanish *llaga* (teste D'HARCOURT, 1939, p. 94).

Apart from linguistic indications we have a documentation in pre-Columbian pottery, which shows that cutaneous leishmaniasis evidently existed long before the coming of the Spaniards.

Ancient Peruvian Mochica pottery has left in the form of anthropomorphic vessels which date mostly from the pre-Inca period, many representations of pre-Columbian pathology. Some of these

vessels show what may be lesions of the mouth and the nose caused by leishmaniasis or blastomycosis (plate IV). There are figures which possibly represent cases of *Verruga peruviana*. A number of the vessels with facial lesions are according to the modern view, examples of changes due to intentional, possibly punitive mutilations, some vessels may represent normal desiccated heads of mummies (note 3). The comparatively rare occurrence of Mochica vases showing changes which may be attributed to leishmaniasis may be explained by the fact that the people who produced the vessels lived near the coast where leishmaniasis was less frequent. Second period. Soon after the Conquest, Spanish historians mentioned in their works ulcerations and destruction of nose and mouth of the Indians in the high Andean valleys and of Spaniards who entered these regions. FERNÁNDEZ DE OVIEDO (1535) speaks of 'llagas rebeldes'. PEDRO PIZARRO (1571) describes the 'disease of the Andes', which occurs among the inhabitants of the hot humid valleys on the eastern side of the Cordilleras where the Indians cultivate coca. He states that the Indians are decimated by a disease which destroys the nose and affects the nasal cavities. It resembles St. Anthony's Fire and gradually causes the death of the patient. Natives of these valleys are similarly attacked as newcomers (note 4).

FRAY RODRIGO DE LOAYSA (1586) deplored the Indians who in order to be able to pay the excessive taxes imposed by the Spaniards went for work to the regions where coca was cultivated. There they got the disease so that out of ten only five returned and these in a most miserable physical condition (teste D'HARCOURT, 1939). He calls the disease 'ande-ongo' (from the Indian name 'anti-oncco'). It destroys the nose and 'worms' develop and multiply in the nasal cavities (note 5). SANTILLAN (1572) compared the disease of the coca growing Indians to cancer.

For additional details and literature, see COBO, 1890-1895; D'HARCOURT, 1939; GARCILASO DE LA VEGA, 1943; LAS CASAS, 1927; LASTRES, 1951; LAVORERIA, 1902; PALMA, 1908.

Third period (about 1885-1909). American leishmaniasis was identified with Oriental sore. This opinion was already held by Bravo in 1852. In Brazil A. Cerqueira (1885) expressed this view which was shared by numerous subsequent investigators (teste LUIS A. LEÓN).

Fourth period (from 1909 to the present time). Leishmanias were found by CARINI and PARANHOS in 1909 in 'ulcera de Baurú' in Brazil and later in the various forms of leishmaniasis in South and Central America and in Mexico. G. Vianna in 1911 created the

species *Leishmania brasiliensis* and postulated its specificity in causing American leishmaniasis.

As the present publication deals only with early documentation and transmission, the reader interested in the more recent work on leishmaniasis is referred to P. WEISS, 1943, and LUIS A. LEÓN, 1957. He will find in these two publications numerous bibliographic references.

The fact that American cutaneous leishmaniasis with destruction in various degree of nose and mouth involving the mucosa existed already long before the coming of the Spaniards and their slaves is of considerable medical interest. The American destructive cutaneous leishmaniasis evidently did not develop from an introduced comparatively mild Oriental sore, carried from the Old World, but existed long before such an introduction might have taken place.

### Notes

1. Leishmanias were probably first seen by Cunningham in 1885, later by Firth in 1891 and by Borowsky, a Russian military surgeon in Tashkent in 1898.

2. In 'uta' the ulcerative skin lesions may invade the mucosa by direct extension. In 'espundia' the ulcerations of the mucosa usually have no direct contact with the primary skin lesions, and appear often after the skin lesions have healed.

American cutaneous leishmaniasis shows different clinical pictures in different parts of the continent. In Mexico, Central America and in French Guiana *L. brasiliensis* invades the mucosa comparatively seldom. In some hot humid regions, as in parts of Brazil, involvement of the mucosa is frequent. SHATTUCK (1938) pointed out the correlation in the degree of severity of *L. brasiliensis* infection and different parts of South- and Central America and Mexico.

3. The Peruvian anthropomorphic vessels 'huacos' with facial lesions attracted the attention of anthropologists, pathologists and physicians since the middle of the last decade of the nineteenth century. At first leprosy, lues and lupus were chiefly regarded as cause of the facial changes. This opinion was gradually discarded in favour of uta and blastomycosis. Intentional punitive mutilation seemed also a possible explanation.

HOLLÄNDER (1912) expressed the opinion that some of the vessels with supposed signs of a destructive disease such as uta merely were representations of heads of desiccated mummies. He pointed out that in such mummies as found in the dry climate of Peru the lips retract so that the teeth are visible to a great extent. The nose

shrinks and may even give the impression of having been cut off during life. HOLLÄNDER believed that these huacos formed a parallel to the antique European drinking cups with reliefs of skeletons such as found in Pergamon and Boscoreale. They served the purpose of stimulating the guests to drink according to 'carpe diem'. A few Peruvian vessels have on the top a sitting blind musician without nose and lips, playing a tamburine. A reliefband or paintings encircle the vessel showing skeletons and dead people without nose and lips dancing and playing instruments.

A rather unusual explanation of the face destructions was given according to H. DIETSCHY (1938, p. 2016) by R. N. Salaman, who had made special studies on the history of the potato. He came to the conclusion that the changes of the face in the Peruvian vessels were intentional ritual mutilations in connection with the potato cult. According to Salaman, the mutilations were carried out so that the head without nose and lips somewhat resembled a potato and was regarded as representing the potato-demon, called papamama by the Queshua. In this connection it may be mentioned that Peruvian pottery shows specimens of a large potato with two human noseless faces (father and mother) and several small faces with their pointed noses just emerging from the potato (the children).

Leaving apart the various mentioned explanations, it may be stated that a certain number of the Peruvian huacos with lesions of the face represent in the present writer's opinion destructions caused by leishmaniasis (uta).

4. More recent investigators such as PALMA, 1908, and TAMAYO, 1908, found that in endemic regions the native population has a certain immunity against uta. According to these authors, usually children there get this disease which heals spontaneously leaving only some scars. TAMAYO assumes the existence of a hereditary immunity.

5. FRAY RODRIGO DE LOAYSA in 1586 states: 'Los que entran en los Andes que les da un mal en las narices a manera de mal de San Antón, que no tiene cura, aunque hay algunos remedios para entretenerla, al fin se les vuelve y les mata' (copied from P. WEISS, 1943, p. 320).

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## III

*Malaria**Africa*

Malaria, on account of the characteristic periodical recurrence of the fever attacks and the enlargement of the spleen, must have been recognized in very early times and differentiated from numerous other diseases accompanied by fever. We find descriptions of what must have been malaria in early medical texts of various ancient civilizations, for example in Mesopotamia, India, China, Greece, and Rome.

*Plasmodium* infection existed in prehistoric times long before the coming of man. Mosquitoes found in translucent amber and petrified mosquitoes from the Isle of Wight include *Culex*, *Aedes*, and *Mansonia*. As RUSSELL, 1955, points out, it is very likely that malaria-transmitting *Anopheleini* which morphologically represent a more primitive stem, likewise existed. The earliest human infections probably occurred in Africa. Certain chimpanzees in Central Africa are naturally infected with a plasmodium which seems identical with *P. malariae* of man. The quartan parasite is probably the oldest plasmodium in the scale of evolution and was possibly the earliest to infect man.

Mosquitoes and malaria: Herodotus, c. 500–424 B.C., states that the Egyptian fishermen used to sleep with their nets arranged around their beds, so that mosquitoes could not reach them (note 1)<sup>1</sup>.

A connection between mosquitoes and disease was assumed by various Arabic authors, for example by al-Harith ibn Kalada, a physician of Mohammed (GEMAYEL, 1932).

In Somaliland, the Somalis have the same word *Kaneo* for both mosquito and malaria. In the middle of the nineteenth century, RICHARD BURTON (1856) landed on the coast of British Somaliland and went up into Abyssinia. In several of his accounts he mentions the belief of the native population that malaria is transmitted by the bite of mosquitoes. Negroes in the Usambara mountains called malaria *Mbu*, the name for mosquito, as they believed that malaria came from the bite of mosquitoes when they went to the lowlands (teste Robert Koch, see RUSSELL, 1955, p. 40). In some parts of East Africa, the local Bantu equivalent of the Kiswahili word *Mbu*,

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<sup>1</sup> Regarding beliefs in a connection between mosquitoes and malaria held in different countries and statements by various authors, see RUSSELL, 1955, chapter 3.

mosquito, is similarly used for both mosquito and malaria which is known as the mosquito sickness<sup>2</sup>.

It is very likely that malaria existed in Ancient Egypt, although it may not have been very important for the population as a whole. Enlarged spleens, possibly due to malaria, have been found in mummies about three thousand years old (teste RUSSELL, 1955). Enlarged spleens with fever are mentioned in the Papyrus Ebers (EBBELL, 1937) but there is no clear description of malaria in the papyri which so far have been translated.

In 1892 W. GROFF discussed the inscription of a prayer to different months of the year in the temple of Denderah. This prayer mentions the periodical action of the evil spirit *Aat* represented by the goddess Sekhmet and the calamity following regularly the inundation of the Nile. GROFF drew the conclusion that it was malaria which nowadays is prevalent annually in September and October after the inundations.

Prof. Ch. Kuentz, Ancien Directeur de l'Institut français d'Archéologie orientale in Cairo, with whom the present author discussed the question of the existence of malaria in ancient Egypt, drew his attention on two similar inscriptions in the temple of Denderah and the temple of Edfu (note 2). The inscriptions represent a long prayer to the New Year; each stanza begins with an invocation to the New Year that it may be favourable. In the temple of Denderah the stanza in question says: "O Year . . . keep the goddess Hathor free from all misfortune, from all calamity, from all bad air." In the temple of Edfu the wording is the same, except that the prayer is in favour of the local god Horus, identified with Pharaoh, and that the sequence of the words is different: "from all misfortune, from all bad air, from all calamity" (note 3).

The expression 'bad air', although vague, reminds of 'mal-aria' and might be interpreted as suggesting the specific disease 'malaria'<sup>3</sup>.

Regarding this point, the present writer consulted also Prof. W. Westendorf, Director of the Seminar für Aegyptologie at the University of Munich<sup>4</sup>. In his answer Prof. Westendorf expressed his opinion as follows:

The wording *t3w nb dw* "all bad air" or "every kind of noxious breath" does not allow the assumption of a specific disease. In the

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<sup>2</sup> The writer wishes to express his thanks to Dr. J. R. Audy, Director of the George Williams Hooper Foundation, University of California, for the information about the views of negroes regarding a connection between mosquitoes and malaria.

<sup>3</sup> Concerning the name 'malaria', see RUSSELL, 1955, pp. 17-23.

<sup>4</sup> Now at Göttingen.

old Egyptian medicine this wording is so widely used, also in other connections, that one has to regard it as a figurative expression to indicate causing a disease in an indirect way as if a malevolent God breathed on human beings.

Also nb “every, every kind of” indicates that it is a collective notion which in the text of PAPYRUS EDWIN SMITH and the closely related Denderah and Edfu texts might be translated as epidemic or pestilence. There is the only certainty that this pestilence appears in connection with the Nile inundation. It may be malaria but just as well typhoid fever or some other disease. It is absolutely certain that the expression in Denderah and Edfu is identical with that in PAPYRUS EDWIN SMITH in as far as the incantations against epidemics are concerned.

From these discussions one may conclude that malaria was possibly one of the diseases to which the prayer refers; the expression is, however, too frequently used and too vague to diagnose malaria with a certain probability<sup>5</sup>.

When Europeans started the African slave trade, malaria was known to exist widespread in Africa. The Guinea coast gradually got the reputation of being so unhealthy that Europeans could hardly live there. Examples of the high death-rate are found in Hakluyt's *Voyages* and later ones have recently been published by GELFAND (1965) in his *Rivers of Death*. He showed that the loss of lives chiefly due to malaria but to some extent also caused by dysentery was extremely high (see Part Three: Diseases and mortality of Europeans on the Guinea coast at the time of the slave trade). Reports on malaria in the Dongola region in the first half of the nineteenth century have been collected and published by D. J. LEWIS (1948).

#### *America*

Malaria existed widespread in Europe, especially in Italy, Spain and Portugal<sup>6</sup>. It is therefore certain that the conquering Spaniards carried malaria to the West Indies and the American mainland. In a much higher degree, however, malaria was transmitted by the ever increasing number of negro slaves as most of them were probably infected.

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<sup>5</sup> The author is greatly indebted to Prof. Ch. Kuentz for having drawn his attention to the inscriptions, and to Prof. W. Westendorf for his detailed information.

<sup>6</sup> In the second half of the 15th century so many negroes were brought to Portugal that the malaria which they introduced depopulated portions of the Tagus valley. (R. LINTON, 1955; E. H. HUDSON, 1964.)

In this connection the question arises: Did malaria exist in America before the arrival of Columbus, or was it for the first time introduced during the Conquest?

JARCHO (1964) has examined this question carefully and critically and comes to the conclusion based on the paleontological, archeological, linguistic, historical, epidemiological and clinical evidence discussed by him, that there is no convincing documentation that malaria existed in any part of the Western Hemisphere before the arrival of Columbus. His personal opinion is that the presence of malaria in pre-Columbian America is improbable but not impossible.

ASHBURN (1947) had come to similar conclusions. He found no real evidence that malaria existed in any part of America before the Conquest. As the disease was common and well recognized in Europe, it would, according to ASHBURN, certainly have been mentioned by the early Spanish chroniclers if the Spaniards had observed it after their landings. In later works dealing with the New World it was frequently mentioned.

For one or two generations after the first arrival of the Spaniards, there are no reports of diseases which might be regarded as malaria, not even from localities which later acquired the reputation of being highly malarious. Examples are the Isthmus of Panama, Honduras and the Mexican coast near Veracruz. Cortés and his troops remained there from March to August 1519 before starting for the conquest of Mexico. Neither Cortés in his letters to Charles V nor BERNAL DIAZ DEL CASTILLO nor GÓMARA in their descriptions of the Conquest mention diseases among the troops which could be regarded as malaria. Guayaquil, which later got a very bad reputation of being highly malarious, was a health resort before and during the first time of the Conquest. HERRERA stated that many sick people went there to recover their health. The coastal area near Veracruz, which later became very unhealthy on account of malaria, was thickly populated when the Spaniards arrived.

BUSTAMANTE, 1967, points out that the various flourishing pre-hispanic civilizations, especially those of the Olmecs and Mayas, could not have developed in highly malarious regions.

The question whether man may have brought malaria with him from Asia to America across the Siberian Alaskan connection has been discussed and rejected by BOYD, 1941, JARCHO, 1964, DUNN, 1965, and others. Conditions in north-eastern Siberia and north-western North America during and after the Pleistocene did not allow malaria transmission.

The Vikings, who without doubt reached the coast of north-

eastern America about five hundred years before Columbus (INGSTAD, 1964<sup>7</sup>), arrived at regions north of any *Anopheles* mosquito population which could have transmitted malaria. If one admits that perhaps a few people from islands of the central Pacific reached the American continent in subtropical and tropical zones, one has to consider that these islands have been without *Anopheles* which might have served as vectors and have probably always been free from malaria (RUSSELL et al., 1963). Pre-Columbian contacts of the New World with the Old across the Pacific Ocean were discussed by CLARKE, 1961; MASON, 1961; MACGOWAN and HESTER, 1962; MCNEILL, 1963.

BRUCE-CHWATT, 1965, on the other hand, regards it as probable (though not proved) that malaria existed in the Americas before the Spanish conquest and that sea-going people may have brought it to the New World long before the voyage of Columbus.

In this connection one has to consider the possibility of its introduction into small areas by negroes who reached the Western Hemisphere before Columbus, either by shipwreck or by bringing merchandise as slaves of Arabic traders. A number of investigators have dealt with this question.

In examining the results of their studies one gets the impression that negroes came to the American shores long before Columbus and settled there in a few small communities. Even if some of the reports are vague and contradictory in details, there remain other statements which evidently record simple facts. As the question of the arrival of negroes from Africa in the Western Hemisphere before Columbus is of special importance regarding the possible existence of malaria in America before Columbus, we have dealt with these reports in some detail in note 4.

One is justified in assuming that among the negroes who may have arrived from Africa before Columbus there were some who carried malaria parasites in their blood, and as in all likelihood *Anopheles*, which might serve as vector existed in America, it is probable in the present author's opinion that malaria existed before Columbus in America in a few small areas with isolated communities which had no connection with the indigenous Indians with whom they were, as for example in Darien, constantly at war.

It should be added that in recent years simian malaria attracted special interest. The accidental infection in 1960 of four research workers with *P. cynomolgi bastianelli* from *Macaca mulatta* following bites of infected *Anopheles freeborni* produced symptoms of *vivax* malaria (EYLES, COATNEY, and GETZ, 1960).

<sup>7</sup> See also: *The Vinland Map and the Tartar Relation* by R. A. Skelton, Th. E. Marston and G. D. Painter. Yale University Press, New Haven and London, 1965.

Of interest are also the results of recent experimental work by EYLES, COATNEY & GETZ, 1960, and BEYE et al., 1961, who were able to transmit *Plasmodium cynomolgi bastianelli* from rhesus monkeys to man by the bite of heavily infected mosquitoes (*A. quadrimaculatus* and *A. freeborni*) and the work of COATNEY, 1963, who succeeded in transmitting *P. cynomolgi* from man to man.

DUNN, 1965, who made special studies of the malaria parasites of neotropical primates, came to the conclusion that indigenous human populations and cebid monkeys must originally have got malaria parasites from Europe and Africa. Based on the result of his studies he assumes that malaria was introduced into the Western Hemisphere after 1492.

COCKBURN, 1963, and BRUCE-CHWATT, 1965, likewise discussed the relationship between simian and human malaria in connection with the problem of eradication.

### *Modorra*

A disease which was introduced by the Spaniards into America early in the sixteenth century and caused many deaths among the Spaniards was known as modorra. Its symptoms were fever, apathy, loss of consciousness and coma. The best descriptions are those by DIAZ DEL CASTILLO and LÓPEZ DE GÓMARA dealing with the last illness and the death of Luis Ponce de León, who had been sent out from Spain to succeed Cortés. From the descriptions it is difficult to make a definite diagnosis, and modorra is here only mentioned, as some authors assumed that it was a cerebral form of malaria. From the various symptoms, which need not be discussed here, one may draw the conclusion that modorra was not malaria but possibly epidemic cerebrospinal meningitis (STICKER, 1922).

### *Blackwater fever – Schwarzwasserfieber*

Blackwater fever in the modern sense of the word, connected with attacks of malaria or a prolonged malaria infection, was only recognized as late as in the second half of the nineteenth century. Before that time blackwater fever was apparently often confused with other diseases accompanied by fever and dark urine.

Between 1850–1860 French naval surgeons described blackwater fever from Madagascar. At about the same time it was observed in Greece. In North America it was first described in 1859 from Louisiana and subsequently from several other Southern States. It is common in Central America and the West Indies, also

in the northern part of South America. It is, however, of greatest importance in tropical Africa.

Blackwater fever is rare in Negroes. It affects particularly Caucasians who lived for long periods in the tropics where malignant tertian is widespread; it is also found among Arabs, Hindus and Chinese.

There is no connection between the slave trade and the occurrence of blackwater fever in America.

### *Notes*

1. HERODOTUS. "Gnats are abundant; this is how the Egyptians protect themselves against them; those who dwell higher up than the marshy country are well served by the towers whither they ascend to sleep, for the winds prevent the gnats from flying aloft; those living about the marshes have a different device instead of the towers. Every man of them has a net, with which he catches fish by day, and for the nights sets it round the bed where he rests, then creeps under it and so sleeps. If he sleeps wrapped in a garment or cloth, the gnats bite through it; but through the net, they do not even try at all to bite." Book 2. 95. Loeb Classical Library, 1946.

2. The Horus temple of Edfu was built between 237–57 B.C. The temple of Denderah was built at the time of Augustus and was dedicated to the goddess Hathor.

3. The inscription in the temple of Denderah is found in: A. MARIETTE, *Le temple de Dendérah*, Paris 1873. Tome IV, planche 30 c, 4.

The second inscription is found in: E. CHASSINAT, *Le temple d'Edfou*, Cairo 1931 (Institut français d'archéologie), Tome VI, p. 96, 1. 58.

4. Among investigators who dealt with the question of the presence of negroes in pre-Columbian America are the following: AHMAD ZAKĪ PASHA, 1920; COMAS, 1956; DONNELLY, 1950; HERRERA, 1944; IBN FAḌL ALLĀH AL-'UMARĪ, 1927; JEFFREYS, 1953; LAS CASAS, 1951; LÓPEZ de GÓMARA, 1941; PEDRO MÁRTIR DE ANGLERIA, 1944; QUATREFAGES, 1887, 1889; SCHEDL, 1957; STEWART, 1939; WEITZBERG, 1922; WIENER, 1920–22.

QUATREFAGES (1887)<sup>8</sup>, according to DONNELLY (1950, p. 137), reported that "Black populations have been found in America in

<sup>8</sup> JEAN LOUIS ARMAND DE QUATREFAGES DE BRÉAU (1810–1892), Introduction à l'étude de Races Humaines (Paris, 1887).

very small numbers only, as isolated tribes in the midst of very different populations. Such are the Charruas of Brazil, the Black Carribees of Saint Vincent, in the Gulf of Mexico; the Jamassi of Florida, . . . such, again, is the tribe that Balboa saw some representatives of in his passage of the Isthmus of Darien in 1513 . . . they were true Negroes.”

JEFFREYS, 1953, p. 210, points out that between the islands of the Atlantic coast of Africa and the Americas lies the region of the calm equatorial seas of the Doldrums. Such seas are in their calmness most suitable for vessels driven by oars and the heavy rainfall ensures a water supply. The Arabs used maps, astrolabes and a primitive kind of compass. They knew the Canaries and the Azores<sup>9</sup> before the first Europeans landed there<sup>10</sup>.

Regarding Columbus, JEFFREYS, 1953, p. 211, states: “From the Journal of his third voyage, JANE translates ‘certain chief men of that island of Santiago came to see him and they told him that to the southwest of the island of Huego, which is one of the Cape Verde Islands and which is twelve leagues from them, an island was visible . . . and that there had been found canoes which set out from the coast of Guinea and steered to the west with merchandise’.”

Further JANE writes (quoted from JEFFREYS, 1953, p. 211): “. . . and that he (Columbus) thought of testing the truth of that which the Indians of Espaniola (Haiti) said that there had come to this island from the direction of the south and the south-east black people and that they had the points of their spears made of a metal which they call ‘guanin’, of which he had sent some to the sovereigns that an assay might be made, from which it was found that of thirty-two parts, eighteen were gold and six silver and eight copper” (see also HERRERA, vol. I, p. 325, Asunción del Paraguay, 1944). The present author does not know of any statement that Columbus carried out the planned investigation regarding the alleged arrival of black people in Espaniola previous to his own landing.

There exist reports by three early Spanish chroniclers about Vasco Nuñez de Balboa’s finding negroes on his march across the Isthmus of Darien, when he was on his way to discover the Pacific.

PEDRO MÁRTIR DE ANGLERIA<sup>11</sup> states in his *Decada Tercera*,

<sup>9</sup> The Canaries and the Azores were inhabited by stone-age populations and Carthaginian coins of the fourth century B.C. have been found on one of the islands of the Azores. (BIBBY, 1962.)

<sup>10</sup> LI HUI-LIN, 1960, provided evidence of transatlantic travel by Arab mariners from the study of Chinese geographical documents of the twelfth century.

<sup>11</sup> PIETRO MARTIRE DE ANGLERIA belonged to an ancient family of Arona in the north of Italy. In 1487 he went to Spain where he remained to the end of his life. He died in 1525 at the age of seventy.

libro I, Capitulo 2, p. 200, 1944: "Encontraron alli' esclavos negros de una región que dista de Cuarecua solo dos dias, en la cual no se criian más que negros, y estos feroces y sobremanera crueles. Pien-san que en otro tiempo pasaron de la Etiopia negros a robar y que naufragando, se establecieron en aquellas montañas. Los de Cuare-cua tienen odios intestinos con esos negros, y se esclavizan mutua-mente o se matan."

FRANCISCO LÓPEZ DE GÓMARA, 1941, tells the same story but with the slight difference of stating that Balboa received some black slaves from the Cacique.

The third early chronicler who refers to the negroes, whom Balboa met in Darien, is BARTOLOMÉ DE LAS CASAS. He also gives a different report by stating that Balboa fought a battle with the black people whose chief was Quarequa, who perished in the fight.

Neither HERRERA nor OVIEDO referring to Balboa's expedition mention the episode with the negroes.

A very curious story is told by IBN FADL ALLĀH AL-'UMARĪ in his famous *Masālik al-absār fi mamālik al-amsār* (1927). He reports that Mansa Musa, sultan of Mali (Melle) made in 1324 a pilgrimage to Mecca with a great number of attendants and great riches, especially gold which he spent so lavishly that the price of gold in Cairo dropped for several years. His pilgrimage was long remembered. When reaching Cairo, Mansa Musa stopped there for a while, and was invited by the governor of Cairo Ibn 'Amir Hadjib. The governor asked the sultan how he had reached his high position and Mansa Musa gave the following explanation: His predecessor wished to know whether there was land in the West of the (Atlantic) ocean. He therefore fitted out 400 boats, 200 to transport his men and 200 to carry gold, water and food, sufficient for a long journey. After a long time only one boat returned. The captain told the sultan that his boat had been the last one and that all preceding boats had been swallowed by a very strong current in the midst of the ocean. He had therefore returned. The sultan did not believe this story and fitted out a still larger fleet with more men and he personally took part in this expedition after he had delegated his royal power for the time of his absence to Mansa Musa. Nothing was ever heard of these boats and the men. When after a very long time the sultan had not returned, Mansa Musa became officially the new ruler. This story was nearly literally copied by AL-QALQASHANDĪ in his chronicle.

IBN FADL ALLĀH AL-'UMARĪ heard the story from the governor Ibn 'Amir Hadjib directly, or through the governor's son, the emir 'Amir Hasan 'Alī. In 1920, AḤMAD ZAKĪ PASHA translated the story of 'Umari into French and published it in the *Bulletin de l'Institut*

d'Egypte (tome 2, pp. 57–59, 1920). It was again translated by GAUDEFROY-DEMEMBYNES in the *Bibliothèque des Géographes Arabes*, tome II, Paris 1927. This last translation was used by the present writer<sup>12</sup>.

It is unlikely that Mansa Musa's story as recorded by 'Umari is a pure invention; it is obviously possible that the expedition got lost at sea, there is, however, a possibility that some of the boats reached the Western Hemisphere and that the negroes settled somewhere in tropical America. There are certain indications of relations between Negroes and Indians in Central America and Mexico.

However, the statement by WIENER, 1922, that a colossal stone head of a negro had been found in the region of Tuxtla is apparently based on a misconception. A number of colossal basalt heads, some with a flat nose and thick lips, were found in the region of Tres Zapotes and San Lorenzo (Veracruz) and La Venta (Tabasco). These heads – one at San Lorenzo has a height of more than nine feet – belong to the Olmec culture and do not represent negroes. Up to 1955 ten typical colossal heads were known (STIRLING, 1940, 1943, 1955).

Cowrie shells, *Cypraea moneta*, which came from the Eastern seas, were brought by the Arabs to Africa. They were widely used as currency on the Guinea coast. Cowrie shells have been found in the Roden Mounds, Marshall County, Alabama (JEFFREYS, 1953, p. 213). The Roden Mounds were constructed before their builders had any contact with white people.

Non-barking dogs were found by Columbus on his first voyage when he went ashore on Cuba. JEFFREYS, 1953, justly asks: Is it a coincidence that the dogs of negro Africa likewise do not bark?

Another indication of a relation between negroes and Central American Indians is given by the distribution of four food crops; as pointed out by JEFFREYS, 1953, Yam, Taro, Manihot, and Maize. The first two are not indigenous to America, the other two are. All were long cultivated in Africa before Columbus sailed for America (see also JEFFREYS, 1953 a, Pre-Columbian maize in Africa).

Lastly it should be mentioned that T. D. STEWART, 1939, described (pre-Columbian?) negro skeletal remains from Barbados, British West Indies.

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<sup>12</sup> This rather fantastic story unfortunately does not indicate the place on the African West coast wherefrom the expedition started.

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## IV

### *Amoebic dysentery*

#### *General statements*

Dysentery has drawn the attention of physicians and laymen from early times.

During the first half of the nineteenth century the old theory still prevailed that dysentery was but one of the symptoms of malaria.

Although dysentery was known in Europe from antiquity, its existence in the tropics drew general attention only from the eighteenth century on, on account of the very high death rate which it caused among the Europeans and to some extent among the native population.

A series of interesting studies were published from the West Indies where England had obtained colonies. There were always many cases among the soldiers, sailors and the negro slaves.

In India likewise a number of British physicians paid special attention to dysentery; BALLINGALL, 1818, based on his experience with European troops in India, differentiated the two distinct clinical types of dysentery, now known as the amoebic and bacillary form.

In the second half of the 19th century, LAMBL's finding in Prague, 1859, of living *amoebae* in the stool of a child with diarrhoea and, most important, the discovery by LOESCH, 1875, in St. Petersburg of *amoebae* in a case of chronic dysentery and his experimental transmission of the infection to four dogs started a series of scientific investigations which placed the knowledge of amoebic dysentery on a solid base.

SHIGA, 1898, discovered and isolated in Japan the dysentery bacillus of the epidemic form.

Among the various remedies employed in cases of dysentery ipecacuanha played an important rôle. This drug is the root of *Cephaëlis ipecacuanha*, a native plant of Brazil. The first statement

of 'ipecaya' as a remedy for the 'bloody flux' was made by a Portuguese priest, it was published by SAMUEL PURCHAS in 1625 (note 1). The 'dysentery root' was used by the Indians. PISO, 1648, referred to it and described the plant<sup>1</sup>.

#### *Africa*

In Africa we find dysentery mentioned as one of the greatest dangers to health already in the earliest reports by traders, travelers and sea-captains. Dysentery existed evidently widespread in Africa from ancient times. This is proved by the fact that the natives were not only familiar with it, but had developed quite elaborate systems of treatment which, although rather different from European methods, were in many cases quite efficient (CLARKE, 1860).

J. BARBOT, 1732, in his description of the coasts of South Guinea states: "The Bloody-flux is also common, and sweeps away multitudes of the Blacks after they have lost all their blood. They fancy this distemper is given by witches and sorcerers called here *Sovah-Monou*. The Quojas Negroes affirm, they never knew of the bloody-flux till it was brought from Sierra Leona in the year 1626, eight months after the Dutch admiral Laun had left that place."

The 'bloody flux' caused the death of many Europeans and made more invalids. Among well-known victims were Clapperton and David Livingstone.

There are no early publications from Africa which like some in the West Indies and India distinguished between the two forms, bacillary and amoebic dysentery. It is certain that both were present and that the epidemic outbreaks among negro slaves in the barracoons on the African coast and on the slave ships were bacillary dysentery.

In Egypt KARTULIS, 1885, found *amoebae* in the stool of 500 patients suffering from dysentery and also in the wall of liver abscesses. KRUSE and PASQUALE, likewise in Egypt, proved in 1893 experimentally the existence of two species of *amoebae*, one harmless (*E. coli*), the other one pathogenic (*E. histolytica*) producing amoebic dysentery.

#### *America*

WINTERBOTTOM, 1803, and BRYSON, 1847, described the horrors of dysentery among the slaves. Out of 700 slaves shipped from

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<sup>1</sup> For more details regarding the early history of dysentery the reader is referred to Sir PHILIP MANSON-BAHR, *The Dysenteric Disorders*, second edition, 1944, chapter III.

Sierra Leone to Barbados, only 380 lived to reach their destination (WINTERBOTTOM).

BRYSON, Director General of the Naval Medical Service, who passed nine years mostly in ships on the African West Coast, writes in his *Report on the Climate and Principal Diseases of the African Station*: "The diseases from which negro slaves suffer most severely on board of the vessels destined for their transportation, are dysentery, fever, small-pox, ophthalmia, and diarrhoea; the first two are by far the more generally destructive and it not unfrequently happens that they acquire such virulence, as to carry off a fourth or even a third of the whole cargo in the short period of a few weeks" (note 2).

Amoebic dysentery exists nowadays all over Africa with North Africa and especially the equatorial parts showing a much higher incidence. Negro slaves who were mostly taken from the tropical zone of West Africa, will have carried their amoebic infection to the Western Hemisphere together with the more spectacular bacillary infection.

Similarly as in the case of malaria the question arises: did amoebic dysentery exist in America before the arrival of the negro slaves? It is hardly possible to give a definite answer. It seems that in Central- and South America, the infection, although widespread nowadays, is nevertheless apparently more frequent in certain areas and therefore somewhat more localized than in Africa.

Some of the places where formerly slaves disembarked are nowadays heavily infected, which might be interpreted as an indication that the infection was originally introduced by African slaves. However, in the absence of extensive examinations regarding amoebic infection in places to which slaves were shipped in large numbers over long periods and comparative examinations of regions which had formerly few slaves, one has to defer judgement as to whether amoebic dysentery existed in America before the coming of the Spaniards. In any case it is certain that negro slaves carried the infection to the Western Hemisphere.

### Notes

1. "For the Bloody Fluxe. Igepecaya or Pigaya is profitable for the bloudie Fluxe; the stalke is a quarter long, and the roots of another or more, it has onely foure or five leaves, it smelleth much wheresoever it is, but the smell is strong and terrible, this roote beaten and put in water all night at the deaw, and in the morning if this water with the same roote beaten and strained be drunke,

onely the water it causeth presently to purge in such short, that the laske ceaseth altogether." (From PURCHAS Hakluytus posthumus; or Purchas his Pilgrimes, 1625, copied from MANSON-BAHR, 1944, p. 23.)

2. "There is perhaps not any condition in which human nature may be viewed in a more revolting aspect than that of a crowded slave vessel with dysentery on board. Of all the horrors attending the middle passage with the exception perhaps of small-pox, it is the worst. The effluvium which issues from her decks, or rather prisons, is peculiar and sickening by any conception, and is generally perceptible at a great distance to leeward" (BRYSON, 1847).

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## B *Borrelia* infections

### *African Relapsing Fever*

#### A. Epidemic louse-borne Relapsing Fever<sup>1, 2</sup>

##### *Africa*

Up to the middle of the nineteenth century epidemic African relapsing fever was mixed up with other diseases such as typhus, typhoid fever and certain forms of malaria. The most common name used was 'bilious typhoid'. The first description of cases was given by W. GRIESINGER (1853 and 1854) from Egypt. He described in detail the 'bilious typhoid', its symptoms, course and autopsy findings from observations of 132 patients and 101 autopsies. He also reported his observations regarding epidemiology: increased number of cases in winter and spring; patients belonging to the lowest classes, workmen, soldiers, people who must sleep crowded together in small rooms; transmission of the disease to people doing laundry work.

In his first publication GRIESINGER does not clearly state that he regards the 'bilious typhoid' as relapsing fever. Subsequently, however, in 1864 he takes the viewpoint that the 'bilious typhoid' is an especially grave form of febris recurrens of long duration. He also expressed the belief that epidemics observed in 1812 by Larrey in Egypt were due to the same disease.

Cosmopolitan louse-borne relapsing fever is widespread in Africa. Similarly as is the case of relapsing fever in Europe, epidemic outbreaks are connected with wars, famine, large troop movements, and various disruptions of the normal life of the people. Between 1921 and 1928 several severe epidemics occurred in West- and Central Africa.

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<sup>1</sup> The name 'Relapsing Fever' was first given to an epidemic which occurred in Edinburgh in 1843-1848 and was described by Craigie and Henderson (teste SCOTT, 1942, vol. II, chapt. XIV, p. 781).

<sup>2</sup> The pathogenic agent is *Borrelia recurrentis*, synonyms are *B. obermeieri* and *B. novyi*.

### B. Endemic African Tick Fever<sup>3</sup>

It occurs in the whole of Africa, except the Sahara.

The Somalis call both tick and infection by the Arabic word *gurud*. According to G. A. WALTON, 1962, in the Lake Victoria area *ebibo* is relapsing fever or the fever of the ticks.

The indigenous population in all the endemic areas of tick-borne relapsing fever from Somaliland to South Africa knew already for a long time that the bite of ticks is occasionally followed by fever and sickness. They also knew that people living in tick-infested areas suffered less from tick bites than newcomers who occasionally became seriously ill and might die (note 1).

In some places, for example in Nyasaland, the natives were apparently aware that they lose their tolerance or immunity against tick bites, if they temporarily change their place of residence and leave the tick-infested area. It has been reported (teste SCOTT, 1942) that in such a case people take some ticks with them and allow them to feed on them in order to preserve their immunity. A similar observation has been made by Prof. R. Geigy in Tansania (GEIGY, 1968).

The symptoms and the sickness following tick bites were described by D. LIVINGSTONE (1857) from Ambaca, Angola and from Tete, Mozambique. He himself was bitten by ticks. In Angola the tick was called *Tampan*, in Mozambique *Carapato* (note 2). The Portuguese commanders in both places warned LIVINGSTONE of the effect of tick bites. The Portuguese like the natives knew that people living in tick-infested areas developed a certain tolerance and as a rule did not become seriously ill (note 3). Several writers besides LIVINGSTONE, for example PINTO ROQUETE (1868), reported their observations that tick bites may be followed by fever. Many foreigners knew of a tick fever of unknown aetiology occurring in different parts of Africa.

#### *America*

Field studies and experiments have shown that the *Borrelia* of relapsing fever are as a rule strictly adapted to certain tick species and cannot be transmitted by other ticks. The tick fever of America, though transmitted by *Ornithodoros* species, *O. turicata*, *O. talaje* and others, does not produce cross-immunity with the African fever. It occurs in British Columbia, the western United States, Mexico, Central- and South America.

Lice, as is well known, live on the body or in the clothing of

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<sup>3</sup> The pathogenic agent is *Borrelia duttoni*, synonym *Spirochaeta duttoni*.

man, and therefore can easily be carried to other places. It is different with ticks which normally live in crevices in the huts of natives or in other hiding places. They are generally not carried by man. This behaviour together with the adaptation of *Borrelia* to certain tick species in different countries makes it improbable that slaves have transmitted African tick fever to the New World. In Central Africa the most important vector of tick fever is *Ornithodoros moubata* which transmits *Borrelia* in its saliva and the coxal fluid.

The discovery of *Borrelia* of African tick fever and the early studies of the disease are connected with the work of a number of investigators, among them C. CHRISTY (1903), A. R. COOK (1904), who in Uganda was the first to detect spirochaetes microscopically in the blood of patients suffering from this fever, P. H. ROSS and A. D. MILNE (1904), D. NABARRO and E. D. W. GREIG (1905), R. KOCH (1905). Independently J. E. DUTTON and J. L. TODD (1905) had studied tick fever in the Congo Free State and had found that it was caused by a spirochaete occurring in the blood and that the infection was transmitted by the bite of the tick *Ornithodoros moubata*. They infected experimentally healthy monkeys with the disease and showed that the infection is transmitted to the offspring of the ticks. During these experiments both investigators became infected with tick fever and J. E. Dutton died<sup>4</sup>.

### Notes

1. Already in 1702 R. Drury, an explorer of Madagascar (quoted by Thézé and Lamoureux from the work of A. Grandidier) reported the existence of a pathogenic insect on the west coast of Madagascar. He stated that persons who are bitten by the 'Poropongy' are sick during six weeks or two months . . . but if one has been bitten and has been sick once, one has nothing to fear any more and one is no more inconvenienced by these insects how numerous they may be. E. BRUMPT, Précis de Parasitologie, cinquième édition, Paris, 1936. vol. I, p. 122.

2. "When sleeping in the house of the Commandant (of Ambaca, Angola) an insect, well known in the southern country by the name Tampan, bit my foot. It is a kind of tick, and chooses by preference the parts between the fingers or toes for inflicting its bite. It is seen

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<sup>4</sup> For details regarding the work of the early investigators, see: E. HINDLE, The Relapsing Fever of Tropical Africa. A Review. Parasitology vol. IV, pp. 183 to 203, 1911; for characteristics of Louse- and Tick-borne Relapsing Fevers, see GEIGY, 1968.

from the size of a pin's head to that of a pea, and is common in all the native huts in this country . It sucks the blood until quite full, and is then of a dark-blue colour, and its skin so tough and yielding that it is impossible to burst it by any amount of squeezing with the fingers. I had felt the effects of its bite in former years, and eschewed all native huts ever after, but as I was here again assailed in a European house, I shall detail the effects of the bite. These are a tingling sensation of mingled pain and itching, which commences ascending the limb until the poison imbibed reaches the abdomen, where it soon causes violent vomiting and purging. Where these effects do not follow, as we found afterwards at Tete, fever sets in; and I was assured by intelligent Portuguese there that death has sometimes been the result of this fever. – The only inconvenience I afterwards suffered from this bite was the continuance of the tingling sensation in the point bitten, for about a week.” LIVINGSTONE, 1857, pp. 382–383.

“I was kindly received by the Commandant Tito Augusto d’Araujo Sicard, who did everything in his power to restore me from my emaciated condition; and as this was still the unhealthy period at Kilimane, he advised me to remain with him until the following month. He also generously presented my men with abundant provisions of millet; and by giving them lodgings in a house of his own, until they could erect their own huts, he preserved them from the bite of the Tampans, here named Carapatos. We had heard frightful accounts of this insect while among the Banyai, and Major Sicard assured me that to strangers its bite is more especially dangerous, as it sometimes causes fatal fever. It may please our homoeopathic friends to hear that, in curing the bite of the Tampan, the natives administer one of the insects bruised in the medicine employed.” LIVINGSTONE, 1857, pp. 628–629.

3. “A Rios de Senna, on appelle fièvre de carrapato une pyrexie qui attaque les nouveaux arrivés plus fréquemment que les acclimatés de la province. Cette fièvre est souvent accompagnée de délire, on l’attribue généralement à la morsure d’un petit insecte commun dans cette localité et que dans le pays on appelle carrapato.

On dit et il passe pour certain que cet insecte, torréfié et réduit en poudre, administré dans un véhicule alcoolique guérit cette maladie avec facilité.” ANTONIO PINTO ROQUETE, 1868, p. 166.

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## C Human Treponematosis

### *Carate (Pinta), Yaws, Endemic Syphilis and Venereal Syphilis*

Human treponematosis, notwithstanding extensive research which especially during recent years gave interesting results, has still a number of unsolved problems.

In the following the four diseases will be dealt with separately. Their assumed origin, their characteristics and relationships are briefly presented in the introduction.

#### Introduction

It is certain that the four diseases are closely connected so that a number of authors, among them BUTLER, 1936; GRIN, 1935; E. H. HUDSON, 1946; believe that yaws and syphilis are caused by the same organism which in their opinion, as WILLCOX, 1960, p. 84, expressed it "produces a different clinical picture because of environmental and immuno-biological influences within and without the host exerted during countless passages through the centuries".

The following may be stated:

1) The treponemes of carate, yaws, endemic and venereal syphilis are with present-day techniques microscopically undistinguishable.

2) The clinical syndromes of the four diseases are in typical cases sufficiently distinct to allow a differential diagnosis.

3) Carate which is restricted to Central- and South America has certain characteristics which are different from those found in the three other forms of human treponematosis. Up to the present the treponeme of Carate has not been adapted to growth in any animal apart from man.

4) Although yaws, endemic and venereal syphilis are as a rule distinct and can be differentiated, they show occasionally varia-

tions of their clinical pictures which make a differentiation difficult or impossible.

5) In prehistoric bones, lesions regarded as characteristic for syphilis are gummatous and proliferative periostitis of the calvarium with jagged stellate scarring of the external surface, osteoperiostitis of the long bones, and circumferential enlargement of the shaft with increased density. (Regarding publications on observations in America, see: J. H. MEANS, 1925; H. U. WILLIAMS, 1936; W. L. HALTOM and A. R. SHANDS, Jr. 1938; H. S. DENNINGER, 1938; T. D. STEWART, 1940; G. W. GOFF, 1953; H. N. COLE et al., 1955). Similar pathological changes have been found in some cases in which they were regarded as due to yaws (T. D. STEWART and A. SPOEHR, 1952). For a brief clear presentation of the difficulties connected with the diagnosis of syphilis from dried bones, see S. JARCHO, 1964, and T. D. STEWART, 1941.

6) 'Leprosy' was during the Middle Ages following the crusades and especially in the century before the discovery of Columbus extremely frequent and widespread in Europe. In the opinion of a number of modern writers, for example E. H. HUDSON, 1961, leprosy at that time was only in part Hansen's disease and to a considerable extent treponematosis, leaving out some other skin diseases of different aetiology which somewhat resembled leprosy (E. H. HUDSON, 1963 a).

One reason for this opinion is that 'leprosy' had the reputation of being highly contagious so that people, apart from being isolated in 'leper houses', had to wear clappers 'Chama Lazarus' (note 1) to warn passers-by to keep away from them. It is nowadays well known that Hansen's disease is not highly contagious and if an infection takes place, it needs as a rule a considerable time, often several years, until definite clinical symptoms develop. The great majority of crusaders returned from the East comparatively soon within a period too short for leprosy to develop and show clinical symptoms.

True leprosy is not a venereal disease, but 'leprosy' of the Middle Ages was associated with sex. In the thirteenth century, Theodorus stated that 'leprous' women were venereally contagious (GOODMAN, 1944), and in 1303 Bernard de Gordon stated that 'leprosy' was associated with prostitutes (HUDSON, 1958, p. 17; HOLCOMB, 1935).

Another reason to assume that in many cases it was not Hansen's disease but treponematosis, is the fact reported by contem-

porary authors that the returning crusaders not only brought 'leprosy' home, but also its remedy, the 'Saracen ointment', which was used with good result against the 'Arabic leprosy'. This ointment consisted of mercury in a fatty base. Cinnabar (mercury sulfide) was highly valued by the Arabs, who knew that mercury could be obtained by heating cinnabar (E. G. BROWNE, 1921). It was found that a certain type of 'leprosy' healed comparatively rapidly under mercury treatment. Probably under the influence of Arabian physicians this treatment was used in the medical school of Salerno to which Constantinus Africanus became attached (note 2). In Salerno crusaders after their return were treated for their 'leprosy'. The number of leper houses, where lepers were isolated, was in Europe very great (many thousands) after the crusades.

Toward the end of the fifteenth and in the first part of the sixteenth century 'leprosy' showed a marked decrease<sup>1</sup> simultaneous with the rapid spread of a disease which became known by different names, such as morbus gallicus, bubas, pocks, grosse verole, spanish disease, disease of Naples etc. (SINGER and UNDERWOOD, 1962). This disease was syphilis (notes 3 and 4) which by the severity of its symptoms attracted general attention. The clinical syndromes were studied and with increasing knowledge a better differential diagnosis was possible, so that many cases which formerly would have been regarded as leprosy, were diagnosed as bubas or morbus gallicus.

Furthermore we have to realize that for very long periods one did not know the connection of the manifestations of syphilis in the different stages of the disease and therefore did not know that they were due to the same infection. As a result, the different manifestations were regarded and described as different diseases.

Apart from the venereal form, endemic syphilis was also present and known under various names.

7) The reason for the development of a particularly severe form of syphilis in the last decade of the fifteenth and the first part of the sixteenth century is still to-day not entirely clear and different explanations have been given. One has assumed the possibility of a new strain of treponemes developing in Europe or having been introduced from the West Indies. In the latter case, yaws treponemes might have been introduced. It is of special interest that examination of bones in the south-eastern part of North America has shown that a disease, either syphilis or yaws, must have been

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<sup>1</sup> There were apparently several causes of this decrease.

very frequent among Indians not long after the arrival of the Spaniards (STEWART, 1940), so that one might assume that *treponema* strains had been exchanged against which Indians and Europeans had no immunity.

Numerous writers in commenting on syphilis as it showed itself toward the end of the 15th century declared that it was a new disease. Actually it was an old disease which for reasons which are even nowadays not clear changed its character and became temporarily an acute malignant disease which caused considerable destructions. Within 40–50 years the symptoms had become much milder and the disease took a character which corresponded more to syphilis as it is known to-day.

Already at the time of Columbus some physicians denied that it was a new disease. Niccolò Leonicensis (1428–1524), for example, stated that the disease was the same which the peasants in Lombardy called 'brosulas' (HUDSON, 1961), which was probably a form of endemic syphilis<sup>2</sup>. It must have existed long enough that it had an established name among the population. According to SUDHOFF (1926), the name 'mal franzoso' was used in northern Italy for about half a century before Columbus.

## 8) Evolution of human treponematosis

### *Yaws*

Treponemes took their origin probably from saprophytic spirochaetes which lived in decaying vegetation (HUDSON, 1958). There is a certain probability that this happened in the rain-forests of Central Africa where human beings lived already in very ancient times. Old endemic areas of yaws are found there to-day among the most primitive tribes. Central Africa was an enormous reservoir of yaws since remote times. Yaws is a non-venereal treponematosis which is usually acquired during childhood among primitive people by direct contact of naked bodies; contaminated fingers probably play an important rôle (HACKETT, 1957). Observation has shown that skin lesions in yaws are often to some degree different during the very humid rainy season and the dry season. RAMSAY, 1925, in Assam found that people in the plains had typical lesions of yaws in the wet season, which changed in the dry season, so that they could be taken for syphilis, and the longer a person with yaws stayed in the hills with a drier climate, the more his lesions appeared as those of syphilis (HUDSON, 1963 b). THOMSON,

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<sup>2</sup> Libellus de epidemia quam Itali morbum gallicum vocant vulgo brossulas, Venice, 1497.

1819, reported that apparently healthy West-Indian negroes developed symptoms of yaws after they had been removed from a cooler mountainous area to a sugar estate with a warm humid climate (WILLCOX, 1960, p. 84).

During the great migrations of man in the Pleistocene, people may have carried yaws with them from Central Africa through Arabia, India, Malaya to Australia and Oceania. There were also migrations through China across the Aleutian bridge through North-, Central- and South America, where carate, which may be regarded as a special variety of human treponematosis, became isolated.

### *Endemic syphilis*

When yaws was carried from hot humid to cooler and drier subtropical regions, the disease syndromes of yaws, as already mentioned, changed to what is nowadays known as endemic syphilis<sup>3</sup>. The treponemes which in yaws existed in highly infective ulcerations and papules all over the body were in endemic syphilis localized in comparatively warm regions of the body surface where perspiration dried more slowly, such as the folds of the neck, the arms, legs, groins around the anus, and especially also in lesions of the buccal mucosa. General skin-to-skin infection as in yaws became more rare, as clothes began to be used. Endemic syphilis was still essentially a non venereal, juvenile disease which was especially transmitted from mouth to mouth by fondling and kissing of children, by unhygienic eating habits and infected eating utensils (McFADZEAN and McCOURT, 1954; E. H. HUDSON, 1958; WILLCOX, 1960). Such conditions exist still nowadays in parts of the Middle East where HUDSON in arid regions of Syria studied 'bejel' among the Bedouins.

### *Venereal syphilis*

The evolution of venereal syphilis is connected with the development in prehistoric and early historic times of larger towns and cities and of urban life. In consequence of better organization of the family, better clothing, better nutrition and better personal hygiene, endemic syphilis could not spread as in primitive rural communities. Although infection by simple contact of naked bodies as in endemic syphilis was still possible, the chances of infection by

<sup>3</sup> The appearance of lesions in treponematosis of experimentally infected animals after many passages has been described by TURNER & HOLLANDER, 1957.

these ways decreased. The transmission which was independent from climatic conditions, the wearing of clothes, unhygienic eating habits and infected eating utensils was sexual intercourse, and gradually this form of infection developed and treponematoses transmitted by the sexual act — venereal syphilis — spread to different countries over the globe. It had its principal centers in larger cities and communities with a sophisticated population.

The just outlined evolution of human treponematoses corresponds essentially to the hypothesis of E. H. HUDSON, 1958. Opinions similar in some respects are found in the publications of HACKETT, 1963, WILLCOX, 1960, COCKBURN, 1961, and of a number of other writers on human treponematoses.

There remains still the question whether carate, yaws, endemic and venereal syphilis are caused by one and the same organism which acts differently under environmental and immunobiological influences, or whether there are four very closely related different species of treponemes which developed by mutations. In the first case one had to speak of human trepanomatoses, in the second of four trepanomatoses. Probably this question can finally only be settled by experiments with human volunteers, as suggested by WILLCOX, 1960.

Typical cases of yaws, endemic and venereal syphilis appear clinically as distinctly different diseases. One has on the other hand to keep in mind that transitions have been observed under different conditions, so that the assumption of different strains of the same treponema instead of different treponema species gives in the writer's opinion a better and more plausible explanation.

African slaves which from remote times were carried in millions by land and sea to Europe, Asia and later to the Western Hemisphere played undoubtedly a very important rôle in the distribution of treponematoses all over the world. In carrying yaws from the African rain forest to countries with similar climatic conditions they introduced yaws; in more dry climates their yaws changed into endemic syphilis, which they also transmitted directly from arid African regions bordering on the hot humid zones of the rain-forest.

From the middle of the 15th century on Portuguese shipped slaves from the Guinea coast. For many centuries African slaves had been transported already by land over the old caravan routes to North Africa, Sicily, Portugal, Spain, Egypt, and the Near East. In these cooler, less humid countries yaws either disappeared or became endemic syphilis, which for many centuries existed there under various names and ultimately was in the larger cities replaced by venereal syphilis. Nowadays, with improvement of hygiene and

the general living standard, such diseases as sabbens, button scurvy and other forms of endemic syphilis in Europe of the 17th, the 18th and the first part of the 19th century have disappeared but exist still in parts of the Near East and Africa.

### *Notes*

1) The clapper of the lepers, 'Chama Lazarus', was often made of the shells of mussels, fastened in a way that they could be used as a clapper.

2) Constantinus Africanus, born in North Africa, probably in Tunis, became famous by translating Arabian works into Latin and in this way introduced them to scholars in Western Europe. He died at Monte Cassino about A.D. 1087.

MORITZ STEINSCHNEIDER published an article on his work in Virchow's Arch. 37, 351-410, Berlin, 1866.

3) The name 'Syphilis' is taken from the famous poem "Syphilis sive morbus Gallicus" (Verona, 1530) by GEROLAMO FRACASTORO (1478-1553). The poem became very popular and was published in many editions and different languages.

4) The disturbed political situation and the wars in Europe, especially the expedition of the French king Charles VIII to Italy and the occupation of Naples, contributed to the spread of venereal syphilis, especially as the soldiers on their return from the war carried the infection to various countries (see regarding Switzerland: MEYER-AHRENS, 1841).

It is of interest that diseases which apparently were venereal syphilis in a severe form were observed and reported from distant countries such as Persia, China and Japan at the beginning of the 16th century (ELGOOD, 1951; SIGERIST, 1926; DOHI, 1926). These reports indicate that a severe form of syphilis was observed shortly after its appearance in Europe, but they do not exclude the possibility of the existence of the infection in these countries at very much earlier times (WONG and WU, 1932).

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## I

*Carate – Mal del Pinto – Pinta*

Documentation in the New World: Carate is widespread in Central- and South America, in the West Indies and Mexico where it is mostly found in warm, humid regions. According to LUIS A. LEÓN, 1942, carate existed in America in pre-Columbian times; for additional historical data, see MAZZOTTI, 1966. The disease is here mentioned, as some authors, for example the Jesuit historian JUAN DE VELASCO (1727–1819) from Ecuador in his *Historia del Reino de Quito*, 1789, and writers from Columbia claimed in their publications that carate had been introduced into America from Africa by negro slaves in the first part of the sixteenth century.

Two facts speak against this view:

1. Carate apparently did not exist in Africa in historical times, and should it be present, it is so rare that practically it could not have played a rôle in a transmission. Furthermore, the few cases which have been reported from Africa in the past, are doubtful and may have represented diseases with similar skin alterations but of a different aetiology.

2. In Mexico and in Central- and South America there are regions in which the native population, although heavily infected with carate, had never any contact with negroes. This, for example, is the case with the population in some parts of Mexico and with tribes in the forests of Brazil; furthermore, according to CHAVARRÍA and SHIPLEY, 1925, with the Tunebos who live in the plains of eastern Columbia.

There are also no reports on negroes in America infected with carate.

The first reference to carate was apparently given by FRIAR ROMÁN PANE, who accompanied Columbus on his second voyage and having spent some time on Espaniola, wrote a report on the beliefs and folklore of the local Indians (WEISS, 1947). His report is included in *La Historia del Almirante Don Christoval Colon* written by his son Fernando. ROMÁN PANE tells of an Indian myth which describes how Indians in need of women tried to catch some mythical beings without male or female sexual characteristics (they afterwards became women) but failed to hold them. Subsequently they employed Indians with carate who succeeded in catching them, as the skin on the palms of their hands was very rough in consequence of the disease (note 1).

OVIEDO in his *Historia General y Natural de las Indias*, 1535, refers to carate, although he does not mention the colour changes of the skin. He states that prominent persons and caciques in the region of Castillo de Oro (nowadays a part of Columbia) used to be carried by slaves in hammocks and that they used by preference slaves with carate, as they were especially strong (note 2).

It should here be pointed out that FRANCISCO HERNÁNDEZ<sup>1</sup> did not refer to carate. He mentions in his *Historia Natural de la Nueva España* a disease which the Aztecs called Tzatzayanaliztli and which was regarded by some modern authors, for example CHAVARRÍA and SHIPLEY (1925) as carate. This erroneous interpretation is due to an incorrect translation of the respective paragraph of HERNÁNDEZ by J. J. LEÓN. According to the symptoms of Tzatzayanaliztli as described by HERNÁNDEZ, it cannot have been carate (note 3).

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<sup>1</sup> FRANCISCO HERNÁNDEZ (1517–1587), the famous naturalist, was sent by Philip II to New Spain (Mexico) where he spent a number of years in the preparation of his great work. The manuscript with a great number of illustrations remained unpublished for a very long time after the author's death. A part dealing with medical botany was printed by the famous Ibarra Press at Madrid in 1790. Recently, starting in 1959, an excellent complete edition has been published in Mexico D.F. under the title *Obras completas del Dr. Francisco Hernández*, edited by the Universidad Nacional de Mexico (see note 3).

*The pretended letter by Cortés supposed to have been written to the emperor Charles V about the existence of carate in Mexico*<sup>2</sup>

During about the last hundred years a number of authors dealing with carate, among them HERREJÓN, 1938, and FRANCISCO LEÓN Y BLANCO, 1942, one of the best specialists of carate, gave as a proof that the disease was autochthonous in America a passage from a letter supposed to have been written by CORTÉS to the emperor Charles V. This passage mentions different colours of the skin in the same person characteristic of carate as observed in Indians.

The first author who referred to this letter was, as far as the present writer is aware, the Mexican FRANCISCO ITURBIDE in *El Porvenir*, 1870. The passage in question reads: "En este país de ventura existen rarezas en el color de sus habitantes presentando variedades en el mismo individuo." In the opinion of a Spanish scholar familiar with the writings of CORTÉS, whom the present author consulted, the phrase is not in the style of CORTÉS.

ITURBIDE did not state the date of the letter nor the place where it had supposedly been written.

The letters by CORTÉS to Charles V (five very long ones, and a short one) have been published several times and there exists also a facsimile edition. The most recent edition is that by Prof. Mario Hernández Sánchez-Bárba of the University of Madrid in the Colección Porrua, Mexico D.F., 1963. This edition is apparently the most complete one. Notwithstanding a careful check, the passage quoted before could not be found in any of the letters.

In 1925 CHAVARRÍA and SHIPLEY published a paper on carate and therein mentioned the letter of CORTÉS. They stated that in order to verify the authenticity of the letter, they had written to Cadiz for information and had received a personal communication from the secretary of the Archives at Cadiz that the letter containing the quoted passage was authentic and was kept there with nineteen (!! ) other letters by CORTÉS to the emperor Charles V.

The present author, during a four months' stay in Mexico D.F., tried to locate the letter by CORTÉS or a copy of it in the Archivo General de la Nación, but without success. During a subsequent four months' stay in Madrid he realized after some futile personal attempts to find the letter that the most hopeful procedure would be to have some Spanish authority approach officially the various archives where the letter might be kept, as in this way persons

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<sup>2</sup> As this letter has been referred to by various authors in the past, the results of the investigation by the present writer are reported in note 4.

familiar with the contents of the respective archives might find the letter among the large number of documents.

Dn. José López de Toro, Académico de número de la Real Academia de la Historia, was very helpful and approached the respective important Spanish archives and libraries requesting information about the mentioned letter<sup>3</sup>. The answers of the various officials showed that they had carefully carried out the investigations. All their answers, however, were negative (note 4).

In the archives of Simancas (Valladolid), a letter by CORTÉS to Charles V is kept, but this letter merely announces his visit to Spain in 1528. The letters of CORTÉS to the emperor, kept in the Archivo General de Indias (Sevilla), have been published in the Porrúa edition and none of those letters contains the quoted phrase.

Regarding the statement in the publication of CHAVARRÍA and SHIPLEY (1925) that information had been received from Cadiz about the letter in question which, it was stated, existed there and was kept together with nineteen other letters by CORTÉS to Charles V, it may be mentioned that a recent enquiry showed that not a single letter by CORTÉS was kept in the archives of Cadiz.

As a result of all these investigations, which were carried out by persons familiar with the respective archives, one may state that it is extremely unlikely that a letter by CORTÉS to Charles V describing symptoms of carate exists.

The foregoing has been given in some detail as from time to time for nearly one hundred years the letter by CORTÉS has been mentioned in publications on carate as a proof that carate existed in America before the Spanish Conquest. This proof, however, is not valid and not even needed as for reasons discussed before (OVIEDO, ROMÁN PANE) carate has to be regarded as autochthonous in America; it was not introduced in historical time by negro slaves from Africa.

COCKBURN, 1963, suggested that carate is the result of geographical isolation and the reason for its existence only in Central America is that not only the treponeme of carate differs from those in other parts of the world but also the human host there in his reaction to the carate treponeme is different.

About an old theory of the origin of carate in Mexico, see note 5.

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<sup>3</sup> The author wishes to thank Dn. José López de Toro, Académico de número de la Real Academia de la Historia in Madrid for his very great and efficient assistance.

## Notes

1. "... viendo, que no podían cogerlas; para que las guardasen i buscasen, para cada una un Indio caracarcol, que tenía muy asperas las manos, i que así las tendrón estrechamente, sin que se les escurriesen; dijeron al carique que había cuatro de estos caracarcoles, y los llevaron. Es el caracarcol una enfermedad como Tiña, que causa gran aspereza en el cuerpo. En efecto las cogieron, i habiendo tenido Consejo sobre el modo de hacer estas Personas mugeres, por faltarles naturaleza de ellas i de Hombre . . ."

They fastened the persons who had been caught to trees, and a bird (Pico) mistaking them for trees, picked an opening in their bodies, where the missing female sexual opening should be.

Escritura de FR. ROMÁN PANE del Orden de San Geronimo. De la Antigüedad de los Indios etc. in: *Historiadores Primitivos de las Indias Occidentales . . .* edit. Gonzales Barcia, Madrid, 1749, t. I, p. 63, de la *Historia del Almirante Don Cristobal Colón . . .*

2. "Estos indios que en lo que dicho sirven de las hamacas buscanlos que sean carates. GONZALO FERNÁNDEZ DE OVIEDO Y VALDÉS. *Historia General y Natural de las Indias, Islas y Tierra-Firme del Mar Océano (1535)*. T. III, lib. XXIX, cap. XXVI, p. 126, edic. de la R. Academia de la Historia, Madrid, 1853.

3. The *Obras completas del Dr. Francisco Hernández* (1959) contain in the second and third volume the *Historia Natural de la Nueva España*, which has the paragraph of the treatment of a disease, erroneously assumed to be carate. HERNÁNDEZ states cap. XIX, p. 405, that the plant Ixtenextic is used to treat Tzatzayanalitzli. This disease causes, according to HERNÁNDEZ, a hardening and cracking of the skin of the whole body. The patchy changes in colour and the subsequent depigmentation of the skin, characteristic of carate, are not mentioned. Based on the erroneous translation by J. J. LEÓN, CHAVARRÍA and SHIPLEY (1925) attributed to HERNÁNDEZ the statement: "Llamaba la atención de una nueva enfermedad que los aztecas llamaban Tzatzavalistli (sic.) que daba a los habitantes colores variados."

Regarding the early publications of HERNÁNDEZ' work, 1649 and 1790, see the excellent detailed *Bibliografía del Dr. Francisco Hernández* by GERMÁN SOMOLINOS D'ARDOIS to whom the present author is greatly indebted for valuable information.

4. During the investigation regarding the existence of a letter by CORTÉS to Charles V mentioning carate, the following institutions were approached:

- a. Archivo General de Indias, Sevilla.
- b. Archivo General de Simancas (Valladolid).

- c. La Colegiata de Jerez.
  - d. La Cartuja de Jerez.
  - e. La Real Academia Hispano-Americana de Artes, Ciencias y Letras de Cadiz.
  - f. Don Augusto Conte y Lacave, correspondent of the Real Academia de la Historia. He has a very great knowledge of the historical documents kept at Cadiz.
  - g. Centro Coordinador de Bibliotecas at Cadiz.
  - h. Guia de Fuentes para la Historia de Ibero America, Comisión Española.
  - i. La Coleccion Muñoz in the Real Academia de la Historia in Madrid (examined by the present writer).
5. In Mexico Padre ALZATE, 1797, discussing the cause of the colour of the negroes, mentions the presence of 'Curicua' (carate) in the neighbourhood of the volcano Jorullo and in San Juan Hue-tano (Michoacán). He believed that the disease was due to atmospheric disturbances caused by the eruption of the volcano in 1759.

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## II

### *Yaws – Framboesia – Pian*<sup>1</sup>

A clear differentiation between the clinical syndromes of yaws and venereal syphilis was up to the 19th century generally not made, so that it is often difficult or impossible to decide from the descriptions given in publications of the 16th to the beginning of the 19th centuries whether the mentioned diseases were yaws or syphilis.

This difficulty is still increased by the old terminology which applied the name 'bubas' (spelled in various ways) sometimes to yaws, sometimes to venereal syphilis and not seldom to both. In Brazil 'boubas' was used for yaws.

Yaws occurs in different parts of the world between the tropics of cancer and capricorn in regions with abundant rainfall. It is usually found at low altitudes, but has been observed in some places, for example in the Philippines, up to 2000 meters. Yaws is absent in arid mountainous regions.

Yaws is a non-venereal juvenile disease which occurs among native people with a low living standard. Usually the infection takes place through direct contact of naked bodies covered with highly infectious papules and ulcerations. Children who touch or scratch their papules may transmit treponemes to their playmates (for details see HACKETT, 1957).

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<sup>1</sup> 'Yaws' is a transliterated African name used at the Guinea coast; 'framboesia' derived from framboise = raspberry, was proposed by F. BOISSIER DE SAUVAGES in 1768 for this disease; 'pian' originated from the Caribbean word 'epian'.

Less important but frequently mentioned, especially in the earlier literature, is the rôle of flies which may transmit treponemes from an ulceration to superficial skin lesions of a healthy person (BARNARD, 1952<sup>2</sup>). The first author who pointed out this kind of transmission of yaws was GABRIEL SOARES DE SOUSA, 1587 (note 1) (FRANÇA, 1921).

One had apparently observed since long that the disease takes usually a milder course, if contracted in childhood. In consequence in Fiji mothers formerly inoculated their children with yaws (Arch. Surg. 1896, teste WILLCOX, 1960). Similar observations have been reported from Africa (MASON, 1831; FINDLAY, 1946).

When persons with yaws went to cooler regions with a more arid climate, the clinical symptoms changed to those of endemic syphilis. It has been pointed out by a number of authors that yaws, although certainly often introduced from the tropics into regions with a more dry and cooler climate, never gained a foothold as yaws.

#### *Africa*

Yaws existed in Africa from remote times. Indications are the finding of prehistoric bones with pathological changes attributed to yaws, some sculptures, for example a terracotta head of about the fourteenth century, showing mutilation probably caused by 'gangosa' (tertiary yaws)<sup>3</sup> discovered in Ife, Nigeria, numerous wooden African masks with signs of gangosa, dating back several centuries, furthermore old local names for yaws.

The Portuguese on their first exploration of the African west coast at about the middle of the 15th century observed the occurrence of a disease which to judge from their description was yaws (AZURARA, 1896, 1898).

Numerous writers from the sixteenth to the nineteenth century pointed out the frequency of yaws among negroes in Africa, but it was often not clearly differentiated from syphilis. Among early authors who mention yaws in Africa are: WINTERBOTTOM, 1803 (note 2); JAMES BRUCE, 1805, who found it in Abyssinia; GUYON, 1853, who mentions that the Tebib, the native practitioners in Algeria, regarded yaws as a kind of syphilis and treated it correspondingly. BOYLE, 1831, refers to its occurrence on the African west coast, and BRYSON, 1847, described yaws from slave ships

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<sup>2</sup> BARNARD, 1952, gives a complete review of the literature with numerous quotations.

<sup>3</sup> 'Gangosa' means muffled voice, it was used by the Spaniards for tertiary yaws with destruction of nose, mouth and pharynx.

(note 3); PINTO ROQUETE, 1868, reported the occurrence of yaws in Mozambique.

'Goundou'<sup>4</sup>, an osteitis of the facial bones, especially the nasal bones with usually symmetrical exostoses, is nowadays by most investigators regarded as due to yaws. In the second half of the nineteenth century MACALISTER, 1883, and LAMPREY, 1887, drew attention to the existence of 'horned men' in Africa by their publications. MACLAUD in 1895 gave the name 'goundou' or 'anakhré' to this pathological condition. CHALMERS in 1900 published five cases of goundou. Subsequently numerous additional cases have been reported mainly from Africa, but also from various other tropical countries.

BOTREAU-ROUSSEL, who had opportunities to study many cases of goundou, observed 1934–1936 the appearance and development of goundou during the secondary eruption of yaws in 32 patients. His observations have been confirmed by a number of other investigators, among them CLAPIER in equatorial Africa and HACKETT in Uganda (BOTREAU-ROUSSEL, 1952, 1961, 1962).

#### *America*

From the results of recent investigations one may conclude that yaws was widespread in the tropics from ancient times. Prehistoric skeletal remains with pathological alterations regarded as caused by yaws have been found on the island of Tinian (Mariana Islands) in the western Pacific, by T. D. STEWART and A. SPOEHR, 1952. Captain J. COOK (COOK & KING), 1784, stated that the people of Hawaii were infected by yaws before the arrival of the white man.

ANTONIO PIGAFETTA (about 1491 – died after 1534), who accompanied Magellan on the first circumnavigation of the globe (1519–1522) reports in his description of the voyage that 'lo mal de S. Jop' (Syphilis) was frequently seen in the Malay archipelago, especially on the island of Timor. As Magellan's ship 'Victoria', the only one which completed the circumnavigation, returned in autumn of 1522, it was probably not syphilis, as VIRCHOW, 1871, assumed, but yaws.

Yaws was first definitely mentioned as a special disease by JACOBUS BONTIUS (1592–1631) from Amboyna and the Moluccas (note 4). The first edition (in Latin) of his work was posthumously published in Leiden (1642) under the title: *De medicina Indorum*. BONTIUS regarded yaws as different from the 'Spanish pocks'

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<sup>4</sup> N'goundou in Agni dialect on the Ivory Coast signifies 'big nose' or 'enlargement of the nose'.

(syphilis); he observed that it is usually not transmitted by sexual intercourse.

From the Western Hemisphere we have several early references to 'buas' or 'bubas' which although formerly often regarded as venereal syphilis were probably in many cases yaws. The term 'bubas' caused much confusion in the literature. In Brazil bubas (boubas) meant yaws, in other parts of South America, the West Indies and Mexico bubas referred to syphilis or to both yaws and syphilis<sup>5</sup>. In the present writer's opinion and contrary to HACKETT's view, yaws existed in Espaniola and South America before the arrival of Columbus.

A very early reference is found in the *Escritura* of Fray ROMÁN PANE contained in the *Historia del Almirante Don Christoval Colón written by his son Fernando Colón* (1488–1539). We have already mentioned Fr. ROMÁN PANE in dealing with carate. He collected old myths of the Indians in Espaniola and relates that a famous mythical hero Guagagiona, a kind of great ancestor of the Indians, fell in love with a beautiful woman, but as he suffered from a disease which as ROMÁN PANE stated was known to the Spaniards as the 'French disease', he had first to stay away from her and treat himself in a secluded place until he was cured. His bubas may have been yaws and not venereal syphilis.

OVIEDO in his *Historia general y natural de las Indias*, 1535, refers to the bubas and to their treatment by the Indians with decoction of Guaiac wood. He states that the Spaniards got the infection from the Indian women.

SIGAUD, teste HIRSCH vol. II, 1885, p. 107, mentions a manuscript from the year 1587 which refers to yaws in Brazil<sup>6</sup> and is preserved in the (former) Royal Library at Rio de Janeiro.

A description of yaws and its differentiation from syphilis was given by G. PISO (note 5) (WILLEM PIES, 1611–1678) in a valuable work, jointly published with G. MARKGRAF (1610–1644): *Historia naturalis Brasiliae*, 1648. This publication contains twelve books, the first four are by PISO: *De medicina Brasiliense*; the following eight books are by MARKGRAF: *Historia rerum naturalium Brasiliae*.

In the 17th and especially in the 18th and the 19th century, quite a number of physicians on the American mainland and in the West Indies dealt in their publications with yaws. We will give only a

<sup>5</sup> It has to be added that the term bubas was occasionally even used by some authors for diseases with an entirely different aetiology, for example cutaneous leishmaniasis.

<sup>6</sup> The author of this manuscript who is not mentioned was perhaps GABRIEL SOARES DE SOUSA (see note 1).

small selection of authors. They all realized the great similarity of yaws and syphilis but did not agree on the question whether they were two different diseases or whether yaws merely represented syphilis modified by climatic conditions and possibly also influenced by racial factors. HILLARY, 1759, who made his observations in Barbados, regarded yaws as syphilis changed by the tropical climate. Père LABAT<sup>7</sup> in the French Antilles held yaws to be syphilis (note 6). SCHILLING, 1770 (note 7), and likewise WINTERBOTTOM, 1803 (note 2), regarded yaws and syphilis as different diseases. DU TERTRE, 1667, 1671, was of the opinion that yaws was an especially malignant syphilis, he considered the possible influence of food. DAZILLE, 1776, and POUPPÉ DESPORTES, 1770, likewise held yaws for a particularly malignant syphilis. BAJON, 1777, described yaws from Cayenne and pointed out the introduction of yaws by negro slaves from Africa (note 8). BOISSIER DE SAUVAGES in his *Nosologia methodica*, 1768, suggested the name *Framboesia*. BRICKELL, 1737, was the first American author who wrote about yaws (note 9).

The number of negroes suffering from yaws who worked in the Antilles and in South- and Central America gradually became so great that many plantations had their yaws houses (yaws huts) where the infected slaves had to live and were treated. When after the liberation of the slaves the inmates of the yaws houses became free, the disease spread among the population until a systematic control and treatment of the yaws patients, for example in Jamaica, caused a great reduction of the disease (GENTLE, 1965).

For treatment of yaws, the Indians used decoctions prepared from Guaiac wood, various roots and barks and certain berries. Later mercury in different preparations was introduced by foreign physicians. As a curiosity, it may be mentioned that REECE, 1817, recommended intentional infection of the patient with smallpox, as this disease supposedly caused yaws to disappear.

As mentioned before, yaws in the present writer's opinion existed in parts of the American mainland and in some of the Antilles in pre-Columbian times. It is, however, in any case certain that many cases were introduced from Africa by negro slaves after the discovery of Columbus.

### Notes

1. Digamos logo dos mosquitos, a que chamam nhitinga; e são muito pequenos e da feição das moscas; os quaes não mordem, mas

<sup>7</sup> JEAN-BAPTISTE LABAT (1663–1737) was a French Dominican missionary who was sent to the West Indies.

são muito enfadonhos, porque se põem nos olhos nos narizes; a não deixam dormir de dia no campo, se não faz vento. Estes são amigos de chagas, e chupam-lhe a peçonha que tem; e se se vão pôr em qualquer cossadura de pessoa sã, deixam-lhe a peçonha n'ella, do que se vem muitas pessoas a encher de boubas. – GABRIEL SOARES DE SOUSA, Tratado Descriptivo do Brasil em 1587. Capitulo XCIII. Que trata dos mosquitos, grillos, bizouros e brocas que ha na Bahia. Third edition, São Paulo, 1938.

From the identical Portuguese text of chapter 93 in 'Noticia do Brasil', São Paulo, 1945, Clifford Dobell gave the following translation (see BARNARD, 1952):

"We must now refer to those mosquitoes which are called nhitinga, and which are very small and of the form of flies (i.e. house flies); these do not bite but are very troublesome, because they settle on the eyes and in the nostrils, and will not let one sleep in the open unless there will be a wind. They are very fond of sores, and suck the poison which is in them; and if they there go and settle upon any abrasion on a healthy person, they leave the poison in it, and hence many people are seen covered with boubas."

2. Of all the diseases which are supposed to have originated in Africa, the only one which can be said with any degree of certainty to be indigenous in that continent is the Yaws. It frequently occurs among the slaves in the West India islands and America, by whom it has been imported from Africa into those countries; it is almost unknown in Europe, for though it has sometimes been imported, it has never spread.

The yaws is called by the Bulloms *Bihl*, by the Timmanees *Tirree* or *Catirree*, by the Mandingos *Mansera*, and by the Soosoos *Dokkettee* or *Kota*. It is called by the Portuguese on the coast *Boba*, and by the French *Pianes*. – TH. M. WINTERBOTTOM, An Account of the Native Africans, etc., 1803, Chapt. VIII, p. 139 Yaws.

3. Yaws is the only disease which occasionally proves troublesome amongst this class of people (slaves); like *craw-craws* (sic) it is engendered by filth, insufficient food, and the over-crowding of many people into a small, badly-ventilated space; it is also propagated by contact. – A. BRYSON, Report on the Climate and Principal Diseases of the African Station, 1847.

4. In Amboyna and especially in the Molucca islands there is a general plague occurring frequently, similar in its attacks to the Spanish pocks. Yet it is different in so far as there is no Venus play in its aetiology, it being usually propagated in the following way:

First spots appear on the face, and tophi and swellings on the arms and legs, which are hard and scirrous from the beginning and occur as frequently over the whole body as warts and corns do on

hands and feet in our own country; and if they ulcerate, then a tough gumlike substance is excreted, which is so sharp and biting that deep ulcerations are excavated with hard horny and subverted edges. (Translated from the Dutch.) – BONTIUS, PISO EN MARKGRAEF, *Oost- en West-Indische Waranda*, Amsterdam 1694 and 1734 (quoted from E. H. HERMANS, 1831).

5. PISO, G. *Historia naturalis Brasiliae*, Lugd. Batavorum 1648. Apud Lud. Elzevirium.

Contains:

- I. GUILIELMI PISONIS M.D. *De medicina Brasiliense libri quatuor* and
- II. GEORGI MARCGRAVI DE LIEBSTAD MISNICI GERMANI. *Historiae rerum naturalium Brasiliae libri octo*.

In I, p. 35. Cap. XIX De Lue Venerea.

Lues quaedam ex coitu non tantum per contagium, vel parentum haereditario malo in liberos, sed ex leviori attactu atque per se contrahitur, orta potissimum ex alimento foetido & salso, potu rancido & corrupto. Inter Afros non solum atque Indos, sed Lusitanos & Belgas quoque saevit, tumoribusque schirrosis & virulentis ulceribus totum corpus infestat. Quae quidam lues huic regioni est Endemia & Bubas ab Hispanis & Brasilianis appellatur.

6. De l'Épian, maladie ordinaire des Sauvages. "Les Caraïbes sont fort sujets à l'Épian. On doit avouer que cette maladie est particulière à l'Amérique, elle y est naturelle, tous ceux qui y naissent Negres ou Caraïbes de quelque sexe qu'ils soient, en sont atteints presque en venant au monde, quoique leurs pères, leurs mères & leur nourrices soient très sains, ou de moins qu'ils paraissent tels.

L'Épian est réellement ce que les François appellent le mal de Naples, & que les Italiens nomment le mal François. Tout le monde le connoît sous le nom de mal Venerien, & on devoit avec justice l'appeler le mal Américain, puisqu'il est né dans ce Pais-la, & que c'est de là que les Espagnoles premiers conquerans de ce nouveau Monde l'ont apporté en Europe.» – JEAN-BAPTISTE LABAT, *Nouveau Voyage aux Isles de l'Amérique*, vol. IV (1700), p. 358.

7. This disease (framboesia) is prevalent among the niggers and infects all manner of persons, young and old, male and female, of all kinds of dispositions: childhood being, however, the most susceptible to it. – SCHILLING, G. W., 1770 (quoted from HERMANS, 1931).

8. La maladie désignée sous ce nom, est tout-à-fait inconnue en Europe; elle semble être particulière à ces Noirs, qui naissent sous des climats brûlants de l'Afrique, et qui par leur émigration l'ont portée dans toutes les parties de l'Amérique méridionale où elle est

actuellement, peut-être plus commune qu'en Afrique même. — BAJON, 1777, vol. I, Mémoire IX, *Sur les Pians*.

9. The Yaws are a Disorder not well known in Europe, but very common and familiar here; it is like the Lues venerea, having most of the Symptoms that attend the Pox . . . This Distemper was brought hither by the Negroes from Guinea where it is a common Distemper amongst them. — BRICKELL, *Natural History of North Carolina*, 1737, p. 48 (copied from BUTLER, 1936).

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## III

*Endemic Syphilis*

Disease syndromes resembling to a large extent those of venereal syphilis have been described under various names in Europe in the 18th and early 19th centuries. Similar diseases have been found in different parts of the world, where they evidently existed for many centuries, to judge from the old names used by the native population.

Modern studies which started at about 1928 (GRÖN, 1928; HUDSON, 1928; GRIN, 1935) have provided clinical and epidemiological characteristics, so that the name of 'endemic syphilis' was generally accepted and replaced the various names formerly used for these so-called syphiloids.

Endemic syphilis is a non-venereal syphilis contracted usually in childhood. A primary lesion is often not found, generalized secondary lesions are comparatively rare, lesions of the buccal mucosa are frequent and tertiary lesions may be very extensive and destructive. Congenital syphilis, cardio-vascular and neurological involvement apparently do either not occur or are very rare. TURNER and HOLLANDER, 1957, made animal experiments with different strains of treponemes of syphilis and of yaws; these experiments gave interesting results regarding the relationship of these diseases.

In endemic syphilis the main source of infection are the lesions of the mucosa of the mouth wherefrom children by putting their fingers in the mouth may carry treponemes to the fingers or the mouth of other children. They may also transfer the treponemes directly by kissing. Furthermore eating utensils, drinking-cups, spoons, etc. which are not properly cleaned and are shared by several persons may transmit the infection (MCFADZEAN and McCOURT, 1954).

In Europe endemic syphilis occurred as the 'sibbens' of Scotland (GILCHRIST, 1771; CARMICHAEL, 1814). It was known as Framboesia Cromwellia as it was originally regarded as venereal syphilis introduced by soldiers of Cromwell's army and which in the view of some authors continued in the non-venereal form as endemic syphilis (WILLCOX, 1960, p. 87). Similar diseases were the 'button scurvy' of Ireland (CARMICHAEL, 1814; FAYE, 1842), the 'radesyge' of Norway (BÖCKER, 1809; HÜNEFELD, 1828), the 'salt-fluss' of Sweden (BÖCKER, 1809), the 'Dithmarsh evil' (HÜBENER, 1835), the 'pian de Nérac' (CAVAILLON, 1958) and the 'spirocolon' of Greece (LANCEREAUX, 1868).

In Bosnia endemic syphilis was known as 'skerljevo', and it existed also in other parts of Jugoslavia (GLÜCK, 1888; GRIN, 1935, 1952, 1953, 1956, 1961; GUTHE, 1960).

Endemic syphilis gradually disappeared in most parts of Europe during the first half of the 19th century as economic and social conditions improved (GUTHE and LUGER, 1957).

In the Middle East cases of endemic syphilis have been found existing under various names (KAIL, 1955), 'bejel' in Syria and Iraq has been studied in detail by E. H. HUDSON, 1928. (See also VON DÜRING, 1918.)

Regarding Asia, endemic syphilis has been reported from Mongolia and Tibet (GUTHE and WILLCOX, 1954).

The disease syndromes have been reported also from Canada during the early settlements around St. Paul's Bay (CARMICHAEL, 1814; WRIGHT, 1855) and Lake Huron (LANCEREAUX, 1868).

### *Africa*

In Africa endemic syphilis occurs among primitive tribes in arid areas near the Sahara desert and the Kalahari desert. It has been reported from Morocco (LÉVY-BING and GERBAY, 1917), Mauritania, Senegal (HACKETT, 1959), Gambia (MCFADZEAN and McCOURT, 1954), Sudan (HEWER, 1938; GRIN, 1961), former French Equatorial Africa (BAYLET, 1954) and Niger territory (MATHURIN, 1953). It was found in Northern Nigeria, in Abyssinia (MANSON-BAHR, 1941) and in Uganda (DAVIES, 1956). According to DAVIES, intentional protective inoculation of children with endemic syphilis was an old practice in Uganda.

From Southern Rhodesia the disease has been described as the 'njovera' (WILLCOX, 1951, 1960) and from Bechuanaland as the 'dichuchwa' (MURRAY et al., 1956; MERRIWEATHER, 1959)<sup>1</sup>.

The Peuhls in former French West Africa called endemic syphilis 'pouzzé'. Along the Gambia in transitional climatic zones where both yaws and syphilis occur, endemic syphilis was called 'siti'.

It is very probable that before the discovery of the New World, when many African slaves were sent from North Africa to southern Europe, especially Portugal, Spain and Italy, cases of endemic syphilis and cases of yaws which changed into endemic syphilis were introduced and the disease became established in southern Europe.

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<sup>1</sup> For additional references, see: GRIN, E. I., 1953; GUTHE, T. and WILLCOX, R. R., 1954; HACKETT, C. J., 1963; HUDSON, E. H., 1946; WILLCOX, R. R., 1960.

*America*

After Columbus' discovery, African slaves from Mauretania, Morocco, Algiers and Tunis were for a short period shipped to the New World, but this traffic was soon forbidden by the Spanish Government for religious motives. It was officially stated that muslim and newly baptized Christian slaves could not be introduced into the newly conquered territories of the Western Hemisphere.

The comparatively few slaves which at the beginning of the slave trade with America reached the New World either from the northern coast of Africa or from Lisbon and Sevilla will have brought endemic syphilis to Central America and Mexico. In the tropical regions endemic syphilis will – provided the above outlined hypothesis of evolution is correct – have changed to yaws, while in the cooler regions such as on the high plateau of Mexico it may have persisted as endemic syphilis and may also have developed into venereal syphilis. In later periods of the slave trade, when the slaves came mostly from equatorial Africa with a humid hot climate, they introduced yaws into the New World. There will, however, still have been a certain number of slaves taken from arid zones bordering on the African rain forest who carried endemic syphilis.

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## IV

*Venereal Syphilis**Africa*

Whereas yaws was from ancient times a heavy burden for the population of equatorial Africa, it seems that venereal syphilis was noticed there comparatively late.

So far no papyri, inscriptions, works of art or pathological changes in mummies have been discovered which would give a definite documentation of the existence of venereal syphilis in ancient Egypt.

No prehistoric bones with lesions which might be attributed to syphilis but could not also be due to yaws have been found in Africa.

The Arabian literature has likewise not given proofs for the existence of venereal syphilis in Africa before the discovery of the New World. One has, however, to consider that there are still numerous Arabian works which have not been translated and therefore have not been used by western medical historians. It is possible that in some future indications regarding the existence of venereal syphilis in Africa will be found in such works. We know that the Arabs greatly valued mercury for the treatment of what was probably in part endemic syphilis, and it has been mentioned before that the 'Saracen ointment' was brought back from the Near East by the crusaders to cure their 'leprosy' (LENDRUM, 1952; MONTEJO, 1863).

It is in the present writer's opinion certain that endemic syphilis occurred already before the crusaders in parts of Africa and that also venereal syphilis existed, at least in North Africa. Leo Africanus, according to his 'Descrittione dell'Africa', saw in 1516–1517 many cases in Cairo (note 1).

He believed that venereal syphilis had been introduced into North Africa from Europe, especially from Spain. In the western part it was called the Spanish disease, in Tunis, Egypt and Syria the French disease.

Leo Africanus held the 'marranos', the Spanish Jews expelled from Spain in 1492, mainly responsible for the introduction of syphilis into North Africa, an opinion which has not been shared by modern investigators.

Ramusio (1485–1557) gives the report of a Portuguese pilot that already in the first half of the 16th century syphilis was present on the island of São Tomé (note 2).

The early references to the occurrence of venereal syphilis in

Africa were mostly given by non-medical men such as sea-captains, traders and explorers, who made no differentiation between syphilis and yaws. From about the 17th century on, the descriptions became more precise and allow to some extent a distinction between the two diseases. Endemic syphilis was not recognized as syphilis, although it was known to the local people in different regions under different names.

Venereal syphilis was frequent in North Africa, especially Egypt, due to the contact with southern Europe and the Near East.

The Portuguese were apparently responsible for the introduction of syphilis into Abyssinia in the 16th century where it gradually spread over the whole country.

The east African coast and the islands Réunion, Madagascar and especially Zanzibar (LOSTALOT-BACHOUÉ, 1876) gradually became centers of infection with venereal syphilis; the Portuguese and the Arabs were chiefly responsible for the introduction.

On the west coast, Angola got venereal syphilis after the Portuguese occupation (F. PIGAFETTA, 1591; DAPPER, 1686), (note 3).

The Guinea coast became heavily infected with venereal syphilis after foreigners had settled there and had built forts.

On the other hand, South Africa remained comparatively free until the first half of the 19th century.

LIVINGSTONE, 1857, expressed the opinion that syphilis did not get a foothold in populations of pure negro blood in the interior of Africa. In his *Missionary Travels*, 1857, he states (p. 128):

“A certain loathsome disease which decimates the North American Indians and threatens extirpation of the South Sea islanders dies out in the interior of Africa without the aid of medicine. And the Bangwaketse who brought it from the west coast, lost it when they came into their own land southwest of Kolobeng. It seems incapable of permanence in any form in persons of pure African blood anywhere in the centre of the country. In persons of mixed blood, it is otherwise; and the virulence of the secondary symptoms seemed to be in all the cases that came under my care, in exact proportion to the greater or less amount of European blood in the patient.”

He had stated 1853 (LIVINGSTONE'S *Private Journals*, 1960, p. 184): “The venereal disease abounds at the Barotse. It is called ‘Manasa’. It was brought from the Bashukulompo.”

FRITSCH, 1867, found syphilis rare in Bechuanaland but stated that there were sufficient cases to disprove LIVINGSTONE'S opinion that the disease did not occur in pure negroes in the interior of Africa.

In the first half of the nineteenth century several authors stated

that syphilis was frequent along the coast where the native population came in contact with foreigners but the disease became increasingly rare if one went from the coast to the interior.

With a better knowledge of parts of Africa which had not been visited by foreigners interested in medical questions, the distribution of syphilis in the 18th and 19th centuries became more clear. There was a general agreement that the northern coast of Africa, especially Egypt, was heavily infected (MADDEN, 1904; LACAPÈRE, 1923). In Egypt the troops of Napoleon I were blamed for having introduced venereal syphilis which, however, existed there already for many centuries (Leo Africanus). The disease was called 'Marrad Affrangi', the disease of the Franks, a term applied to all foreigners (MADDEN, 1904). In Abyssinia venereal syphilis is nowadays spread over the whole country (NÄGELSBACH, 1926; MANSON-BAHR, 1941). Both endemic and venereal syphilis occur.

Regarding Uganda, DAVIES, 1956, expressed the opinion that endemic syphilis existed in southern Uganda for centuries. A certain indication is the old practice of vaccinating healthy infants with syphilis, as it was believed that the disease transmitted in this way produced immunity in the adult. With the rise of the living standard endemic syphilis disappeared and was replaced by venereal syphilis. There are different opinions regarding the early history of venereal syphilis in Uganda. G. T. WILSON and R. W. FELKIN, 1882, vol. I, p. 183, state: "Syphilis is extremely common, especially among the men." C. WRIGLEY, in an article in the *Economic History Review*, vol. X, no. I, p. 72, quotes Sir Apolo Kagwa and Nsimbi<sup>1</sup> as saying that syphilis was rife in Buganda in the 18th century.

T. H. PARKE, 1891, who took part in the Stanley expedition to the relief of Emin Pasha stated: "Syphilis is very common all over the Pasha's province" (later a part of S. Sudan and small parts of Nn. Uganda). He also reports (chapter XXII, p. 396): "The Pasha tells me that the Monbuttu tribe in his province inoculate with the virus of syphilis. The rash and all sequelae appear very rapidly but their course is not so virulent." (Compare with DAVIES.)

Sir HARRY JOHNSTON in *the Nile Quest*, 1903, speaking of the people in Uganda states: "Syphilis had wrought but slight ravages amongst them; indeed it was a disease of but recent introduction."

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<sup>1</sup> Apolo Kagwa was the 'Prime Minister' of Buganda for about 25 years at the end of last century and first quarter of this. He wrote many books in Luganda which are regarded as authoritative traditional histories. Nsimbi is a more recent Buganda historian. The writer is indebted to Mr. Bryan Langlands for the information.

It was attributed to the first Nubian slave- and ivory trading caravans and also to the Zanzibar trading caravans.

The same author, 1908 (*Georg Grenfell and the Congo*, vol. II, p. 555) states: "Syphilis of relatively recent introduction is more common in the west, east and south than in the center and north; and among the riverain population of the main Congo rather than among the tribes removed from this great artery of travel. Syphilis in all probability was unknown in these regions till the seventeenth and eighteenth centuries, when Europeans – Dutch and Portuguese – introduced it into Angola and the lower Congo. It spread thence to the Luanda Empire but obtained no great hold."

In Senegambia HÉBERT, 1880, found venereal syphilis of frequent occurrence.

The Guinea coast was especially infected. DANIELL, 1849, speaking of the conditions on the bights of Benin and Biafra stated that syphilis was perhaps the most frequent and fatal of the diseases there.

Similar statements were given from the Gold coast (CLARKE, 1860; the Cameroon coast (GRIFFON DU BELLAY, 1864) and Gabon (ABELIN, 1872).

Concerning the Sudan, PRUNER, 1847, stated that Turkish troops had introduced the disease into Kordofan.

It has already been mentioned in the previous chapter that in South Africa endemic syphilis 'njoвера' has been found in Southern Rhodesia (WILLCOX, 1951, 1960) and 'dichuchwa' in Bechuanaland (MURRAY et al., 1956; MERRIWEATHER, 1959).

Venereal syphilis is of comparatively recent introduction and the infection was due to the contact with the whites.

In the first half of the 19th century venereal syphilis was rare among the Hottentots and still more rare in Bechuanaland (FRITSCH, 1867). LICHTENSTEIN, 1812, travelling in South Africa between 1802 and 1806, could not find syphilis among the Xhosas; the statements of LIVINGSTONE have been mentioned before.

SAX, 1952, refers to the '*Report of the Contagious Diseases Commission of 1906–07*', which found that there were several native names for syphilis but they were names for a newly introduced disease.

The Zulus call syphilis 'isifo sabelungu' (disease of the white men) or 'isifo sedolopi' (disease of the town). According to SAX, 1952, there are many signs that syphilis was brought to the east African coast during the 16th century. The southward migrating Bantu people, however, had little contact with white men. Syphilis was carried northward by the white colonists during the northward expansion of the European settlement at the Cape of Good

Hope. Sailors and slaves introduced more and more syphilis into the Cape Colony.

Hottentots invading Bechuanaland in the second half of the eighteenth century are blamed for having brought syphilis to the Bechuana natives. This was on a comparatively small scale, but a rapid spread of venereal syphilis followed the opening of the diamond mines in 1866, which attracted many labourers from distant tribes.

The 1906 Contagious Diseases Commission obtained evidence that the introduction of syphilis among the native population was of comparatively recent date. The disease was brought to the native villages by natives who returned from work at the mining centers, especially Kimberley.

It could be shown that syphilis had been unknown to the Xhosas and to the Fingoes in the forties and that it had been unknown in Basutoland before 1876.

For more details, the reader is referred to SAX, 1952. He concluded that within 40 years after the migration of Bantu workers to South Africa's newly established industries, syphilis had spread all over the country and that the rapidity of spread is comparable to that of the 15th century epidemic syphilis in Europe.

#### *America*

Based on the results of modern research, the present author assumes the existence of venereal syphilis and yaws in the Western Hemisphere before Columbus (JARCHO, 1964). There are prehistoric skeletal remains, although not in great numbers with lesions which, even judged very critically, have to be regarded as due to syphilis; in some cases yaws may have been the aetiological agent (J. C. TELLO, 1909; J. H. MEANS, 1925; H. U. WILLIAMS, 1932, 1936; W. L. HALTOM and A. R. SHANDS, Jr., 1938; H. S. DENNINGER, 1938; H. N. COLE et al., 1955; C. W. GOFF, 1953; T. D. STEWART, 1940 and 1941). The difficulties of making a correct diagnosis have been pointed out by I. BLOCH, 1901, 1911; T. D. STEWART, 1941, and S. JARCHO, 1964.

As mentioned before, prehistoric skeletal remains with pathological changes apparently due to syphilis have been discovered comparatively rarely in the Western Hemisphere; on the other hand, post-Columbian bones with gummatous lesions apparently due to syphilis have been found quite often in the South East of North America, in areas where Indians and foreigners had come into frequent contact (T. D. STEWART, 1940).

Concerning old myths and folklore, we know that in Mexico Nanauáztin was regarded as connected with bubas. He somewhat

corresponded to Tapeu in Guatemala. Among the Quiché of Guatemala bubas were regarded as a sign of great and powerful persons who got the infection from their relations with many women. The disease proved their virility and at the same time their wealth and social status, as ordinary people could not afford to live in that way (SCHERZER, 1857).

The story of Guagagiona, the mythical Indian hero who wished to have sexual relations with a woman but had first to treat himself, because he suffered from bubas, as told in the *Escritura* of FRAY ROMÁN PANE, has already been mentioned in the chapter on yaws.

LAS CASAS states that he had asked the Indians of Espaniola, whether bubas was an old disease amongst them, and got the answer it had existed from very remote times.

Several of the early Spanish chroniclers who described the various conquests in the West Indies and on the American mainland mention that many Spaniards who had intercourse with Indian women got bubas. The Indians themselves apparently suffered less from them. They used Guaiac wood for treatment (FUCHS, 1953, and note 4). Later authors regarded the mentioned infection with bubas as a proof that the Spaniards got syphilis. However, one must keep in mind that the name 'bubas' was applied to diseases of a different aetiology.

We know that yaws is normally a juvenile non-venereal disease which, however, can be transmitted during sexual intercourse. It seems to the present writer more likely that the Indians in the Antilles, who had a low living standard and were more or less naked, suffered more from yaws than from syphilis, although venereal syphilis may have been introduced from cities with a high civilization of the Mexican empire.

A mural in a ruined temple of about A.D. 200 at Teotihuacán, near the city of Mexico, shows a man with deformed legs and with dark spots (ulcerations?) all over the body, called the 'Buboso' by the local people (plate VIII). The picture may represent a man with yaws, syphilis or exanthematic typhus.

Among the early chroniclers who describe the Spanish conquest and mention 'bubas' one of the best known is GONZALO FERNÁNDEZ DE OVIEDO Y VALDES, 1526, 1535. He was the first to suggest that bubas were carried by the Spaniards to Europe soon after the discovery of Columbus; for some other early chroniclers see note 5.

BERNARDINO DE SAHAGÚN states that the bubas were of two different kinds, one kind produces soft moist condylomata and ulcerations – possibly yaws, the other kind causes a dry exanthema – possibly syphilis.

We may be very brief in dealing with the old, often discussed question whether syphilis was carried from America, possibly by the sailors of Columbus to a syphilis-free Europe or vice versa. This old question which has still nowadays representatives of both opinions (note 6) has become rather irrelevant, as modern research has shown that human treponematosi s existed in different parts of the world since ancient times. One is justified in assuming that syphilis, both endemic and venereal, was present in the Western Hemisphere and in the Old World. Therefore it makes no great difference whether some sailors of Columbus carried venereal syphilis or yaws to Europe, or whether Spaniards and Portuguese carried endemic or venereal syphilis to America. Skeletons with lesions which could be attributed to syphilis, dating from post-Columbian times, have been found in the south-eastern part of North America, as mentioned before.

However, these considerations leave one question open which also will probably not be answered and definitively settled in future: The reason why in the last years of the fifteenth century and in the first decades of the sixteenth century syphilis spread in a severe form in Europe, and to judge from the just mentioned skeletal remains, spread also on the southern coast of North America.

Even if one admits that the reports may have been exaggerated, one cannot deny that the disease appeared with very severe destructive syndromes regarding skin and bones and was carried in this severe form to different countries, often in consequence of war (note 7).

Within 40–50 years the spectacular skin manifestations became much milder and syphilis showed itself as we know it to-day.

From the contemporary descriptions we see that in its severe form syphilis of the 15th and 16th centuries caused ulcerations of the skin with mutilations and also involvement of the bones. There are, however, no indications that the central nervous system was also involved.

Among the different theories which attempt to explain the appearance of a severe syphilis shortly after the return of Columbus from his first voyage, is the hypothesis that new, especially virulent strains developed and that strains against which little or no immunity existed, were exchanged between the Europeans and Indians. This not unreasonable assumption cannot be proved or disproved at present and will probably also not be proved in the future (SINGER and UNDERWOOD, 1962; CASTIGLIONI, 1941).

It may be regarded as certain that the sailors of Columbus had sexual relations with Indian women in Espaniola and that in all

probability some became infected with yaws or syphilis and brought the infection back to Spain where, however, syphilis at least in the endemic form already existed. How far these few sailors influenced the evolution of a severe syphilis in the Iberian peninsula and in Italy is difficult to ascertain, just as it is difficult to know how far Spaniards who might have had endemic syphilis were responsible for the appearance of numerous cases of syphilis which were traced by the finding of diseased post-Columbian bones on the south-east coast of North-America.

As far as negro slaves are concerned, there can be no doubt that, especially during the later years of the slave trade, when venereal syphilis was present in many African ports, negroes with venereal syphilis were shipped to the New World. Generally speaking, negro slaves transported to the Western Hemisphere played a very important rôle in the introduction of human treponematosis. The transmission of yaws has been pointed out by contemporary writers dealing with slavery in the Antilles. Slaves originating from more arid zones bordering on the tropical rain forest will to some extent have introduced endemic syphilis. According to the hypothesis outlined before, these two diseases may have contributed by their evolution to the appearance of venereal syphilis, independent from cases of venereal syphilis directly introduced from Africa.

The close relationship of yaws and syphilis and the possibility of an exchange of the clinical syndromes from one disease to the other was recognized by some writers long ago. In this connection, SYDENHAM's theory may be mentioned: THOS. SYDENHAM (1624–1689) was of the opinion that the bubas (yaws) had been brought by negro slaves from the west coast of Africa to America. There they became transformed into venereal syphilis, which was then transmitted by Spaniards to Europe. Subsequently it was carried from Europe to the different parts of the World.

SYDENHAM's theory is interesting but it does not pay attention to the time-factor. The appearance of a malignant syphilis in Europe occurred very soon after Columbus' return from his first voyage (1493), whereas the first negro slaves in greater number were carried to the West Indies and the American mainland only in the first two decades of the sixteenth century. Therefore they could not be responsible for the appearance of a severe syphilis in Europe during the last years of the fifteenth century.

Already in the past some authors expressed the opinion that syphilis existed both in the Old and in the New World. Among them are PADILLA, 1861, and CASTIGLIONI, 1941.

Numerous details regarding the history of syphilis will be found in BLOCH, vol. I, 1901, and JEANSELME, vol. I, 1931.

Merely as a curiosity it may be mentioned that JAUREGUI and LANCELOTTI, 1924, claimed that syphilis had originally been a disease of the lamas in Peru and that man had first got it from them by sexual acts (note 8).

There exist very many publications on venereal syphilis; for an excellent bibliography, see J. K. PROKSCH, 1966.

### Notes

1. LEO AFRICANUS, Al-Hasan ibn Muhammad al-Wazzān al Zayyāī (or al Fāsī) ca. 1485–ca. 1554, born in Granada, was in Egypt in 1516–17. During his return he was captured by Christian pirates, brought to Rome and was presented as slave to Pope Leo X. He was baptised in 1520 and got the names Johannes and Leo. He returned to Africa sometime before 1530, and died a Moslem in Tunis. There are no traces of him after 1554.

In 1526 he completed in Rome his 'Descrittione dell'Africa', which is composed of nine books; book VII, Terra Negra, describes the then unknown regions south of the Sahara; book VIII deals with Egypt. The work was first published by G. B. RAMUSIO as vol. I of his *Navigazioni e viaggi* (1550) (condensed from Encyclopaedia Britannica, vol. 13, 1964).

2. GIAN BATTISTA RAMUSIO, 1485–1557. *Navigazioni e Viaggi*, 3 vols. Vol. I 1550; vol. II 1556; vol. III 1559.

3. OLFERT DAPPER, born ca. 1636–1637, died 1689. *Description de l'Afrique traduite du Flamand*. Amsterdam 1686. In chapter: Du Royaume d'Angola, Ambonde ou Dongo: maladies pp. 362–363: "Le mal de Naples y est fort fréquent & personne ne s'en scandalise: on tâche de le guérir, par des herbes & des frictions, mais ce n'est pas avec tant de succès qu'en Europe."

4. "About 1508 a Spaniard who was suffering from syphilis went to the island of San Domingo and discovered that the natives used for treatment a local product, guaiac wood. He was cured by its use, and he set up as a seller of the wood. Guaiac at once became a favorite remedy and it was regarded as a specific for syphilis for at least a century." CHARLES SINGER and E. ASHWORTH UNDERWOOD, *A Short History of Medicine*. Sec. edit. Oxford 1962, p. 108.

5. Among the early chroniclers of the Spanish conquests who refer to bubas the following may be mentioned: PEDRO MÁRTIR DE ANGLERIA; FRANCISCO LÓPEZ DE VILLALOBOS; GONZALO FERNÁN-

DEZ DE OVIEDO Y VALDES; RUY DIAZ DE ISLA; FERNANDO COLÓN; FRANCISCO LOPEZ DE GÓMARA; ANTONIO DE HERRERA; BERNAL DIAZ DEL CASTILLO; FRAY BARTOLOMÉ DE LAS CASAS; FRAY BERNARDINO DE SAHAGÚN.

6. Many authors have written about the old question, whether syphilis originated in the Western Hemisphere or in the Old World. Only a few early and some recent ones are given in the following:

A. Americanists: GONZALO FERNÁNDEZ DE OVIEDO Y VALDES, 1526, 1535; RODRIGO DIAZ DE ISLA, 1539, 1542; FRAY BARTOLOMÉ DE LAS CASAS, 1561, 1877; J. ASTRUC, 1740; I. BLOCH, 1901, 1911; W. A. PUSEY, 1933; L. W. HARRISON, 1959.

B. Anti-Americanists: NICOLO SCILLACIO, 1944; FRANCISCO DELICADO, 1529<sup>2</sup>; FR. MARTIN SARMIENTO, *manuscr.* 18th century Madrid; RAFAEL FLORANES, *manuscr.* 18th century Madrid; FR. J. CLAVIGERO, 1844; K. SUDHOFF, 1912, 1913; H. E. SIGERIST, 1926; R. C. HOLCOMB, 1937; E. ISLA CARANDE, 1945; P. GONZALEZ RODRIGUEZ DE VERA, 1956.

Among the authors who held the view that syphilis had existed from early times in both, the Western Hemisphere and Europe are M. PADILLA, 1861, and A. CASTIGLIONI, 1941.

7. MEYER-AHRENS, 1841, collected early reports on the first appearance of syphilis in its severe form in Switzerland. He came to the conclusion that the disease had been introduced by Swiss soldiers who had served with the French troops in Italy on their return to Switzerland.

8. The experimental results of JAUREGUI and LANCELOTTI (1924) could not be confirmed by other workers. Syphilis is not a disease of the lamas. According to an old tradition, still existing in Peru, the Incas already had made laws against sexual acts of humans with lamas. This tradition may have stimulated the work of JAUREGUI and LANCELOTTI.

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<sup>2</sup> See C. H. FUCHS, 1953.

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## D Helminth Infections

### *General Statements*

Most of the protozoan diseases mentioned before were, regarding their clinical symptoms, well known for many centuries; their causative agents, however, were only discovered after microscopic research and experimental work had greatly advanced during the 19th century.

It was different with helminth infections as the larger intestinal helminths of man and of a number of animals could not have been overlooked.

Among non-intestinal worms *Dracunculus medinensis* was noticed and recorded already in antiquity, and *Loa loa* migrating under the conjunctiva of the eye was long known to the local population in endemic areas of equatorial Africa. They told GUYOT, a French naval surgeon in the second half of the 18th century, when he visited Angola and saw for the first time a filaria moving under the conjunctiva that it was a 'Loa' and that the infection was not rare among them<sup>1</sup>.

Ancient records of helminths occurring in Africa (Egypt) are found in the Papyrus Ebers (VON OEFELE, 1902; EBBELL, 1937). The worms mentioned in the Papyrus Ebers were probably *Ascaris lumbricoides*, *Taenia saginata*<sup>2</sup>, as according to Herodotus pork was not generally eaten by the Egyptians, and *Dracunculus medinensis* (EBBELL, 1937; HOEPPLI, 1959). It should be kept in mind that the identification of these three worms can only be made with a certain reserve (EBBELL, 1938) as the wording of the Egyptian text can be interpreted in different ways. Another worm, Herxetef (RIAD, 1955), is regarded by some authors to be *Enterobius vermicularis*. Although the clinical symptoms of schistosomiasis due to *S. haematobium*, especially haematuria, were apparently known, it is highly improbable that the Egyptians knew the parasite (see GHALIOUNGUI, 1963; HOEPPLI, 1959). In the second quarter of the second century B. C. AGATHARCHIDES of Cnidus referred to *Dracunculus medinensis* as common among the population on the

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<sup>1</sup> Loa is an African name used by the native people.

<sup>2</sup> VON OEFELE assumed the existence of *Diphyllobothrium latum* in ancient Egypt.

shores of the Red Sea. After Egypt had become a part of the Roman Empire, PLINY (Hist. nat.) mentioned the frequent occurrence of tapeworms among the Egyptians. PLINY also knew of *Dracunculus medinensis*.

After the conquest of North Africa by the Moslems in the seventh century, Arabic medicine was introduced. From the writings of the Arabic authors the following three conclusions can be drawn regarding intestinal worms: (a) They regarded *Cucurbitini* — single *Taenia* segments — as a distinct helminth species; (b) those who speak of the existence of three kinds of helminths, refer to *Ascaris*, *Enterobius* and *Cucurbitini*; (c) those who differentiate four kinds of helminths (e.g. Avicenna), distinguish *Ascaris*, *Enterobius*, *Taenia* and *Cucurbitini*.

Although some Persian-Arabic authors may have known *Ancylostoma duodenale*, there is in their works no clear reference to this form. The Arabic physicians knew the Guinea worm, but it was not regarded as an animal by all of them<sup>3</sup>.

In the Western Hemisphere intestinal helminths were known before Columbus. The *Historia General de las Cosas de Nueva España* by SAHAGÚN in the *Códice Matritense del Real Palacio* and in the *Florentine codex* contains the pictures of a man and a dog discharging large intestinal worms (plate XV)<sup>4</sup>. The early Spanish authors writing soon after the Conquest refer to round-worms, lumbrici, evidently *Ascaris lumbricoides* and mention various anthelmintics used by the indigenous population.

EGGS of *Trichocephalus* were found by PIZZI and SCHENONE, 1954, in the intestinal contents of the corpse of a boy of the late Inca period, buried on a mountain near Santiago de Chile.

We do not know at present whether *Hymenolepis nana* existed in the Western Hemisphere before Columbus. It is nowadays the most common human tapeworm in the Southern United States.

The existence of *T. saginata* and *T. solium* in Mexico, Central and South America before the Conquest is very doubtful, as cattle and pigs were only introduced by the Spaniards.

Nowadays *T. saginata* is widely distributed in Mexico and *T. solium* occurs from Mexico and Venezuela to Ecuador.

Some early Spanish writers mention the peccary as a kind of pig which 'had the navel on its back' (it is actually a large sebaceous gland). As the peccary has a strong odor, it was probably not

<sup>3</sup> For a good review of the opinions of Graeco-Roman and Arabic-Persian authors on helminths, see F. ADAMS, 1846, vol. 2 (Book IV), pp. 139-153.

<sup>4</sup> A detailed discussion of the SAHAGÚN codices is given by F. GUERRA: *Aztec Medicine*, 1966, pp. 317-318.

eaten often and it may not harbour *Cysticercus cellulosae* (ASHBURN, 1947).

Apart from helminths which were certainly autochthonous in the Western Hemisphere, such as *Ascaris* and *Trichocephalus*, a number of African species were introduced by the imported negro slaves as will be shown in the following chapters.

## I

### *Intestinal Helminths*

*Ascaris*, *Enterobius*, *Trichocephalus*, *Taenia*, *Hymenolepis*

#### *Africa*

Except for the publication of ALEIXO DE ABREU, 1623 (Angola and Brazil), who describes what may have been *Trichocephalus* infection, there are no records regarding intestinal helminths in equatorial Africa up to the 18th century when worm infections were occasionally mentioned by foreign physicians, traders, and explorers. In the following a few statements are given:

THOMAS M. WINTERBOTTOM, 1803. Sierra Leone.

“Worms of the intestines are well known among the Africans, and considered as a very frequent cause of diseases, particularly in children. The Timmanees and Bulloms do not distinguish the different species of worms by particular names but use the word *Abilloo*, worms, or *Abilloo Rokóor*, ‘worm sickness’, to denote the whole. Among the Foolas and Mandingos, the various kinds are very accurately distinguished; the *ascarides*, or maw worms, are called by the Soosoos, *Koolee*, by the Foolas, *Toomboo*; and by the Mandingos, *Nyaallee*. The *lumbrici* or long worms are called by the Foolas and Soosoos, *Tonnangho*, and by the Mandingos, *Shoóndes*. The Foolas name the *taenia* or tapeworm, *Neagoómee*; the Mandingos and Soosoos call it *Cálligbrày*.

The Foolas are particularly subject to the tapeworm. This they attributed to their living so much upon milk.”

“The slaves who are brought down to the water-side by the Foolas for sale are always infested with the tapeworm; this probably arises from the very scanty and wretched diet with which they are fed in the *path*, as they term the journey, and which from the distance they are brought inland, often lasts for many weeks at the same time that their strength is further reduced by the heavy loads, they are obliged to carry.”

F. PRUNER, 1847. Cairo.

He found intestinal helminths extremely frequent among Egyptians, *Ascaris*, *Enterobius* and *Trichocephalus* were as a rule present in large numbers already in children. *Taenia saginata* was known to be especially common in Abyssinia. He found *T. saginata* also frequent in regions inhabited by negroes.

WILLIAM F. DANIELL, 1849. Gulf of Guinea.

(Bight of Benin) “. . . of the species of intestinal worms, teniae and ascarides are the most common, particularly the former, and the populations of several inland countries not infrequently suffer severely from their continual existence.”

Various French physicians stressed the frequency of intestinal worms in the indigenous population of different parts of Africa.

*Taenia* is common in the Sudan (QUINTIN, 1869). It is also very common in Algeria (REY, 1880) and Senegal (BORIUS, 1882). The same statement was made by DAZILLE, 1776, for Réunion. According to BORIUS (1882), in Senegal *Taenia solium* besides *T. saginata* has occasionally been observed. The present writer has found no other early reports of the occurrence of the pork-tapeworm in Africa as pork was generally not eaten, especially not by Moslems.

*Hymenolepis nana*, the dwarf-tapeworm, was discovered by BILHARZ in 1851 in the small intestine of a boy who had died of meningitis in Cairo. It is fairly cosmopolitan but apparently more frequent in warm climates and certainly more frequent in children than adults.

#### *America*

Negro slaves introduced their intestinal helminths into the New World, and infections with worms drew the attention of the slaveholders. JAMES THOMPSON in his *Diseases of Negroes*, 1820, says (of Jamaica) that “of all complaints this (worms) is the one the planter should make himself most completely master of, from its varied appearance, fatality and being so much under his power of judicious management.”

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### Hookworm: *Ancylostoma duodenale* and *Necator americanus*

#### *Africa*

Hookworm infection existed in Eurasia and Africa since ancient times. Anaemia, probably due to hookworm infection, is mentioned in the Papyrus Ebers. Hippocrates refers to people with yellowish colour who suffer from intestinal disturbances and indulge in geophagy, in Rome Lucretius (first half of first century B.C.) and Lucanus, A.D. 39-65, remark on the pale skin of those working in mines. In China hookworm disease was well known. Early authors refer to it as "able to eat but lazy to work yellow disease" (HOEPPLI, 1959, p. 29).

Whereas the clinical symptoms of hookworm infection were well known since antiquity, one will remember that the worms themselves were only fairly recently discovered: *Ancylostoma duo-*

*denale* in 1838 and *Necator americanus* in 1902 (noticed already before that year by several workers, but not described as a different species)<sup>1</sup>.

Nowadays one assumes that the original distribution of *Ancylostoma* and *Necator* was only in the Eastern Hemisphere and that *Ancylostoma duodenale* occurred about north of 20° north latitude, while *Necator americanus* occurred south of 20° north latitude.

The migrations of people have changed considerably the original distribution of these two hookworm species, and as DARLING pointed out, the present distribution gives interesting indications of the early migrations.

Concerning Africa there is an exclusively *Ancylostoma duodenale* infection in the northern coastal region. In Equatorial and South Africa we find an overwhelming or pure *Necator* infection except in the Portuguese colonies, especially Angola, where *Ancylostoma duodenale* is also found, introduced by the foreign immigrants.

*Necator* infection occurs also in pygmies (LOOSS, 1905).

In 1847 PRUNER rediscovered *Ancylostoma duodenale* in Egypt in cases of Egyptian chlorosis, and in 1853 BILHARZ related hookworm infection and chlorosis as cause and effect, a relation which was strongly emphasized by GRIESINGER in 1854.

In the second half of the nineteenth century, hookworm disease was reported from different parts of Africa, especially from Senegambia, the Guinea coast, the Comoro group and the Zanzibar coast.

#### *America*

Introduction of the two hookworm species into America.

It may be mentioned that, as DARLING pointed out, "it is possible that either or both species have also been introduced into the American continent from Asia, Indonesia or Polynesia by voyagers or stormtossed fishermen. This is a subject for future research."

SOPER, 1927, following DARLING's theories examined Lengua Indians living isolated in the Paraguayan Chaco and found an *Ancylostoma* – *Necator* ratio of 13 to 1. This is by far the highest ratio for any group on the American continent. If one leaves open the question whether *Ancylostoma* had been introduced in prehistoric times by migrants from Asia, one has to consider the possibility or even greater probability that the infection had been transmitted by Spanish conquistadores.

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<sup>1</sup> It is doubtful whether certain statements by Arabic authors, e.g. Avicenna (A.D. 980–1037) refer to hookworm.

Europeans, especially Spaniards and Portuguese from countries bordering the Mediterranean or close to it, have introduced *A. duodenale* into Brazil and other parts of South- and Central America. In more recent times, Japanese, Chinese and Indian workmen likewise contributed to the introduction.

*Necator americanus* has been introduced into America within historic times by negro slaves from Africa. Apart from them, workmen from India and Indonesia played a rôle in more recent times.

Even if we consider the possibility that in prehistoric times migrants had transmitted *N. americanus*, the infection cannot have been a widespread and heavy one, as the early Spanish historians never mention in their description of the conquered territories and their populations a disease with symptoms which might indicate hookworm infection.

On the other hand, following the importation of a large number of African slaves, not only physicians but also government officials, planters and traders mentioned a disease which practically was only found in negro slaves. The described symptoms leave no doubt that they were due to hookworm infection. Geophagy – dirt-eating – attracted special attention and was described by several authors such as LABAT, 1742, BAJON, 1777–78, WINTERBOTTOM, 1803, MOREAU DE JONNÈS, 1816 (note). The disease got various names: ‘mal d’estomac’, ‘mal de cœur’, ‘anaemia tropicalis’, ‘cachexia africana’, ‘cachexie aqueuse’, ‘oppilação’, and was for a long time regarded as peculiar to negro slaves.

In the first half of the 17th century, PISO in Brazil had already described a disease with intestinal disturbances, anaemia, weakness and dropsy.

Similar symptoms were reported by Père LABAT from negro slaves in Guadeloupe.

From the beginning of the 18th century, French and English physicians, based on their observations in the Antilles, divided the symptoms in those caused by intestinal disturbances and others connected with anaemia and circulatory disorders. In 1820 JAMES THOMPSON described the ravages of the disease among slaves in Jamaica.

Only a few of the numerous authors dealing with hookworm disease in the West Indies, Central- and South America may be mentioned: PISO, 1648, Brazil; BAJON, 1777–78, Cayenne; LABAT, 1742, MOREAU DE JONNÈS, 1816, Guadeloupe; RODSCHIED, 1796, Brazil; SAVARÉSY, 1809, Martinique; LEVACHER, 1840, Antilles; SIGAUD, 1844, WUCHERER, 1872, Brazil.

In concluding it may be repeated that *N. americanus* infection was introduced into the West Indies and the American continent

by negro slaves from Africa (not considering more recent introductions). Proofs are (1) that symptoms of the disease were not mentioned by early Spanish historians describing the Conquest. (2) Those who showed symptoms of hookworm disease in the Western Hemisphere were practically all African slaves. (3) The infection was widespread in those parts of Africa, wherefrom the slaves came.

*Ancylostoma duodenale* was introduced into the Western Hemisphere (not considering more recent introductions) by the conquistadores and other immigrants from mediterranean countries, chiefly Spaniards and Portuguese.

### Note

“That strange propensity called ‘dirt eating’ in the West Indies, where it frequently occurs among the slaves and often proves fatal by inducing chronic complaints, is sometimes met among the children in Africa. When this pernicious practice has been followed for some time, it induces such a change in the countenance and complexion, as renders the disease obvious to every one at first sight. The colour of skin changes from a deep black to a dirty light brown, or even approaches a clay colour. The skin also feels rough, and is cold to the touch. The tunica conjunctiva, or white of the eye, becomes of a dusky yellowish white. The countenance appears dejected, the eye-lids are puffy, and the whole face is bloated. The gums lose their healthy red colour, becoming pale and flaccid, and the inside of the lips and tongue appear almost white; even the hair undergoes a change of colour, and becomes of a dirty white, like that of the white negro. There is a constant uneasy aching pain at the stomach, attended with a degree of nausea and loathing of food. The pulse at first is not much affected but gradually becomes quicker and very small; there is frequently a troublesome palpitation of the heart, and a constant throbbing of the large vessels in the lower part of the neck. The respiration is often oppressed, and is always hurried by the least degree of exercise. The abdominal viscera, particularly the mesenteric glands being enlarged and hardened cause the belly to swell; the lower extremities become anasarcaous; and frequently towards the conclusion of the disease effusion takes place into the cavities of the abdomen and thorax.

The unhappy people are fondest of a white kind of clay, resembling tobacco pipe clay, with which they fill their mouths and allow it to dissolve gradually.” THOMAS WINTERBOTTOM, 1803. An Account of the Native Africans, etc. Chapt. XIII. Dirt eating.

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## II

*Filariae**Wuchereria bancrofti* – Elephantiasis*General Statements*

Elephantiasis understood as a pathological condition representing enlargement of various parts of the human body with fibrous thickening of the skin was known from ancient times in different parts of the world; it may have very different causes. *Elephantiasis graecorum*, for example, judging from the various descriptions, referred chiefly to leprosy. *Elephantiasis arabum* was elephantiasis due to filaria infection. *Sli pada* of Indian medical literature was mainly elephantiasis in cases of filariasis.

It is certain that some filaria species are able to produce elephantiasis, but this condition develops only in a certain percentage

of cases. Heavy infection and especially continuous reinfection over a long period are important, apart from individual factors which determine the strength and the kind of reaction against the parasite.

The causative organism is in Africa *Wuchereria bancrofti*.

In Africa *W. bancrofti* is endemic in Egypt, in tropical West-, Central- and East Africa, also in Madagascar, Mauritius and Réunion. In the New World it occurs in the West Indies, in some parts of Central America and in the northern part of South America, from Columbia to the north of Brazil. Small foci which existed in some of the southern States of North America, especially in South Carolina and Alabama, have apparently disappeared; Charleston, S.C., was formerly an endemic focus of infection (FAUST, 1949).

For a detailed historical review of the work of various investigators concerning the discovery of the microfilariae, of the adult male and female parasite, the periodicity of the microfilariae and their transmission by mosquitoes, the reader is referred to MANSON-BAHR, 1959.

#### *Africa*

Elephantiasis occurred probably in ancient Egypt. A statue in painted sandstone of Mentuhotep III, 1998–1991 B.C., a pharaoh of the XIth dynasty, about 2000 B.C., shows pronounced enlargement of both legs (Egyptian Museum, Cairo, no. 287). The enlargement, however, is completely symmetrical and therefore it is doubtful whether elephantiasis due to *W. bancrofti* infection is represented. Elephantiasis in this infection is usually not equally developed in both legs.

T. Lucretius Carus, ca. 98–55 B.C., regarded elephantiasis even as a characteristic disease of the Egyptians. He emphasized the importance of the country's climate for the prevalence of certain local diseases and stated that elephantiasis originated on the Nile in the climate of Egypt and nowhere else<sup>1</sup>.

Ibn Battūta (1304–1377), the famous islamic traveller, reports in his *Rihla*, 1355, that he saw many cases of elephantiasis in Zafar (SARTON, 1947, vol. III).

The negroes of equatorial Africa must have noticed cases of elephantiasis from ancient times and during the last 2000 years reproduced it in works of art.

In the Museum of Jos in Nigeria there is the torso of a terracotta statuette of the Nok period (ca. 500 B.C.–A.D. 200), which shows in a simplified way but definitely elephantiasis of the scrotum (plate IX).

<sup>1</sup> "Est elephas morbus qui propter flumina Nili gignitur Aegypto in media neque praeterea usquam."

Another terracotta statue of about the 12th–14th century, kept in the Museum of Ife, Nigeria, likewise represents elephantiasis of the scrotum in a naturalistic style (plate X).

The British Museum and the Wellcome Historical Medical Museum in London have each a Yoruba bronze figure of a sitting man with a very pronounced elephantiastic enlargement of the scrotum. Both figures are very similar and date probably from the middle of the 19th century (plate XI).

An Ashanti Goldweight in the Pitt Rivers Museum in Oxford shows a naked beggar with marked elephantiasis of the scrotum. He is sitting on the ground with outstretched legs, holding a bowl between his feet (plate XII).

Elephantiasis from Africa has been mentioned by numerous writers of the 18th and 19th centuries. Among them are: JOHN BARBOT, 1732, Sierra Leone (note 1); CLARKE, 1860, Gold Coast (note 2); ANTONIO PINTO ROQUETE, 1868, Mozambique (note 3).

#### *America*

As *W. bancrofti* infection is widespread in tropical Africa, it is certain that many slaves with microfilariae in their blood but without clinical symptoms were shipped to the Western Hemisphere and, in the presence of a suitable mosquito, contributed to the spread of the infection. It is somewhat surprising that elephantiasis has not been mentioned by the early Spanish historians in their descriptions of the newly conquered territories and their inhabitants.

Some modern authors, for example ASHBURN, 1947, therefore assume that *W. bancrofti* probably did not exist in the Western Hemisphere before the coming of the Spaniards. One may, however, point out that even in parts of the world heavily infected with *W. bancrofti*, elephantiasis is often rather rare due to local conditions. It is therefore possible that even if cases of elephantiasis existed in small numbers, the Spaniards may not have noticed them (see also C. W. DANIELS, 1898)<sup>2</sup>.

<sup>2</sup> In the ruins of Dzibilchaltun, 75 miles away from Chichén Itzá, the well-known Maya center in Yucatán, a temple was found of about A.D. 500 which contained seven small clay figurines buried under the floor of a sanctuary. They are of unpainted clay crudely modeled and each exhibits some deformity. (E. WYLLYS ANDREWS, Dzibilchaltun: Lost City of the Maya. Nat. geogr. Mag., vol. 115, no. 1, 1959, 90–109.)

The present writer had no opportunity of seeing these figurines but a photo of them, reproduced on page 105 shows a figure which, as far as can be judged from the photograph, represents a case of elephantiasis scroti.

The writer is indebted to Miss R. Greter, Basle, who drew his attention to E. WYLLYS ANDREWS' article.

As mentioned before, *W. bancrofti* infection was brought by negro slaves from Africa to the New World where it may have existed already in some parts before the conquest. It is interesting to trace the ways how the infection spread in America. Only the migration of Jewish settlers with their slaves from Brazil may be mentioned as an example (note 4).

### Notes

1. "From Sierra Leone to Rio Sestro – Inland. Here is another elsewhere unknown and foul distemper, the Blacks are subject to, throughout all the country about Sierra Leona, and in Quoya; i.e. a wonderful swelling of, or in the Scrotum; mostly occasioned by the excessive drinking of palm-wine, which causes violent pains, and hinders their cohabiting with women."

JOHN BARBOT, A description of the coasts of North- and South Guinea and of Ethiopia Inferior etc. in six books, London 1732. Book II, chapt. 5, A description of the Coasts of South Guinea, p. 118.

2. "Elephantiasis and lepra in all its hideous forms prevail, and sarcomatous enlargements of the scrotum frequently attain such dimensions as to reach to the knees, and even below them. The disease is said to prevail more on the windward than on the leeward part of the coast. The natives suppose it may be induced by drinking excessively of palm wine which has been mixed with the juice of the bamboo; but it may, with much greater reason, be accounted for by an excess of fish diet!" – R. CLARKE, Topography and Diseases of the Gold Coast. Trans. epidemiol. Soc. 1, p. 106, 1860.

3. "Enfin on observe aussi l'éléphantiasis des Arabes et quelques cas d'éléphantiasis des Grecs parmi les mulâtres, les Arabes et les Maures qui résident à la côte mozambique. L'éléphantiasis du scrotum est plus fréquent chez les indigènes." – ANTONIO PINTO ROQUETE. Note sur la topographie médicale de Mozambique. Arch. Méd. nav. 9, 1868, p. 167.

4. With the kind permission of Dr. I. Snapper, Director of Medical Education of the Brookdale Hospital Center, Brooklyn, New York, I give in the following a part of a letter which he wrote me on May 14, 1964<sup>3</sup>:

"Starting in 1623, the West India Company, incorporated in Amsterdam, repeatedly tried to invade Brazil which, at that time,

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<sup>3</sup> The author wishes to thank Dr. Snapper for his information.

was a Portuguese colony. In 1629, the Hollanders took Olina, Recife and Pernambuco and in 1636, one of the Princes of the House of Orange, Count Johan Maurits of Nassau, left for South America to become the Governor of the new Dutch possessions in the 'Brasyl'."

"His small army was accompanied by a Dutch physician, Jan Willem Piso, who carefully studied the diseases of Brazil and the remedies the natives used. The book Piso wrote about his experiences in this remote tropical country was probably the only advantage the Netherlands ever obtained from this invasion because the Portuguese after 1645 gradually succeeded in recapturing their original colony."

"During the time the Hollanders were in Brazil, a large number of the Spanish and Portuguese Jews suffering under the Inquisition in their home countries emigrated to Brazil. As soon as the Hollanders started to retreat from this territory, the Jews had to flee again. A large number of the displaced persons settled in the area which is now the Province of Antiochia of the Republic of Columbia. Even today, although practically all inhabitants of Antiochia are Catholics, their given names are often Sarah, Rebecca, Moses, David, and the citizens of Columbia outside Antiochia designate the inhabitants of the latter province as 'Judio'. A second wave of Jewish emigrants went to Surinam and Curaçao, a third wave went to Charleston, S.C. One ship with Jews from Brazil arrived in New Amsterdam in 1653."

"I have always surmized that the endemic filariasis of Charleston, could be connected with the arrival of the Jews. The Jews and their slaves have at all times lived as if they belonged to one family and this custom persisted after the slaves had been freed. When a Jewish child was born, a small Negro child was selected to be its special servant who stayed with his master or mistress from the cradle to the grave. During the night the small special servant slept before the bed of the child. In other words, at all times, a child heavily infected with filaria was sleeping before the beds of Jewish children. Since filaria only takes hold in the human organism after many infections have taken place, there were always more severe cases of filaria among the Jews than among the rest of the population."

"Even today this can be observed in Surinam. There, all women wear short skirts, except the women with elephantiasis due to filariasis who wear long skirts. Walking in the streets in Paramaribo, it is striking that far the greater part of the women with long skirts are Jewish women."

“I am not aware whether I ever *read* that the filariasis of S.C. depended upon the influx of the heavily infected Jews in the 1650ths. I may well have dreamt it up as a *possible* explanation of the course of the endemic.”

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### *Dracunculus medinensis* – the Guinea worm

The Guinea or Medina worm was known since antiquity. In Africa it is found in Mauretania, on the west coast and across equatorial Africa to northern Uganda. It occurs in the southern Sudan and in Egypt. It was very frequent on the Guinea Coast but rarely found in the Congo. On the east African coast it was not reported from Djibouti southward.

By the slave trade *Dracunculus* was transmitted to the West Indies; furthermore to the Guianas and the State of Bahia in Brazil.

Fedschenko (1869) discovered the life-cycle and indicated that species of *cyclops* are the necessary intermediate hosts of *Dracunculus medinensis*.

#### *Africa*

It is very likely that *Dracunculus medinensis* was known to the Egyptians, as it was mentioned by AGATHARCHIDES (see below).

The fiery serpents of the Bible (Numbers XXI. 6) were in the opinion of some writers Guinea worms (KÜCHENMEISTER and

ZÜRN, 1878–1881, pp. 419–425). Their opinion is not shared by some more recent authors (HAIM BEN HAMRAN, 1959).

*Dracunculus medinensis* was, according to PLUTARCH (c. A.D. 46–120) Symp. lib. VIII, cap. 9, mentioned by the geographer AGATHARCHIDES of Cnidus, who wrote in Alexandria in the second quarter of the second century B.C. and was the teacher of one of the sons of Ptolemy VII Alexander (Physcon) (note 1).

Besides AGATHARCHIDES the following Greek and Roman writers who knew *Dracunculus* may be mentioned: Pliny, 23–79; Soranus of Ephesus fl. in Rome under Trajan and Hadrian, i.e. A.D. 98–138 (in Caelius Aurelianus and Paulus Aegineta); Julius Pollux, fl. under Commodus, 180–192; Galen, 129–c. 200; Leonidas of Alexandria, 3rd century (in Aetius lib. XIV, cap. 86); Aetius of Amida, fl. under Justinian I, 527–565; Paulus Aegineta, fl. c. 640 in Alexandria; Joannes Actuarius fl. under Andronicus III, 1328–1341.

Leonidas stated that *Dracunculus* occurred in Ethiopia (teste MOULÉ, 1911). Galen had never seen *Dracunculus*, he regarded it as of a nervous nature, resembling varices. Soranus of Ephesus and Pollux likewise denied that *Dracunculus* was an animal. Pollux called it a piece of corrupted nerve.

The Arabic physicians knew the Guinea worm but it was not universally regarded as a worm. It was described as 'corrupted matter' or as a kind of filament, a nerve, a vein or even the root of a plant. It should also be kept in mind that the Arabic word ark or erk, which has been used to describe *Dracunculus*, merely means something long, thin or filiform.

Among outstanding Persian-Arabic authors dealing with the Guinea worm are Rhazes (Abū Bakr Muhammad ibn Zakarīya al-Rāzī, born in the middle of the ninth century, died 923–24), who regarded *Dracunculus* as a worm, AVICENNA (Abū 'Alī al-Husayn ibn 'Abdallāh ibn Sīnā, 980–1037, a Persian), who denied the animal nature of *Dracunculus* (note 2), ABU'L QĀSIM, 936–c. 1013, and Avenzoar, Abū Marvān ibn Zuhr, ca. 1091–1162.

During many centuries, physicians and scientists speculated about the nature of *Dracunculus*. The important question was always, whether it was a worm or something else. AMBROISE PARÉ (1510–90) was of the opinion that it was not a worm but a corrupted nerve (DELAUNAY, 1926). Even after most investigators at about the beginning of the 18th century had come to the conclusion that it was a worm, hardly anything was known about its structure.

Regarding early illustrations of the Guinea worm, see note 3.

In the following a few brief excerpts from reports on the occurrence of *Dracunculus* in Africa from 1600 to the middle of the

19th century are given. Although the list is very small, the publications reflect the various opinions held during about 250 years.

1. HAKLUYTUS POSTHUMUS or Purchas His Pilgrimes (1625), Glasgow 1905, vol. VI, p. 350: "The negroes themselves are much troubled with them (Guinea worms), especially those that dwell about the castle of Mina, and it is a thing to be wondered at for the negroes that dwell but 25 miles lower East-ward are not troubled with worms as their neighbors are."

The negroes suspected that the infection is due to water. During extraction the worm should not be broken.

2. ALEIXO DE ABREU, Tratado de las siete enfermedades, 1623. All over the Mina coast another worm is generated as well, in the legs of men mainly, which being born very small, grows to the size and width of a thick fiddle-string. This is cured (by) extracting it little by little, turning it around a little stick in order (that) it will not break for this will result in great damage. (Transl. from the Spanish by F. GUERRA, 1968.)

3. O. DAPPER, 1686. Dapper describes the clinical picture of *Dracunculus* infection. Suspects that bad air or water are responsible. Mentions that while the infection is very common in some regions, it is absent in others. Negroes are chiefly infected, but foreigners may also get the infection. Some show the symptoms of dracontiasis while they are still on the African coast, others many months and even a year after their return to Europe. Advises to extract the worm very slowly.

OLFERT DAPPER (ca. 1636–37 to 1689) wrote a very detailed and in many respects correct and interesting work on Africa, although he spent the greater part of his life in Amsterdam and probably never visited Africa. His work was translated from the original Dutch into several languages.

4. W. BOSMAN, 1705. *Filaria medinensis*. Describes the method of slowly extracting the worm. "This Worm-Disease is frequent all the Coast over, but our Men are most tormented with it at Cormantyn and Apam; which perhaps may be occasioned by the foul Water which they are obliged to drink there." Copied from: Ann. trop. Med. Parasit. vol. 29, 1925.

WILLIAM BOSMAN was Chief Factor for the Dutch at the Castle of St. George d'Elmina.

5. F. MOORE, 1734. He describes the symptoms of dracontiasis and the dangerous consequences, when the worm is broken during extraction. Regarding the cause of the infection he states: "The Natives tell me that these Worms are bred with drinking 'thick' water."

MOORE was sent out by the Royal African Company of England as Factor to James Fort at the mouth of the Gambia.

6. JOHN (JEAN) BARBOT, 1732. Book I, chapt. 2. Describes the infection. It occurs in Whites and Negroes, especially the latter "which may be attributed to their usual bad diet and debauchery of all sorts."

BARBOT (French) was Agent-General of the Royal Company of Africa and Islands of America in Paris.

7. JOHN ATKINS, 1742. He mixes up *Dracunculus medinensis* and *Tunga penetrans*. ATKINS is of the opinion that it is erroneous to assume that drinking bad water is the cause of the infection.

ATKINS was a naval surgeon.

8. JAMES BRUCE, 1805 (second edition), vol. IV, p. 234: "The next complaint I shall mention as common in these countries is called *Farenteit*, a corruption of an Arabic word which signifies the worm of Pharaos; all bad things being by the Arabs attributed to these poor kings, who seem to be looked upon by posterity as the evil genii of the country which they once governed."

Then follows the description of *Dracunculus* infection and the method of slow removal by turning the worm around a thin piece of silk or a small bird's feather. The natives know the danger connected with the breaking of the worm.

Bruce, a famous explorer, himself experienced the infection.

9. T. M. WINTERBOTTOM, 1803, vol. II. chapt. V: *Dracunculus medinensis*. "The inhabitants of the river Gambia, and they who live between that river and the Senegal, are said to be affected with the Guinea-worm, but at no other time than the dry season when the water is bad." . . .

"A slave trader in the Rio Nunez informed me that the inhabitants of the kingdom of Bouree, a country from which much gold is brought, and situated about four days journey from Teembo, towards Tombuctoo, are greatly troubled with the Guinea-worm, which he has often seen in the slaves brought from that country. It does not appear that the disease could have been there caused by drinking bad water, as he says that the natives of Bouree take only the water of springs." . . .

"That this disease originates upon the Gold Coast from the badness of water seems probable from the worms being seldom found in those parts, where to guard against it, they take the precaution of boiling the water they drink. — (Mr. Park says the Guinea-worm is very common in certain places, especially at the commencement of the rainy season and is attributed by the negroes to the badness of the water. They allege, he observes that the people who drink

from wells, are more subject to it than those who drink from streams.)” . . .

“Out of two hundred and twenty slaves which were bought at Cape Mount, Cape Mazurado, and Cape La Hou, only one was affected with Guinea worm which occurred in the great toe. On the contrary, among sixty slaves which were bought at St. George del Mina, a third part laboured under this disease; and among six hundred bought at Angola, not a single of it occurred.”

10. H. BARTH, 1857, vol. II, chapt. XXXVII (Plains of Bo’rnu proper), p. 546. “. . . However, I have already had occasion to observe that the water from these stagnant pools is anything but wholesome, particularly after the rainy season, when they receive no further supply; and I have no doubt that the drinking water is the principal, if not the only cause of that dreadful and widespread disease (the *fantit* or *arug – ugi-duvi* in Kanuri – the misery) which disables the working man and makes him a poor wretched being – the Guinea-worm which is sure to be met with in at least one out of three persons who travel a great deal through the whole of Central Africa<sup>1</sup>.” BARTH was an outstanding explorer in Africa.

11. R. CLARKE, 1960. “Regarding Guinea worm, I am satisfied that it is not caused by drinking impure water. . . . To remove the worm the natives use a thread to which they attach a small weight at the free end, for example a piece of lead.”

#### *America*

As mentioned at the beginning, *Dracunculus medinensis* was introduced by the slave trade from Africa into some of the Antilles, the Guianas and the state of Bahia in Brazil. In some regions the Guinea-worm found *cyclops* which could serve as intermediate host, and the infection continued there for many years after the slave trade had ceased. The infection gradually decreased in frequency in the endemic areas and has by now completely disappeared from Brazil.

A very early reference to the Guinea worm, observed in South America, was made in 1599 by the Spanish governor of Rio de la Plata (note 4).

In the following, only a somewhat unusual report from the Western Hemisphere is given:

PERÉ, 1774, studied the infection on the coast of Guinea and at St. Domingo; PERÉ comes to the conclusion that *Dracunculus* is a real living worm, not something else.

<sup>1</sup> It may be added that the Nubas in Kordofan (Sudan) believed that the Guinea worm entered through cuts and abrasions or even through the normal skin of the feet when people were standing in water (see HOEPLI, 1959, p. 242).

He describes the case of a 10–12-year-old negro boy who arrived in March 1771 at St. Domingo from Africa on a French ship carrying negro slaves. The boy had lost so much weight during the voyage that he could not walk. The physician of the slave vessel told PERÉ that the boy had something under the skin of his abdomen and chest which looked like very long veins. The captain, who regarded the case as hopeless, gave the negro boy as a present to PERÉ, who made the correct diagnosis that the supposed veins were the coils of a Guinea worm. He successfully operated and removed the worm. Within a very short time after extraction, the boy gained much weight and was restored to complete health, so that when after three months PERÉ had to leave, he could sell the boy for twelve hundred livres!

The reports on *Dracunculus medinensis* may be concluded by a note of R. T. LEIPER, 1911, on the native tradition that the Guinea-worm can attain maturity outside the body:

In West Africa natives widely held the belief that the Guinea-worm can attain its full maturity outside the human body. Even some European settlers shared this belief. LEIPER got a specimen which was sent to him as a supposed Guinea-worm such as was occasionally found in earth by the natives and regarded by them as a mature Guinea-worm.

On examination, the specimen was found to be a species of the genus *Mermis*.

The various listed reports and statements on the Guinea worm were given by physicians, scientists, traders and explorers. The following may be stated as a summary: *Dracunculus medinensis* was known since antiquity but there was no consensus of opinion up to the 17th century whether it was a real worm or something else. Based on experience, the writers during many centuries strongly advised not to break the worm during extraction as otherwise very often a dangerous inflammation developed.

It is interesting that the natives in various infected regions believed that dracunculosis was due to drinking 'thick' (impure) water. Running water from streams was generally regarded as less dangerous than stagnant water from pools or wells. This correct opinion of the natives based evidently on observation and experience is in contrast with the opinion of some foreign physicians (e.g. ATKINS, 1742, and CLARKE, 1860) who believed that the drinking of impure water had nothing to do with the infection.

Dracontiasis was introduced into the Western Hemisphere by infected negro slaves.

*Notes*

1. AGATHARCHIDES. "That the people taken ill on the Red Sea suffered from many strange and unheard of attacks, amongst others worms upon them which gnawed away their legs and arms and, when touched, retracted themselves up in the muscles and there gave rise to the most unsupportable pains; but their evil was only been found then, neither before nor since amongst any other people." In: PLUTARCH, *Symp. lib. VIII, cap. 9.*

2. *Avicenna* on the Medina worm. "The Medina 'erg' consists in the occurrence on some parts of the body of a pustule that swells, gets spotted and perforated; then something comes out of it reddish-black in colour that goes on lengthening and lengthening, that may have a vermiform movement under the skin, as if it were an animal in motion, indeed as if it were in reality a worm, so that some have thought that it is a reproductive animal; and some have thought it a fasciculus of a nerve fibre that degenerated and thickened. It occurs most frequently in the legs, and I have seen it in the hands and on the side. It is frequent on the side in youngsters. If it stretches and ruptures, the calamity increases and so does the pain, although it may be painful even if it does not rupture. Galen said that he could not make of it anything clear and reliable because he never saw it; and he says that its cause is red, dirty, bad atrabilious blood, or burnt phlegm that becomes sharper with the increase in dryness of the humours. It may be generated by some waters or pulses owing to some property in them. Foods most likely to cause it are dry ones. The sharper the matter from which it originated in the body, the stronger the pain. It may arise in the same body in forty or fifty places although one may get rid of it by treatment. And heaviness in humid bodies and the ones used in baths and refreshing foods and used in drinking. It is most frequently generated in Medina, and for this reason it has been called after it; it may also occur in the country of Khuristan and in other countries, and it may also be frequent in Egypt and in other countries." – AVICENNA, the Canon III Cairo Ed. 1294 H., p. 138, 139<sup>2</sup>.

3. A very early illustration of the extraction of the Guinea-worm by slowly winding it around a thin stick is found in a manuscript by Sharaf al-Din 1405 (Charaf Ed-Din); the illustration is rather primitive. Sharaf al-Din in his work follows closely Abulcasis (HUARD et GRMEK, 1960).

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<sup>2</sup> The writer is greatly indebted to Prof. G. Ghalioungui, Cairo (now Kuwait) for the translation.

LINSCHOTEN's description of his voyage to the East Indies has a plate which has also been inserted by the editors, the brothers de Bry in the publication on the Congo by F. Pigafetta. This plate shows extraction of a Guinea worm in the typical way by the patient himself (see chapter on *Loa loa*).

VELSCH, 1674, in his curious book on *Dracunculus* has pictures of the Guinea worm protruding from various parts of the human body (p. 311) and also the extraction of the worm. He gives, however, no details of the parasite.

MEIGE, 1901, refers to a copperprint by Jan Luyken of about the end of the 17th century. The print represents two patients with dracontiasis. The extraction by winding the worm around a small stick has been completed in one patient and the operator holds up a worm of greatly exaggerated size.

4. Don Diego Rodriguez de Valdés y de la Vanda, governor of Rio de la Plata, who in 1599 had taken a Dutch ship which arrived at Buenos Aires from Amsterdam via the Guinea coast and who held the captain and the crew as prisoners, stated that on the Guinea coast in the Mina region there occurred worms which developed in the legs and other parts of the body and grew to a length of 2–3 varas. He had seen the removal of such worms from two of his prisoners. — *Relación de lo que a pasado con un navio que llegó a este Puerto de Buenos-Ayres a los veinte y nueve de Julio de 1599 años.* (See: HENDRIK OTTSEN, 1918, p. 165.)

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### Loa loa

*Loa* occurs in West Africa from southern Nigeria to Angola and from the Congo through central tropical Africa; it is especially frequent on the West Coast. Numerous infected negro slaves were carried to the West Indies and to parts of South America.

The first report of an infection with *Loa* did not come from Africa but from St. Domingo (MONGIN, 1770). MONGIN recorded the extraction of a worm from between the conjunctiva and albuginea of a negress.

BAJON at Cayenne had already in 1768 removed a filaria from

below the conjunctiva of an eight-year-old negro girl. This case was published in 1777 together with another one in which BAJON had observed a worm in an older negress, moving between conjunctiva and cornea; he was, however, not allowed to operate.

MERCIER at St. Domingo in 1771 extracted a worm from beneath the cornea of a negress. In 1774 he removed a worm from the eye of a negro. His two cases were published by ARRACHART in 1805.

### *Africa*

In Africa cases of *Loa* infection were for the first time recorded by GUYOT, a French naval surgeon, who made seven voyages to Angola and in 1777 observed cases of filariae under the conjunctiva in indigenous people who told him that the worm was a 'Loa'. He attempted the extraction of the filaria after an incision of the conjunctiva in five cases, but only succeeded twice. GUYOT differentiated *Loa* from the Guinea worm.

ARRACHART, 1805, recorded the cases in St. Domingo, known to him; he also reproduced BAJON, 1777, and GUYOT.

Increasing numbers of cases were gradually reported from the West Coast of Africa: Sierra Leone, Gold Coast, Nigeria, Old Calabar, Cameroon, Gabon, Congo, Angola (see BLANCHARD, 1899, and WARD, 1906).

The peculiarity of *Loa* to appear during its wandering in the human body under the conjunctiva was well known to the natives in endemic areas and attracted the attention of foreign physicians who gradually also became familiar with the so-called 'Calabar swellings' caused by this filaria. The African name 'Loa' was used by the native population in Angola.

Early publications on Calabar swellings (Kamerungeschwülste of the German authors) were those by PLEHN (1898) and by THOMPSTONE (1899), a district medical officer in Old Calabar. WARD (1906, p. 41) pointed out that Calabar swellings were recognised as a distinct disease earlier and were referred to under this name already by ROBERTSON (1895).

Concerning treatment, it seems that in general the native population did nothing to remove the worm from the eye. They were of the opinion that it would reappear in longer intervals under the conjunctiva and would ultimately not be seen any more.

Occasionally attempts were made to remove the *Loa* from the eye by means of a thorn or a very thin sharp piece of bone (MORTON, 1877). An English trader, living on the Ogooué, had a *Loa* removed from his eye by a native using a thin thorn (WARD, 1906, p. 14).

*America*

Following MONGIN's first observation in 1770, there were a few more case reports from the Western Hemisphere before GUYOT's first observation of *Loa* in Africa. We have mentioned already BAJON, 1768, 1771 (published 1777) from Cayenne; MERCIER, 1771 and 1774 from St. Domingo (published 1805 by ARRACHART). Subsequently, many more cases were reported from the Western Hemisphere; all concerned slaves who had recently arrived from Africa.

After 1845 *Loa loa* has no longer been recorded from the West Indies or South America. Apparently the cessation of the slave trade was the reason that its occurrence stopped, as all cases recorded up to that date concerned negroes imported from Africa.

Subsequently cases with *Loa* infection which came to America, especially the United States and occasionally also to Europe, were missionaries, government officials and traders who returned from infected parts of Africa (see WARD, 1906).

Several authors, GUYON, 1864, MONIEZ, 1896, and R. BLANCHARD, 1899, have erroneously stated that the first record of *Loa* is found in a plate of FILIPPO PIGAFETTA's 'Description of the Congo', published together with travel records of other authors including J. H. LINSCHOTEN by the brothers Joh. Theod. and Joh. Israel de Bry under the title *India Orientalis* at Frankfort in 1598<sup>1</sup>.

WARD, 1906, has carefully examined this question and came to the following conclusion: PIGAFETTA's 'Description of the Congo' does not contain any reference to *Loa*, a statement which the present writer can confirm, and in its original edition does not have a plate. The plate in question belongs to a publication by JAN HUYGHEN VAN LINSCHOTEN, dealing with his voyage to the East Indies. Even in LINSCHOTEN's publication, the plate is not found in the first edition (1596 in Dutch) but was apparently inserted by the editors in later editions.

The plate shows on the left removal of Guinea-worms from the legs by an infected person, and on the right an operation on the eye of another person, interpreted by GUYON, MONIEZ and R. BLANCHARD as a removal of a *Loa*. From the text of LINSCHOTEN's publication it becomes, however, evident that this operation does not represent the removal of a *Loa*, but the blinding of a relative of the king. On the island of Ormuz, at the entrance of the Persian Gulf, where the scene is supposed to take place, all male relatives of a new king were blinded at his accession, as according to an old law, no blind man could become king. It should be added that *Loa* does not exist at Ormuz.

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<sup>1</sup> The plate is reproduced in BLANCHARD, 1899.

In order to avoid possible confusion, it may be mentioned that there are two different authors by the name of PIGAFETTA with whom we have to deal in the present study, neither of them mentions worms in the eyes:

1. FRANCISCO ANTONIO PIGAFETTA, an Italian traveller and historian. He accompanied Magellan on his circumnavigation of the globe (1519–1522) and is the principal authority on this voyage. He died about 1534.

2. FILIPPO PIGAFETTA, who published a description of the Congo based on records of the Portuguese Edoardo (Duarte) Lopez. It is found together with descriptions of voyages by other authors in de Bry's 'India Orientalis', Frankfurt 1598. A more recent edition is by Hutchinson, London 1881. FILIPPO PIGAFETTA's publication in its original edition does not contain the mentioned plate.

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Carefully prepared lists of records of *Loa* with bibliographic references were published by R. BLANCHARD (1899) – twenty-six cases, and by WARD (1906) – ninety-four cases. The two authors used different methods of listing the published records.

### *Onchocerca* sp. – Enfermedad de Robles – Onchocerciasis

The discovery of *Onchocerca volvulus* and the first reference to the parasite in the literature are connected with the names of LEUCKART and MANSON.

#### *Africa*

In 1892 a German medical missionary removed two subcutaneous nodules from two negroes on the Gold Coast (now the Republic of Ghana). As the nodules were found to contain coiled-up worms, they were sent to LEUCKART for examination. LEUCKART recognized that the worms were a new kind of filaria which he named *Filaria volvulus*. He forwarded some of his material to MANSON, who in 1892 was the first to mention this filaria in the literature.

PROUT in 1901 found two cases of onchocerciasis in Sierra Leone and gave a detailed description of the parasite.

In 1910 RAILLET and HENRY showed that *Filaria volvulus* had the characteristics of the genus *Onchocerca*, created by Diesing in 1841 and should therefore be named *Onchocerca volvulus* (note 1).

The adults, males and females, live in subcutaneous nodules, surrounded by numerous microfilariae which migrate into the subcutaneous tissue all over the body and can be found by skin biopsies (MAZZOTTI, 1951).

The skin in very early stages of onchocerciasis may show rash and pruritus (WANSON, 1950). In later stages, the changes represent essentially different degrees of scleroderma followed by atrophy (JAMISON et al., 1955; HOEPPLI and GUNDERS, 1962; REBER and HOEPPLI, 1964). Heavy chronic infections frequently damage the eyes.

Human onchocerciasis is widespread in Africa; it occurs on the African west coast, in the Sudan and in central Africa extending to the great lakes.

Already in 1875 JOHN O'NEILL, a British naval surgeon, published a case of 'craw-craw' in a negro from the Guinea coast (Cape Coast Castle) in which he found microscopically small nematodes in material obtained by a skin biopsy of a papule. The nematode larvae, which he observed actively moving in water on a slide, were in all probability microfilariae of *O. volvulus*.

In consequence of the First World War, 1914–18, not much work on onchocerciasis was carried out for some time in Africa.

#### *America*

An entirely new phase in the study of onchocerciasis began in 1915 with the discovery by RODOLFO ROBLES of the existence of *Onchocerca* infection in Guatemala. The zone of infection is situated at a height of about 600–1300 m above sea-level on the pacific slopes of the chain of volcanos which extend along the southern coast of the country. ROBLES also discovered a causative relation between *Onchocerca* infection and eye lesions, which in some cases improved or even disappeared after excision of the *Onchocerca* nodules. ROBLES furthermore suspected *Simulium* species as transmitters of the infection.

The literature of onchocerciasis is already very large (see SPOTO, 1950), and only a few publications connected with historical aspects are considered in the present study.

Bibliographies and reviews are found in STRONG et al., 1934, 1938; BENITEZ SOTO, 1946; RUIZ REYES, 1952; MARTÍNEZ BÁEZ, 1962; FIGUEROA MARROQUIN, 1963; Editorial Universitaria, Universidad de San Carlos de Guatemala, vol. No. 43, 1963.

As ROBLES made his great discovery during the First World War, the first announcements appeared in two journals 1916 and 1917 (Editorial in 'La Republica' 1916 and CALDERON in 'La Juventud medica' 1917) which were not widely known outside Guatemala (note 2). In 1919 ROBLES published his discovery in the *Bulletin de la Société de Pathologie Exotique* with the result that investigators in increasing number studied onchocerciasis, which nowadays in Latin America, especially in Guatemala, is generally known as 'Enfermedad de Robles' – Robles Disease.

In 1923 FÜLLEBORN expressed the opinion that human onchocerciasis existed also in Mexico. His opinion was soon confirmed and many Mexican workers contributed valuable studies on the various problems of onchocerciasis.

BRUMPT, 1919, regarded for biological reasons the American

*Onchocerca*, which he named *Onchocherca caecutiens*, as different from the African *O. volvulus*. BRUMPT's opinion was not generally accepted – see, however, the recent work by WOODRUFF et al., 1966, and ROMEO DE LEON and DUKE, 1966.

The eye lesions in onchocerciasis aroused special interest. The pioneer in these ophthalmological studies in the Western Hemisphere was RAFAEL PACHECO LUNA, 1918 (Guatemala). Early Mexican investigators in this field were ISAAC OCHOTERENA, 1930; LARUMBE, 1930, and JUAN LUIS TORROELLA, 1930.

Stimulated by ROBLES' discovery, work on onchocerciasis was intensified in Africa (STRONG et al., 1938), and it was found that here, similarly as in the Western Hemisphere, the infection damages the eyes. The early studies in the Congo of the eye lesions due to onchocerca by HISSETTE, 1931, were especially valuable.

The hypothesis of ROBLES that *Simulium* species were the transmitters of *Onchocerca* was confirmed by numerous investigators, among them BLACKLOCK, 1926, and BEQUAERT, 1938, in Africa, and C. C. HOFFMANN, 1930, DAMPF, 1931, and VARGAS, 1945 (numerous publications, see M. MARTÍNEZ BÁEZ, 1962) in Mexico and DALMAT, 1954, 1955, 1956, in Guatemala.

In 1947 a very small focus of onchocerciasis was discovered in Venezuela and in 1965 a case of ocular onchocerciasis was found in Colombia in a patient who had never left the country (GEORGES ASSIS-MASRI and M. D. LITTLE, 1965). Subsequently investigators from the Universidad del Valle in Cali, Colombia, and the Tulane University in New Orleans found 43 cases of onchocerciasis in 312 persons living in the village of San Antonio (personal information by Dr. B. B. Waddy, London).

The foregoing very brief review shows that the documentation of human onchocerciasis in Africa goes back to 1875 (O'NEILL) and 1892 (LEUCKART and MANSON). In Guatemala ROBLES made his great discovery in 1915. A focus of *Onchocerca* infection was discovered in Venezuela in 1947 and in Colombia as recently as 1965. There remains the possibility that foci of onchocerciasis will be found in the course of time in other parts of South America.

Among the millions of negro slaves carried from Africa to America during the centuries of the slave trade, there must have been many with *Onchocerca volvulus* infection, especially as a large percentage of the slaves came from the African west coast and other regions where the infection is widespread. Onchocerciasis might have established itself in Mexico, Central- and South America, provided climatic, geographical and botanical conditions for a transmitter were favorable.

We are confronted with the main question whether human

onchocerciasis was introduced into the Western Hemisphere by negro slaves from Africa or whether it was autochthonous in America and existed there long before the coming of the Spaniards, so that negro slaves with onchocerciasis to some extent merely have added to the infection.

### *Hypothesis A*

Onchocerciasis was introduced by negro slaves from Africa during the time of the slave trade; it did not exist in the Western Hemisphere before.

In examining the publications supporting this theory one finds that the authors are not in agreement about the time of introduction. Apart from those who regard onchocerciasis as having been introduced already in the first period of the slave trade, there are others who assume that the introduction took place at a much later time. Some believe that the disease became known only in the first half or the middle of the 19th century (RUIZ REYES, 1952). JAVIER TORROELLA, 1964, is of the opinion that onchocerciasis was first introduced into Mexico by a bataillon of Sudanese sent from Egypt (Alexandria) in January 1862 to assist the French invasion troops of Napoleon III. These Sudanese came from a region where onchocerciasis is very prevalent. They established themselves in Oaxaca at Villa Alta, wherefrom they spread to the neighbouring regions. This happened at a time when, according to different writers who had lived in that area, onchocerciasis was noticed for the first time among the local population.

If one assumes that these comparatively few Sudanese soldiers introduced onchocerciasis into Mexico, one has to admit that among the millions of negro slaves imported during the 300 years of the slave trade, many were infected and must have brought the infection to the New World. The question arises why onchocerciasis has nowadays been found in America only in a few areas in Mexico, Guatemala, Venezuela and Colombia.

In answer it may be stated that the infection apparently depends on certain conditions which in many places did not exist. Geographical, climatic and botanical factors are of great importance for the transmitting *Simulium* species. A certain number of heavily infected persons are apparently required before the parasite can become self-perpetuating in a new area (ROMEO DE LEON and DUKE, 1966). Several other circumstances may also have played a rôle, for example the way how and where slaves were housed and where they worked. It is also possible that small foci of the infection disappeared and that others so far have not yet

been discovered. Many negroes were in the course of time absorbed by the Amerind population so that nowadays onchocerciasis is nearly exclusively found among Indians.

### *Hypothesis B*

Onchocerciasis is autochthonous in America.

This hypothesis was already expressed soon after ROBLES' discovery in 1915. Among the early representatives of the theory that onchocerciasis is indigenous in America is F. DIAZ, who found a small number of pre-Columbian skulls with erosions and perforations which he attributed to *Onchocerca* nodules. He also found by X-ray examination of an *Onchocerca* patient alterations in the skull under a nodule which corresponded to those observed in a skull of the Maya period.

ROBLES, 1919, observed among 500 operated cases of onchocerciasis with nodules on the head, four with a perforation of the external and internal layer of the skull.

A pre-Columbian skull of a male adult found at Santa Maria Astahuacan D.F. is kept in the Instituto Nacional de Antropología e Historia in Mexico D.F. This skull shows on the left os frontale a digital impression which possibly may have been caused by an *Onchocerca* nodule<sup>1</sup>.

One has to add that the total number of pre-Columbian skulls with erosions and perforations (not due to operations) which might be attributed to onchocerciasis is extremely small, compared with the total number of examined skulls and that there is no specific character of the bone lesions in onchocerciasis.

Among other representatives of the hypothesis that onchocerciasis is indigenous in America is H. FIGUEROA MARROQUIN, 1963.

FIGUEROA refers to three interesting statements in the early Spanish literature which indicate to some extent the existence of onchocerciasis at the time of the conquest.

The first report is by Pánfilo de Narváez, the antagonist of Cortés (COUTTS, 1936). Narváez reported that during his expeditions of discovery in Central America, he found, while passing through a colder region, a population in which everybody was blind.

The second report is by FRANCISCO LOPEZ DE GÓMARA, who was chaplain of Cortés. In his *Historia General de las Indias* (completed about 1540), speaking of 'Costumbres de Cumaná' (in Venezuela)

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<sup>1</sup> The writer wishes to thank Prof. A. Romano for the information and for permission to see the skull.

he writes that the water of the river causes the formation of clouds in the eyes. GÓMARA refers to the river which flows through Cumaná, and it is interesting that there, in the Estado de Sucre, in the neighbourhood of Monagas, onchocerciasis was for the first time discovered in Venezuela.

The third report was given about 150 years later by FRANCISCO ANTONIO DE FUENTES Y GUZMÁN in his *Recordación Florida* (written between 1675 and 1699). He states that in a certain town Malacatepeque, all, or nearly all, inhabitants were blind. The town does not exist any more, but from FUENTES Y GUZMÁN's map one can see that it must have been situated in the area of the volcanos Fuego and Acatenango where onchocerciasis is nowadays prevalent (see FIGUEROA, 1963).

The first two reports date from the first half and the middle of the 16th century, the third report was written in the last quarter of the 17th century.

One has to keep in mind that modern investigations have shown, as is obvious, that even in areas with heavy *Onchocerca* infection not all people are blind. There is, however, the possibility that the old Spanish chroniclers were so impressed by a comparatively large number of blind people that they exaggerated the number of cases (note 3).

Regarding a document supposedly sent to Spain at the time of Philip II (1556–98) describing the existence of onchocerciasis, see note 4.

As mentioned before, BRUMPT, 1919, expressed the opinion that the African and the American *Onchocerca* are two different species. Although he could not find morphological differences, he judged their biological differences as sufficient to regard the American form, which he named *Onchocerca caecutiens*, as a new species. As already stated, BRUMPT's view was not generally accepted. Recent research by WOODRUFF et al., 1966, and by ROMEO DE LEON and DUKE, 1966, however, gave results which support the view that the African and the American strain may have been evolving separately since the Continental Drift (KERSHAW, 1964). They show considerable differences regarding clinical features (WOODRUFF et al., 1966) and transmissibility by African and American *Simulium* species (ROMEO DE LEON and DUKE, 1966), so that ROMEO DE LEON and DUKE regard central American onchocerciasis as an indigenous infection, differing in many respects from onchocerciasis in Africa. These authors are of the opinion that the American disease may be referred to as 'Enfermedad de Robles', different from African onchocerciasis. One has, however, also to consider the possibility that people in Guatemala and in

onchocerciasis regions in Africa may differ in their reaction to similar parasites.

Whether or not one regards onchocerciasis as autochthonous in America, one has to admit that infected African negroes during the centuries of the slave trade must have introduced onchocerciasis into regions with suitable transmitters of the Western Hemisphere, where in certain areas the infection may have already existed.

### Notes

1. Several authors stated in their publications that the first description of *Onchocerca volvulus* was given by LEUCKART in 1893. In that year LEUCKART published the second edition of his book 'Die Parasiten des Menschen und die von ihnen herrührenden Krankheiten'. This work contains no reference to *Filaria (Onchocerca) volvulus*. DALMAT, 1956, discusses in detail the early descriptions by different authors. MANSON was the first who mentioned the parasite in the literature.

2. The first two publications dealing with onchocerciasis (Robles disease) in the Western Hemisphere are:

a) Editorial: *Una enfermedad en el continente ha sido diagnosticada en Guatemala*. Diario "La República" 26 (8437); 1 y 4, 29 dic. 1916.

b) CALDERON, V. M.: *Enfermedad nueva en Guatemala*. "La Juventud médica" 17 (8): 97-115, agosto 1917.

3. The early Spanish chroniclers may have exaggerated the number of blind people whom they met in some places. It is, however, of interest that even in the first quarter of the 20th century, there were in Mexico localities with many blind inhabitants. An example was Tiltepec in the Sierra de Ixtlán, Oaxaca.

JOSÉ E. LARUMBE, 1930, who during several years visited Tiltepec and described the local conditions in various publications, found onchocerciasis as the cause of the blindness.

4. A report supposedly sent from Mexico to Sevilla in 1571 describing the clinical symptoms of onchocerciasis as we know them to-day "bolas que se forman en la cabeza, ojos que se arrugan y van perdiendo la noción de ver y piel que se torna en pergamino" is apparently spurious and the product of the fertile imagination of a modern writer. The document could not be found by several investigators in the Archivo de Indias in Sevilla, in the archives of Simancas and in the Archivo General de la Nación in Mexico D.F. For details see: H. FIGUEROA M., 1963, p. 18.

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### III

#### *Blood Flukes*

##### *Schistosoma haematobium* and *S. mansoni* – Schistosomiasis

###### *Africa*

RUFFER found calcified eggs of *S. haematobium* in the kidneys of two mummies of the twentieth Dynasty, ca. 1200–1075 B.C. and in this way proved the existence of the infection in ancient Egypt (RUFFER, 1910, 1921).

Some authors, e.g. EBBELL, 1937, and JONCKHEERE, 1944, expressed the opinion that haematuria, due to *S. haematobium* infection, is mentioned in ancient Egyptian medical texts under the name *ââ* as 'Hématurie parasitaire'<sup>1</sup>.

GHALIOUNGUI, 1962, does not share the opinion that *ââ* represents schistosomiasis. He regards *ââ* as a condition existing in polyinfestation with a number of different helminths, including *Schistosoma*, *Ancylostoma*, *Ascaris* and *Taenia*. As the ancient Egyptian physicians evidently did not see *Schistosoma* and probably also not hookworm, but only larger worms such as *Ascaris*, *Enterobius* and *Taenia*, they probably regarded the latter as caused by *ââ* and responsible for the disease and haematuria.

In an interesting paper GHALIOUNGUI, 1962, has illustrated and discussed reliefs from two tombs of the Ancient Empire in Sakkarah (the tomb of Ptah-Hetep I and the tomb of Mehou, a notable of the VIth Dynasty). In the first mentioned tomb several men are shown with umbilical hernia.

In Mehou's tomb some figures show abdominal distension, scrotal swelling, phallic hypertrophy and complications with inguinal and abdominal hernia. These changes may have been due to chronic schistosomiasis with cirrhosis of the liver, especially as the people represented are peasants, fishermen and bargemen. In one

<sup>1</sup> *ââ*: *ꜥꜥ* (Ajin, Aleph, Ajin).

of the reliefs there is a figure with gynaecomastia, a feminine enlargement of the breasts. Gynaecomastia is known to be occasionally associated with cirrhosis of the liver.

The mentioned changes shown in the reliefs of Sakkarah reproduced by GHALIOUNGUI make it likely that they represent symptoms of chronic schistosomiasis.

Already in 1902 VON OEFELE drew attention to the loss of the male habitus in some persons with chronic *S. haematobium* infection. They become somewhat obese with a rounded contour of the body, protruding belly and gynaecomastia. They acquire to some degree a feminine appearance.

VON OEFELE pointed out that the Nile-god represented in Egyptian statues and reliefs shows a similar, somewhat feminine habitus. VON OEFELE assumed a correlation between the representation of the Nile and the appearance of persons with chronic schistosomiasis, especially as the red colour of the Nile during its rise might have been regarded as an annual menstruation, just as the Fellaheen regarded the haematuria of their boys infected with *S. haematobium*, usually showing itself at puberty, as a kind of male menstruation.

GHALIOUNGUI and DAWAKHLY, 1965, illustrated a relief showing a procession of deities bearing offerings<sup>2</sup>. Among them is *Hapi*, the Nile-god, *Wadj-Wr*, the Ocean-god and *Npri*, the god of wheat. These three gods are shown as obese men with beards but with pendulous breasts and bellies and a general feminine appearance as sign of their nutritive nature.

There are also other male gods with a similiar feminine habitus, so that the Nile is only one of them and VON OEFELE's theory of a correlation between the representation of the Nile and people suffering from chronic schistosomiasis and cirrhosis of the liver with haematuria is difficult to maintain.

Schistosomiasis is widespread in Africa. *S. haematobium* occurs in North Africa from Morocco to the Nile, the infection is especially frequent in Lower Egypt. It occurs in West Africa from Senegal to Angola, in the Sudan and in South and East Africa (BATHO, 1870), furthermore in Madagascar.

*S. mansoni* exists in Lower Egypt, in the Sudan, in East-, South- and West-Africa and in Madagascar.

In the Western Hemisphere it has been found in Brazil, Surinam, Venezuela, Puerto Rico and in some other islands of the Antilles.

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<sup>2</sup> The relief is kept in the Egyptian Museum in Cairo and belonged originally to the temple of Sahu-Rē, Abusir.

THEODOR BILHARZ (1825–1862) discovered in 1851 *Schistosoma haematobium* (*Bilharzia haematobia*) at an autopsy in Cairo. From 1851–1853 he wrote nine letters to his former teacher C. Th. von Siebold, Professor of Zoology at Breslau (Wrocław), and informed him in detail about his discovery and about the pathological changes in the wall of the urinary bladder, which he regarded as due to the infection as they contained worms and eggs. The eggs in the bladder wall had a terminal spine. He found also eggs with a lateral spine but no worms in the intestinal wall and in the liver in cases with the clinical symptoms of dysentery. Von Siebold published the letters of BILHARZ in the *Zeitschrift für Wissenschaftliche Zoologie* 4 (1853) 53 ff. and 454 f., and his drawings in the Tafelband of the *Zeitschrift* (1853), plate V and XVII. (For additional details, see SCHADEWALDT, 1953).

Drawings in black and white and also with colour-pencils of the pathological changes in the mucosa of the urinary bladder due to *S. haematobium* infection were made by the brother (Alfons) of Theodor Bilharz in 1859–60, while he visited Cairo. They represent the earliest illustrations of schistosomiasis of the bladder. One drawing has been published, although greatly reduced, by AHMED ABDALLAH in his paper *The Fight against Schistosomiasis in Egypt*, Ciba Symposium vol. 9, no. 3, 1961, pp. 102–108<sup>3</sup>.

Due to the work of SAMBON and of LEIPER, 1918, the existence of two different species was definitely proved: *S. haematobium* with terminal spine eggs and *S. mansoni* with eggs provided with a lateral spine.

The clinical symptoms of *S. mansoni* infection were not well known until the second half of the 19th century and were often attributed to dysentery.

Haematuria, a characteristic symptom of *S. haematobium* infection, and occasional changes of the outer male genitalia were observed and mentioned already from Egypt by PROSPER ALPIN (PROSPERO ALPINI, 1553–1616), likewise the comparatively frequent occurrence of bladder stones in the population of Lower Egypt.

These symptoms, especially haematuria, drew the attention of French physicians during Napoleon's invasion of Egypt (RENOULT, 1808, and LARREY, 1812–1817) who, however, without knowledge of the nature of the disease attributed the symptoms to very dif-

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<sup>3</sup> The reduced reproduction was made from one of three original drawings belonging to Prof. H. Vogel, Hamburg. The writer wishes to thank Prof. Vogel for having given him details regarding the history of the drawings and for having sent him reproductions in the size of the originals.

ferent causes, e.g. to the climate of Egypt and to a faulty transpiration.

According to R. BLANCHARD, 1904, the Zulus of Rhodesia believed that haematuria was caused by some animal which entered through the urethra while the person took a bath. Therefore, before entering the water, they applied a ligature around the penis or used a kind of protective cover made of fine grass fibres, resembling somewhat the finger of a glove (illustration in BLANCHARD'S publication).

Protective covers of the penis, especially of the glans, were widely used in different parts of Africa and are even shown on prehistoric wall paintings (note).

In the central part of Sierra Leone, in the Kpa Mende area, old people call haematuria due to schistosomiasis *red gonorrhoea*. They believe that it is transmitted to males and females by evil spirits whenever people take a bath outside their house at night or bathe in streams and rivers during day-time. These evil spirits supposedly hate to see naked people and punish them by giving them 'red gonorrhoea'.

In the eastern part of Sierra Leone, in the Kono area, people likewise call haematuria, due to schistosomiasis, 'red gonorrhoea'. They believe that they get it from their streams and rivers, the water having been poisoned by witch doctors.

In the northern part of the country in the Temne area, people hold the opinion that they get 'red gonorrhoea' from their streams when the water enters the male and female organs. To prevent the disease they apply a 'T' shaped country cloth as a bandage. They believe that people suffering from red gonorrhoea contaminate the water.

For treatment they use infusions prepared from pounded leaves of various plants and from the bark of the Mbeli tree *Harungana madagascariensis*<sup>4</sup> cut into small pieces with addition of palm wine (personal information by Mr. N. Williams of the Liberian Institute of the American Foundation for Tropical Medicine).

#### *America*

Negro slaves infected with *S. haematobium* or *S. mansoni* carried their parasites to the New World, but in the absence of snails, which could serve as intermediate host for *S. haematobium*, this parasite could not establish itself in the Western Hemisphere.

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<sup>4</sup> The writer is obliged to Dr. G. Verhaar of the Firestone Plantation Co., Harbel, Liberia, for identification of the tree.

It was different with *S. mansoni* which found suitable intermediate hosts in parts of Brazil, Venezuela, Puerto Rico and on some other islands of the West Indies.

It is the opinion of the great majority of investigators that *S. mansoni* infection was not autochthonous in the Western Hemisphere but was introduced by negro slaves from Africa. It could be demonstrated that the infection was primarily established in those places where slaves had been imported as in the North East of Brazil, Surinam, Venezuela, Puerto Rico and some other islands of the Antilles. The slaves came from parts of Africa where the infection exists.

In Brazil, MARTINS, 1958, found natural infection of wild and domestic rodents with *S. mansoni* rather common in all areas of schistosomiasis which have been investigated. He concluded that in Brazil schistosomiasis was imported by negro slaves from Africa and therefore man was the primitive host of *S. mansoni* which afterwards adapted itself to rodents.

Among the few investigators who believe that the infection with *S. mansoni* is autochthonous in Brazil are BERNARDO FIGUEIREDO MAGALHÃES and CAIO BENJAMIN DIAS (1944). They base their opinion on reports of a disease along rivers which existed before the arrival of the Portuguese and which showed symptoms similar to those found in *S. mansoni* infection.

### Note

STÉPHEN-CHAUVET, 1936, gives illustrations of protective covers of the glans penis in different forms from Togo, from the Zulus and from the Bassari of former French Guinea. He also reproduces prehistoric wall paintings from Southern Rhodesia and from Tassali des Ajjers (Sahara), showing protective covers of the glans in different shapes. These covers were evidently used not only for prevention of diseases but also to protect the glans against injury. The fact that they are shown on prehistoric wall paintings in such distant parts of Africa as the Sahara and Southern Rhodesia indicates their widespread use.

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## E Leeches

### *General Statements*

Since antiquity leeches played an important rôle in medicine in different parts of the world. In Europe they were chiefly used for blood-letting, while in the East, for example in China, they were usually given internally as medicine in various preparations.

Temporary endoparasitism of leeches, especially if swallowed with polluted water, was well known since ancient times and was discussed by numerous medical authors: MOQUIN-TANDON, 1827; BRANDT and RATZEBURG, 1829, 1833; HUBER, 1891; SEYFARTH, 1917; HOEPPLI and C. C. TANG, 1941; HOEPPLI, 1950, 1959.

The fact that certain tropical leeches drop from trees in order to attack men and animals, caused travellers, for example IBN BATTŪTA, to believe in 'flying leeches' (mentioned in the *Rihla* of IBN BATTŪTA).

In exceptional cases leeches were known to enter the anal opening (ZACUTUS LUSITANUS, 1575–1642) and the urethra (MITRA, 1926) while the person was bathing or standing in the water. There are also cases on record that leeches entered the vagina or the conjunctival sac of the eye (KUWAHARA, 1903).

### *Endoparasitism of leeches*

#### *Africa*

It is well known that small leeches, swallowed with polluted drinking water, attach themselves to the mucosa of the throat, nasal cavity, larynx and more rarely of the oesophagus.

Such temporary endoparasitism of leeches was comparatively frequent in the mediterranean region, in North Africa, Algiers, Tunis, Egypt, Palestine, and Syria (GUYON, 1941; BAIZEAU, 1963; R. BLANCHARD, 1891; HUBER, 1891).

Man and especially horses, mules, camels and cattle became infected. During Bonaparte's expedition to Syria and Egypt, the French soldiers suffered greatly from leeches when in May 1799 they returned from Syria to Egypt and on their march drank polluted water from leech-infested ponds (LARREY, 1812) (note 1).

The parasites involved were in most cases young specimens of *Limnatis nilotica* (see WITENBERG, 1944).

Swallowed leeches as a rule do not remain in the mouth and throat, but migrate to the nasal cavity and the larynx, more rarely into the oesophagus. In horses they attach themselves also by preference to the nasal mucosa. In consequence there is bleeding from the nostrils as a sign of infection.

This was well known not only in North Africa but also in other parts of the globe, e.g. in China. T. H. CHIN, 1941, reported that native inhabitants of Kweichow informed him that in their region horses are occasionally infected, having leeches protrude from their nostrils, especially when drinking water, therefore the name 'Lung Hsu Ma' (dragon beard horse).

MANSON, 1875, made a similar observation in Takow, Taiwan; he found leeches protruding from the nostrils of wild monkeys.

In Europe and Africa endoparasitism of leeches in man must have been quite frequent in the past, to judge from the references by numerous authors recommending methods for the removal of the parasites.

The therapy consisted generally in the immediate removal of the leech by some kind of forceps, if possible, or after previous application of various substances, especially vinegar and salt solutions. Similar methods were used in the case of horses and mules. The Arabic farriers in North Africa and Egypt had the reputation of being very clever and experienced in removing leeches from horses. Abu'l-Qāsim (Abulcasis), 936–c. 1013, born near Cordova in Spain, recommended the removal of leeches with a special instrument (ALDROVANDI, 1638, p. 732).

The leeches, if not soon removed, caused great suffering. The patient had frequent cough and expectoration of blood, nausea and rapid loss of weight by his inability to take sufficient food. If larynx and trachea were obstructed, he might die from suffocation (see LARREY, 1812; SEYFARTH, 1917) (note 1).

Endoparasitism of leeches in the throat is mentioned in the Hippocratic collection, Proorrh. II. 17<sup>1</sup>.

HERODOTUS, c. 484–425, stated that the bird Trochilus removed the leeches from the mouth of the Nile crocodile, which apparently appreciated the bird's attention and did it no harm. Several species of leeches such as *Limnatis nilotica* and *Lophobdella quadrefagesii* were regarded as representing the species in question (HUBER, 1891) (note 2).

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<sup>1</sup> It has to be added that some later translators and commentators regarded the respective expression *bdella* as referring to a varicose vein and not to a leech.

It may be added that this relation between the crocodile and a bird apparently exists also in the Congo (note 3).

PLINY, *Hist. nat. XIII*, X, knew of leeches in the trachea of elephants and Caius Julius Solinus, third century A.D., mentioned *dracones* – apparently leeches, from the eyes and ears of elephants.

#### *America*

References to the parasitism of leeches have so far not been found by the present writer in the early Spanish and Portuguese literature of the New World. There was obviously no transmission of leeches by negro slaves from Africa to the Western Hemisphere.

#### *Notes*

1. Avant notre arrivée à Sâlehyeh, on avait rencontré de distance en distance quelques bassins d'eau douce et bourbeuse comme nous en avons vu depuis dans les déserts qui bordent la Libye, remplis de petits insectes, parmi lesquels il existe une espèce de sangsue . . . qui paraît avoir quelque rapport avec celle qu'on trouve dans l'île de Ceylan ; elle a quelques millimètres de longueur. Quoiqu'elle ne soit pas naturellement plus grosse qu'un crin de cheval, elle est susceptible d'acquérir le volume d'une sangsue ordinaire gorgée de sang. Sa couleur est noirâtre et sa forme ne m'a rien offert de particulier.

Nos soldats, pressés par la soif, se jetaient à plat ventre sur le bord de ces lacs et sans penser au nouvel ennemi qui les attendait, buvaient avec avidité ; plusieurs d'entre eux ne tardèrent point à ressentir la piqûre des sangsues qu'ils avaient avalées. Les premiers effets de cette piqûre étaient un picotement douloureux qu'ils éprouvaient vers l'arrière-bouche, une toux fréquente, suivie de crachats glaireux légèrement teints de sang et d'envies de vomir. A cette irritation, que déterminait la sangsue dans les parties sensibles de la gorge, succédaient bientôt l'engorgement de ces mêmes parties et des hémorrhagies fréquentes. Dès lors la déglutition devenait difficile, la respiration laborieuse, et les secousses produites par la toux sur les poumons et le diaphragme causaient au malade des douleurs vives dans toute la poitrine. La toux augmentait en raison des attouchements que faisait la sangsue avec l'extrémité de sa queue sur l'épiglotte ou sur les bords de la glotte. (Le sang qui se porte sur cette ouverture, peut produire les mêmes effets).

Les sujets maigrissaient à vue d'œil perdaient l'appétit et le sommeil ; ils étaient inquiets, agités ; et si on ne leur administrait pas à temps les secours nécessaires, ces accidents les mettaient en dan-

ger et pouvaient les conduire à la mort, comme on a vu les exemples. — D. J. LARREY, Mémoires de Chirurgie militaire et campagnes. Tome I, pp. 259–260. 1812. Paris.

2. HERODOTUS: "Since it (the crocodile) lives in the water, its mouth is all full within of leeches. All birds and beasts flee from it, except only the sandpiper (Egyptian spur-winged lapwing *Hoplopterus armatus*) with which it is at peace, because this bird does the crocodile a service; for whenever the crocodile comes ashore out of the water and then opens its mouth (and this it does for most part to catch the west wind), the sandpiper goes into its mouth and eats the leeches; the crocodile is pleased by this service and does the sandpiper no harm." Book II, 68. Loeb Classical Library.

In this connection we quote from ROTHSCHILD and CLAY, 1952, pp. 23–24: "To-day there is no known bird which habitually enters the mouth of the crocodile to de-leech its gums, although Meinertzhagen has seen the Egyptian plover do so on more than one occasion. For all we know, the species referred to by HERODOTUS as the 'Trochilus' may now be extinct. However, it is generally believed that the Egyptian plover (*Pluvianus aegyptius*) is the species concerned and it is to-day referred to as the crocodile-bird."

3. The relation between the Nile crocodile and a bird apparently exists also in other parts of the world. In an article which appeared in the *Sunday Times*, Singapore, February 13, 1955, dealing with the experiences of a Swedish professor of African languages, Dr. Berndt Storesen, who went to the (former) Belgian Congo, it is mentioned that a small bird, called 'zig-zig' by the natives, behaves similarly as the plover in Egypt. It not only enters the open mouth of the crocodile, but even warns the reptile, by a piercing cry, of approaching danger, with the result that on such occasions the crocodile returns to the water with great speed.

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- ZACUTUS LUSITANUS: see Hoeppli, 1959, p. 228.

## F Arthropod Infections

### I

#### *Bloodsucking Diptera*

##### *General Statements*

A connection between flies and diseases was widely assumed since ancient times; examples are found in the chapters on malaria, sleeping sickness and uta.

In ancient Mesopotamia the god of disease and death was Nergal, whose emblem was a fly symbol, such as is shown on a cylinder seal in the Pierpont Morgan collection in New York (teste GARRISON, 1929, p. 64)<sup>1</sup>.

Baal-zebub, the god of flies, corresponded according to Flavius Josephus to the Greek Zeus Apomuios, the averter of flies (GARRISON, 1929, p. 67).

The connection of certain gods with flies and the fly amulets of the Egyptians indicate that already in antiquity people suspected flies as carriers of diseases.

#### Mosquitoes

##### *Africa*

In many parts of Africa the natives tried to protect themselves against mosquitoes by smoke, produced usually by a fire inside the hut, or as LIVINGSTONE (1857, p. 81) described of the Banagoa tribe, living on the borders of a marsh of the Mababe, north of the Kalahari desert: "Their huts were built on poles and a fire was made beneath by night, in order that the smoke may drive away the mosquitoes which abound on the Mababe and Tamunak'le more than in any other part of the country."

Regarding *Aedes aegypti*, many references are given by CARTER, 1931.

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<sup>1</sup> See also: O. KELLER, Die Antike Tierwelt, Leipzig 1909, 1913, vol. II, pp. 448-449.

*America*

Several early Spanish chroniclers dealing with the Conquest mention mosquitoes; the first is OVIEDO in his *Sumario*, 1526, cap. XLIX.

BERNAL DIAZ DEL CASTILLO (1492–1580), who accompanied Cortés on many of his campaigns, pointed out the great number of mosquitoes, gnats and ticks which attacked the Spaniards, *Historia verdadera de la Conquista de la Nueva España*.

Among the arthropod designs on pottery made by the Pueblo people in the Mimbres Valley, New Mexico, about A.D. 1200, there is a swarm of mosquitoes (H. G. RODECK, 1932).

PISO, 1658, gave two early illustrations of mosquitoes from Brazil. The first illustration of a mosquito-net is probably that by OLAUS MAGNUS, 1555<sup>2</sup>.

## Sandflies – Phlebotomus sp.

In the chapter on cutaneous leishmaniasis it has been mentioned already that, according to Hipólito Ruiz, who visited Peru from 1777–1788, the native population assumed that the disease was caused by the bite of very small and almost imperceptible insects, called uta (sandflies).

## Surret flies – Tabanidae (gad flies or horse flies)

D. J. LEWIS, 1952, has given a comprehensive review *Early Travellers's Accounts of Surret flies (Tabanidae) in the Anglo-Egyptian Sudan* with numerous quotations from the writings of travellers between 1790 and 1900.

The biting flies mentioned by the authors are according to LEWIS chiefly *Tabanidae*. So far some 70 species of *Tabanidae* have been found in the Sudan. Several of them are very destructive to camels and cattle by their biting, some transmit diseases such as the 'Guffer' disease (trypanosomiasis) of camels. In the Sudan these flies are the cause of the annual migration of the Arabs and their animals. The name 'surreta' (plural surret) is used by the nomadic Arab tribes in the Sudan for various species of *Tabanidae*.

The first report on surret flies was given by JAMES BRUCE<sup>3</sup>, 1790, from his observations made in 1772 when he entered the Sudan from Ethiopia. His publication *Travels to discover the*

<sup>2</sup> OLAUS MAGNUS 1490–1557.

<sup>3</sup> JAMES BRUCE 1730–1794.

*Source of the Nile* (first edition 1790) was strongly criticized as many of his statements seemed incredible and his report on the destructive effect of the surret flies greatly exaggerated.

The fly (*Pangonia magretti*) was called *Tsaltalya* in Ethiopia and *Zimb*<sup>4</sup> in modern Arabic.

J. BRUCE speaking of the Cushite in his work (vol. II, Chapter II, p. 314, second edition) writes:

“His mountains, and the cities he built afterwards, were situated upon a loamy black earth, so that as the tropical rains began to fall, a wonderful phenomenon deprived him of his cattle.

Large swarms of flies appeared wherever that loamy earth was . . . As soon as this plague appears, and its buzzing is heard, all the cattle forsake their food and run wildly about the plain, till they die, worn out with fatigue, fright and hunger. No remedy remains but to leave the black earth and to hasten down to the sands of Atbara; and there they remain while the rains last, this cruel enemy never daring to pursue them farther.”

J. BRUCE gave a description of the fly and a rather crude figure of the insect is found in the 4th edition (1813), vol. VII (VIII) no. 39. He was criticized as a travel liar who perhaps had never been to Abyssinia, but gradually it was found that although inexact in numerous details, his statements were essentially true.

The report of Sir SAMUEL BAKER<sup>5</sup>, 1867, one of the great travelers in Africa, confirmed BRUCE's statements concerning the effect of surret flies.

BAKER gave an account of the attacks of the ‘seroot’ and other flies on man, camels and wild animals. “When this fly attacks an animal or man, it pierces the skin instantaneously, like the prick of a red hot needle driven deep into the flesh, at the same time the insect (p. 185) exerts every muscle of its body by buzzing with its wings as it buries the instrument to its greatest depth. The blood starts from the wound immediately and continues to flow for a considerable time . . .” “It was said that of domestic animals only the goat could survive the bites of the fly and that donkeys did not graze when attacked” (quoted from LEWIS, 1952), who adds several vivid excerpts from BAKER's publication.

#### Tsetse flies – *Glossina* sp.

E. E. AUSTEN, in his *Monograph of the Tsetse-Flies*, 1903, has given in chapter II an extensive historical survey with valuable

<sup>4</sup> Zimb corresponds to Zebub in Hebrew.

<sup>5</sup> Sir SAMUEL BAKER 1821–1893.

comments and in chapter IV a bibliography up to 1899. In order to avoid repetition, only a few points in the medical history of tsetse flies will be discussed.

#### *Africa*

The name 'Tsetse' has been explained in various manners. Some authors, e.g. EDMONDS and WALKER, 1929, believe that it is a Zulu word, supposed to resemble the noise made by the fly. BUXTON, 1955, assumes that the word was used in Bechuanaland and signifies a fly destructive to cattle.

The word Tsetse was first used in England in 1849 and soon was found in books on travel in Africa, e.g. by GORDON CUMMING, 1850; LIVINGSTONE, 1857; KIRK, 1865 (see W. E. F. THOMSON, 1960).

R. GORDON CUMMING, 1850, gave the earliest detailed description of the effect of the bite of tsetse flies on horses.

DAVID LIVINGSTONE in his '*Missionary Travels and Researches in South Africa*', 1857, discusses in some detail tsetse (*Glossina morsitans* Westwood 1850) and its destructive effect on domestic animals. He gave a figure of *Glossina* copied from WESTWOOD on the title page of his book and on page 571 the same picture accompanied by a copy of WESTWOOD's figure of the mouth parts and a rough original woodcut made from a drawing by I. E. Gray of the British Museum, representing the fly in nearly natural size.

LIVINGSTONE assumed the existence of a venom which the fly injected by its bite. He writes that "it is well known that the bite of this poisonous insect is certain death to the ox, horse and dog" (p. 80). On the other hand, he found the bite of the tsetse perfectly harmless for man and wild animals; "our children were frequently bitten, yet suffered no harm (p. 82). In LIVINGSTONE's opinion the mule, ass and goat enjoy the same immunity from the tsetse as man and the game (p. 82).

It was very fortunate for LIVINGSTONE that his travelling did not take him into an area with endemic sleeping sickness, as he might have had to revise his opinion that tsetse are perfectly harmless for man.

#### *America*

In dealing with sleeping sickness in a previous chapter, it has been pointed out that occasionally negro slaves in an unrecognized early stage of the infection were shipped to the New World, where they developed the typical symptoms and died. In the absence of tsetse flies the infection could not spread. It may be mentioned that fossil tsetse flies (*Glossina*) have been found in Miocene deposit in Colorado (T. D. A. COCKERELL, 1919).

The work on Nagana and on tsetse flies as transmitters by DAVID BRUCE, as well as the work of BRUCE and other investigators on human trypanosomiasis, is well known, and as it has been carried out at the closing of the 19th and in the early years of the 20th century, it is comparatively recent and is not discussed here.

## II

### *Fly larvae — maggots*

#### *General Statements*

The knowledge of parasitic fly larvae and their destructive effect on host tissue increased considerably both in Africa and the Western Hemisphere in the second half of the nineteenth century (GEDOELST, 1905).

Non-parasitic fly larvae, which develop from eggs of flies deposited in wounds and ulcerations, are only briefly mentioned as not belonging to the subject of our study.

These maggots are known since ancient times and are mentioned already in the nineteenth book of Homer's *Iliad*, when Achilles refers to the wounds of the dead Patroclus and the danger that flies would there produce maggots which would disfigure the body.

In the past, surgeons had sometimes observed a beneficial effect of maggots, as they feed on necrotic tissue and in this way clean the wounds. D. J. LARREY, 1766–1842, Napoleon's famous head of the Army Medical Service, made such observations (note 1).

Since 1930 maggot therapy attracted for a number of years considerable interest as a means of treating badly healing wounds, especially in osteomyelitis (W. S. BAER, 1931). Nowadays treatment by living maggots has been replaced by more convenient and safer methods.

Some early Spanish and Portuguese chroniclers refer to myiasis. SOARES DE SOUSA, 1587, mentions myiasis from Brazil; FRANCISCO ANTONIO DE FUENTES Y GUZMÁN in his *Recordación Florida* (written between 1675–1699) points out the suffering of the Spanish soldiers caused by cutaneous and especially nasal myiasis, and Fray BERNABÉ COBO (1653) knew the 'mosquito-worm', the larva of *Dermatobia cyaniventris*.

There was no transmission by the slave trade.

Only three parasitic fly larvae, known for centuries, will be briefly discussed.

## Blood sucking fly larva

Congo floor maggot — Larva of *Auchmeromyia luteola**Africa*

The Congo floor maggot (larve des planchers du Congo) — larva of *Auchmeromyia luteola* (Fam. *Calliphoridae*) is a well known blood sucking fly larva which occurs in Africa south of the Sahara, including the Cape Verde Islands.

The natives were very familiar with it and gave correct information about the habits of the maggots to DUTTON, TODD, and CHRISTY, who published in 1904 the first detailed description from the Congo.

The natives make a clear distinction between the Congo floor maggot and the larva of the Tumbu fly *Cordylobia anthropophaga*. They know that the first one only sucks blood but never enters the skin as the second always does. They also know that it is easy to find the floor maggot even in greater numbers in the huts within the cracks of the mud floor beneath the mats on which people have slept. The larvae only feed at night. The fly deposits its eggs on the ground in the huts, especially where formerly urine has been voided.

## Myiasis

Myiasis due to the larva of the Tumbu fly, *Cordylobia anthropophaga*, Grünberg*Africa*

*Cordylobia anthropophaga* (Fam. *Calliphoridae*) is widespread in Africa, south of the Sahara. In Southern Africa, it has been found as far southwards as the Orange Free State, Swaziland and Natal (ZUMPT, 1959).

The native population knew the Tumbu fly for centuries. In the Senegal it was called 'ver du Cayor'; the Mendi name for the fly is 'Boyeh'; 'Tumbu' is a Negro-Creole word according to F. SMITH, 1908.

The first publication dealing with the infection is by COQUEREL and MONDIÈRE, 1862. In the Senegal these authors studied the successive changes of the skin from the time of infection until the larva leaves through the small opening in the furuncle-like inflammatory swelling.

The native population held the view that the maggots were the product of a small fly which laid its eggs in the moist sand where they developed, and the larvae entered the skin of a person

stretched out on the sand. COQUEREL and MONDIÈRE disregarded the correct opinion of the natives and assumed that the fly deposited its eggs directly on the skin.

Subsequently the fly and the larvae have been studied in detail regarding their morphology and biology, especially their way of infection by many authors. Among these publications the one by BLACKLOCK and THOMSEN, 1923, is particularly valuable.

The result of their work showed that the infection takes place exactly as the natives had stated.

### Myiasis due to the larva of *Dermatobia cyaniventris*

#### *America*

*Dermatobia cyaniventris* Marquart (Fam. *Cuterebridae*) occurs in tropical and subtropical America from the border of the United States to Argentina. For many centuries the larva and the skin lesions were well known to the local population of different regions. They also knew to some extent about the unusual way of infection as seen from various local names, e.g. Berne or Verme in Brazil; Beef-worm in Honduras; Nuche or Gusano de mosquito, or Gusano de Zancudo (mosquito worm) in Colombia and Venezuela; Gusano macaco or ver macaque in Cayenne; Saglacuru in the Maya language; Moyocuil in Mexico.

The larva lives in the subcutaneous tissue in a small hole which communicates with the outside by a minute opening. The tissue around the opening is infiltrated, forming a slight wall. The larva inside the hole has a position that its posterior extremity with the stigmata turns toward the opening. With the increase of the larva the skin forms a small boil.

The local population in various parts of South America believed that the larvae were due to mosquitoes which introduced their eggs into the canal which they had made in the human skin when they sucked blood. Already in 1653 the Jesuit Fray BERNARBÉ COBO mentioned the 'mosquito-worm' infection.

The work of NEIVA and GOMEZ, 1917, contributed greatly to the understanding of the way of infection. These investigators observed that the fly catches bloodsucking mosquitoes, e.g. *Janthinosoma lutzi* and flies, holds them for a short time and deposits a number of eggs on their abdomen, which are fastened by a sticky substance (for a good illustration, see GEIGY and HERBIG, 1955). Within 5–10 days the larvae are developed; they open the egg on one pole and wait until the mosquito or fly rests on the skin of a victim to suck blood. The larva then tries to reach the skin and, if successful, enters the skin, causing the lesions mentioned before.

When after several weeks the larva is fully developed, it leaves the skin through the small opening of the boil and drops to the ground to bury itself there; it pupates and becomes a fly.

Just as we have found in the case of the Tumbu fly that COQUEREL and MONDIÈRE disregarded the correct observations and beliefs of the natives concerning the way of infection, the opinion that mosquitoes were connected with *Dermatobia* infection held by the local population in South America was for some time likewise disbelieved by modern investigators, some of whom, for example in Brazil, regarded it as a popular error widely spread among the peasants.

Besides the just discussed three parasitic fly larvae there are many others in Africa and the Western Hemisphere which are here omitted as they are not of historical interest.

### Note

Pendant le travail de la suppuration, les blessés furent seulement incommodés des vers ou larves de la mouche bleue, commune en Syrie.

La présence de ces vers dans les plaies paraissait en accélérer la suppuration, causait des démangeaisons incommodes aux blessés, et nous forçait de les panser trois et quatre fois le jour.

(Footnote p. 311) Malgré l'importunité de ces insectes, ils ont accéléré la cicatrisation des plaies, en abrégant le travail de la nature et en provoquant la chute des escarres celluleuses qu'ils dévoraient. *Mémoires de Chirurgie militaire et campagnes de D. J. LARREY*. Tome I, p. 310. Paris 1812 (Campagne en Syrie).

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### III

#### *Scabies – Sarcoptes scabiei*

##### *General Statements*

For a very long time scabies was not clearly differentiated from various skin diseases of different aetiology which were accompanied by itching. Scabies was known from ancient times and was very common among many races but was apparently rare or absent in some countries. In Japan, for example, it was according to MASAO OTA, 1937, only comparatively recently introduced by foreigners. On the other hand, it was widespread in China since early times. In ancient Egypt it was apparently present. The Smith and Ebers papyri give many remedies for a great variety of skin diseases which, to judge from their well defined clinical concepts, included scabies.

The causative organism, the itch mite, *Sarcoptes scabiei*, was evidently known to the common people from antiquity long before it attracted the attention of physicians and scientists.

The earliest descriptions of the itch mite were given by CH'AO YUAN-FANG, c. A.D. 610, and by the Persian-Arabic physicians AHMAD AL-TABARĪ, second half of the tenth century (note 1), and by AVENZOAR (Abū Marvān ibn Zuhr), c. 1091–1162 (note 2).

##### *Africa*

In Africa scabies was frequently called 'craw craw', although this name includes a variety of skin diseases unrelated to scabies. W. F. DANIELL, 1849, reports from the Bight of Biafra about skin diseases: "The one of most prevalency is that denominated by the Bonnians Kraw-Kraw, which is an aggravated form of scabies, attended with much irritation."

It is certain that true scabies due to *Sarcoptes scabiei* was very frequent among negro slaves, as it was pointed out by numerous contemporary writers for example by BRYSON, 1847, dealing with diseases of slaves on slave ships: "Diseases most prevalent amongst captured slaves: craw-craws (sic) is generally found rife in every cargo of slaves and is frequently communicated to the price crew in the course of the voyage; it principally infects the outer part of the arms from the wrists up to the elbow, but also spreads over the whole of the body if neglected."

French authors also emphasized the frequency of scabies among the negroes on the African West coast. Among early French writers on scabies are CHASSANIOL, 1865; REY, 1880; BORIUS, 1882.

### America

Scabies was carried by negro slaves to the New World, where, however, it was most probably already present in pre-Columbian times.

According to a manuscript of the Peruvian Indian Felipe HUAN POMA DE AYALA *El primer nueva coronica y buen gobierno*, c. 1613, scabies of man and mange of lamas *sara oncoy or sara papa acuya* were well known in Peru at his time (DIETSCHY, 1938)<sup>1</sup>. FRIEDMAN, 1947, p. 52, on the other hand, is inclined to assume that scabies was introduced from Europe into the American continent by the Spaniards and later immigrants.

### Notes

1. AḤMAD AL-TABARĪ, the Persian Abu'l-Hasan Aḥmad bin Muḥammad al-Tabarī. A few extracts of the *Kitāb al-Mu'āladja al-buqrāṭīya* have been translated by MOHAMED RIHAB (Arch. Gesch. Med. 19, 123–168, 1927; ref. to the itch mite will be found on p. 134, Isis 10, 119, teste SARTON, *Introduction to the Hist. of Science*, vol. 2, 1950, p. 233).

2. AVENZOAR. Statement regarding Soab (itch mite): "Syrones sunt pedicilli subter manuum crurumque et pedum cutem serpentes, et pustulas ibidem excitantes, aqua plenas, tam parva animalcula, ut vix visu perspicaci discerni queant." Quoted from KÜCHENMEISTER, F., and ZÜRN, F. A., 1878–81. *Die Parasiten des Menschen*, 2nd edition, Leipzig, p. 515.

<sup>1</sup> DIETSCHY, 1938, reproduces eleven pictures from the manuscript.

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## IV

*Ticks**General Statements*

Some authors of early historical time have already mentioned ticks and discussed their origin, feeding habits and supposed qualities as remedies. In China, for example, baked cattle ticks were recommended to be taken by children as a remedy and also as a prophylactic for smallpox.

Among Graeco-Roman and later authors dealing with ticks are Aristotle, M. Porcius Cato, Varro, Columella, Pliny, Dioscurides, Galen and Avicenna. Pliny mentions that ticks have no anus. Several writers point out that certain animals are usually heavily infested with ticks, whereas others, such as mules and asses, are not attacked.

It is of special interest that D. R. ARTHUR (1965) published and illustrated what is possibly the oldest record and the oldest figure of ticks. It concerns a fragment of the head of a hyaena-like animal from an Egyptian tomb (tomb No. 155, Dra Abn el-Nago, Western Thebes, dating from the time of Hatshepsut-Thuthmosis III (eighteenth Dynasty about 1500 B.C.). ARTHUR pointed out three excres-

cences on the inside of the ear which had not been mentioned in previous publications dealing with the tomb and the fragment. The reasons for considering the possibility of these excrescences representing ticks are their shape resembling a partially or fully fed condition, their size relative to the pinna of the host and their feeding location on its inner side.

#### *Africa*

*Ornithodoros sp.* In dealing with 'tick-fever' (African relapsing fever) we have mentioned already that it was well known among the indigenous population and also among foreign residents that tick bites are occasionally followed by fever and sickness. Ticks were therefore feared. LIVINGSTONE, 1857, describes the effect of a tick bite from his own experience at Ambaca (pp. 382-383).

A very simplified pottery tick of the Nok period (c. 500 B.C.—c. A.D. 200) is kept in the museum at Jos, Nigeria (plate XX).

#### *America*

In the Western Hemisphere the Spanish conquistadores found ticks widespread in the West Indies and on the American mainland.

OVIEDO reports from Espaniola tick infestation of cattle in the fields and of the bullocks drawing carts.

Concerning human tick infestation, OVIEDO states that in certain places ticks are numerous and attach themselves to the skin in such a way that they can only be removed with great difficulty. The Spaniards used acid and the Indians sometimes killed them with fire. The result was always that especially the legs were covered with wounds and ulcerations (OVIEDO, Sumario, 1526, cap. LXXXI).

#### *Note*

The papyrus Ebers mentions a plant *qaqa* and, in connection with it, refers to a pathogenic agent. VON OEFELE (1901, p. 509) regarded the plant as *Ricinus* and the pathogenic agent as either a tick, *Ixodes* or a louse, *Pediculus*, because their form somewhat resembles that of the fruit of the *Ricinus* plant.

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## V

*The Sandflea — Tunga penetrans**A. The early knowledge of Tunga penetrans in America and the West Indies*

The original home of the sandflea are the tropical and subtropical parts of the American continent between about 30° N and about 30° S, and the West Indies. The infection existed long before the arrival of Columbus, as it is represented in pre-Inca Peruvian anthropomorphic pottery vessels, 'huacos' (plate XVI)<sup>1</sup>.

The sandflea became known to the Spaniards soon after Columbus had landed at Guanahani on 12th October 1492. The earliest published report is by OVIEDO in his *Sumario de la natural historia de las Indias*, 1526, chapter VIII (nigua).

In his complete work (1535) OVIEDO gives a more detailed description of the infection. He believed that the sandflea could pass its entire life-cycle on a person, as either the eggs or the larvae were deposited in the tissue and in this way the infection could spread on the same person, an error which was repeated by several later writers.

The parasite is known in different countries under different names. In Brazil it is called 'pulga de areia'; 'bicho do pé'; 'bicho de porco'; 'jatecuba'; in the Spanish parts of South America and Mexico 'nigua' or 'pique', or 'piqui', in the French possessions 'chique'. In the British territories and the United States *Tunga* is called 'jigger'; 'chigoe'; 'sandflea'.

Following OVIEDO, quite a number of writers have mentioned sandflea infection from tropical and subtropical America and the West Indies.

Among the early authors is Gonzalo Ximénez de Quesada (1538), whose manuscripts, as far as the present writer could ascertain, have not yet been printed but have been quoted by Piedrahita, Bishop of Panama, one of the early historians of New Grenada (ROULIN, 1870). In 1558 THEVET (1502–1590) reported sandflea infection from tropical America (see SINGER, 1912, and HOEPPLI, 1959, pp. 214–215).

HANS STADEN, 1557, reported sandflea infection from Brazil and SOARES DE SOUSA, 1587, gave a good description of the effects of *Tunga* from the same country.

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<sup>1</sup> MOODIE, 1923, and TELLO, 1924, have likewise illustrated huacos, representing sandflea infection.

BERNABÉ COBO described in detail the infection from Peru and the treatment used by the local Indians. ALEIXO DE ABREU, 1623, likewise mentioned the sandflea from Brazil.

G. PISO (Willem Pies, 1611–1678), who had lived like G. MARCGRAVE (Georg Markgraf, 1610–1644) in Pernambuco during the Dutch occupation of Brazil (ca. 1630–1654), published in 1648 with MARCGRAVE *Historia Naturalis Brasiliae* in twelve books<sup>2</sup>. The first part is by PISO: *De Medicina Brasiliensi libri quatuor*, the second by MARCGRAVE: *Historia Rerum Naturalium Brasiliae libri octo*. Leiden and Amsterdam<sup>3</sup>.

In part I, cap. XXII *De Externis Malis quorundam Insectorum*, PISO describes sandflea infection: “Minutissimos vermiculos Lusitanis *Bicho*, Brasilianis *Tunga* haec terra nutrit.” They are especially frequent in people who walk barefoot on dry sandy soil. — They have nothing to do with the Guinea-worm. “Nihil cum Guineensibus vermiculis commune habent, qui longi, lati & albicantes chordarum speciem referunt.” If one removes them, it is necessary that the little sac should be taken out intact, as otherwise the infection may spread. For protection Acaju oil is used; it is applied to the soles of the feet and on the toes.

In the seventeenth century DU TERTRE described sandflea infection from the West Indies. He recommended the wearing of shoes for protection.

Among eighteenth century authors are LABAT, 1722 (West Indies), SLOANE, vol. II, 1725 (West Indies), CATESBY, vol. II, 1743, who gave one of the early illustrations of *Tunga* (West Indies and southern part of North America), JUAN & ULLOA, 1748, BAJON, 1777, 1778 (Cayenne and French Guiana), MOSELEY, 1792 (West Indies), CHAPPE D'ANTEROUCHE, 1772 (Mexico), GUMILLA, 1745 (Orinoco).

Among writers of the early nineteenth century who refer to sandflea infection is A. von Humboldt, who mentions it in a letter to the Capitán General de Caracas, Manuel de Guevara Vasconcelos, written from Nueva Barcelona 20th August 1800 (teste ARGUMOSA, 1959). Others are WINTERBOTTOM, 1803 (West Indies), and RENGGER, 1832, 1835 (Paraguay).

Just as the Spanish conquistadores in the sixteenth century, the French troops which by order of Napoleon III invaded Mexico in the sixties of the nineteenth century, suffered severely from sandfleas (GUYON, 1870).

Besides the few authors mentioned, there are many others who refer to the sandflea in America and the West Indies. From all

<sup>2</sup> For biographical data see E. G. JACOB, 1965.

<sup>3</sup> PISO published in 1658 a second edition under the title: *De Indiae Utriusque Re Naturali et Medica libri XIV*. Amsterdam.

these publications one may draw the conclusion that *Tunga penetrans* was widely established and known as a pest in tropical and subtropical America and the West Indies when the first Spaniards arrived.

*B. The early knowledge of sandflea infection in Tropical Africa*

Whereas we have from the first half of the sixteenth century numerous references to *Tunga penetrans* infection from tropical America and the West Indies, where the local population knew how to deal with the infection, corresponding reports from Africa are rare and more recent.

There existed the widespread erroneous belief expressed in numerous publications that the sandflea did not occur in Africa prior to 1872 when it was (re-)introduced by a British ship, the 'Thomas Mitchell', sailing from Rio de Janeiro to Ambriz (Angola). There are, however, a few reports which indicate that in all probability sandflea infection existed in Africa much earlier.

The first report concerns the famous pilgrimage to Mecca in 1324 by Mansa Musa, sultan of Mali. In the chronicles it is stated that the caravan proceeded from Walata by the westerly route northward to Twat and there suffered a considerable diminution by an affection of the feet which involved a large part of the caravan. There is no description of the sickness given and no statement that it was caused by sandfleas. It was anyway a major disaster which incapacitated about one half of the caravan so that it was recorded in the chronicles. There is no proof but a certain probability that the event was due to sandflea infection, SHAW, 1906. (See also TROUSSAINT, 1902.)

HENNING, 1904, has drawn attention to an early publication which in his opinion refers to *Tunga penetrans* infection. SAMUEL BRAUN, a physician of Basle, published in his *Schiffahrten*<sup>4</sup>, Basle, 1624 (Report on his first voyage to West Africa in 1611–13), a description of cases with minute 'worms' under the nails of hands and feet which might have been sandfleas. Other symptoms such as deep tissue destruction near the anus had in all probability nothing to do with *Tunga* infection. BRAUN may have observed patients with a mixture of different unconnected pathological conditions including *Tunga penetrans* infection and myiasis.

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<sup>4</sup> BRAUN made altogether five voyages between 1611 and 1621; three times he went to the West Coast of Africa and twice to the Mediterranean (see HENNING, 1904).

FALKENSTEIN, 1877, stated that *Tunga penetrans* had been observed by ADANSON already in 1759 in Senegal. ADANSON, 1759, p. 298, points out the very large number of sandfleas in the huts of the local inhabitants and the irritation caused by them. Strangely enough he does not mention the burrowing in the skin but points out that the sandflea does not jump higher than 3–4 inches. As he did not speak of the burrowing in the skin, some writers, e.g. KARSTEN, 1865, and HESSE, 1899, expressed the view that the flea observed by ADANSON, cannot have been *Tunga penetrans*.

One has to admit that it is surprising that ADANSON did not speak of the burrowing in the skin. On the other hand, he mentions that the sandfleas were of such a small size that one could hardly see them, that their attack caused a very strong itching and that they could not jump higher than 2–3 inches, which is characteristic for *Tunga*.

Regarding another eighteenth century author, BARBOT, there can be no doubt that he referred to *Tunga*. BARBOT designated himself as Agent-General of the Royal Company of Africa and Islands of America in Paris. His publication *A description of the Coasts of North and South Guinea and of Ethiopia Inferior vulgarly Angola, etc.* was published in an English translation in London in 1732. In Book I, Chapter II, p. 32, he writes:

“Men are here plagued with a sort of handworms which in the Caribee islands in America are called Chiques, and work themselves into the soles of the feet, and the heels, becoming the more troublesome and insupportable, in that they are not to be sorted out, if they have once time given them to lay their eggs there.”

HIRSCH, in his Handbook of Geographical and Historical Pathology, vol. II, p. 364, 1885, refers to a statement by a Russian physician that the sandflea had existed in Africa for a long time. HIRSCH doubted this statement as he could not find any supporting data.

The present author has checked the statement, which is found in *Grum's Gesundheitsfreund*<sup>5</sup> (Friend of Health) no. 19, pp. 145–147, 1838 (Mittheilung des Staabsarztes SKRIPITZIN, derzeit ältesten Chirurgen des Seehospitals in Cronstadt – Zeitschrift für die gesamte Medizin Bd. 13, Auszüge p. 77, 1840). SKRIPITZIN reports regarding the sandflea:

“Sein Vaterland ist nicht ausschliesslich America, wie bisher ein grosser Teil der Naturforscher glaubt, und ihn deswegen *Pulex americanus* nennt.

<sup>5</sup> A Russian journal of popular medicine which was apparently well-known in the middle of the 19th century, as it is mentioned in Turgenev's *Fathers and Sons* by the nihilist Bazarov.

Dieser Floh findet sich auch schon bei Negern auf ihrer Überfahrt von Africa nach America vor. Daher findet sich dies Insect in Mozambique, Congo and anderen Gegenden Africa's, mit welchen Negerhandel getrieben wird."

A new development in the history of *Tunga penetrans* infection in Africa begins in 1872 with the arrival of the British ship 'Thomas Mitchell', a sailing vessel of 499 tons, built at Dumbarton on the Clyde in 1851<sup>6</sup>. The ship, which had brought coal from England to Rio de Janeiro, went in ballast from Rio to Ambriz (Angola) where it arrived in September, 1872. The crew suffered from sandfleas, which also infected visitors to the ship. The sandfleas were carried to the shore by the infected persons and also in old coffee sacks (PECHUEL-LOESCHE, 1882, teste HESSE, 1899, p. 523).

Within a short time the local population suffered terribly from *Tunga* infection, especially as the cause of the suffering was at first unknown.

Before the end of 1872, the sandflea had been carried southward to São Paulo de Loanda and northward to the Congo. The rapid spread was due to coastal vessels which called at larger ports along the coast.

While *Tunga penetrans* spread rapidly along the West Coast, its transportation deeper inland needed more time. It took place mainly on the old caravan routes but also by expeditions (e.g. by Stanley's Emin Pasha Relief Expedition of 1887). HESSE, 1899, traced in considerable detail the spread of the sandflea across tropical Africa from the West- to the East Coast, where it was first noticed in 1895. In the same year Senegalese soldiers carried the sandflea to Madagascar (BLANCHARD, 1899); in 1898 it had reached Zanzibar.

It was found not only on the plains but also in the Usambara mountains at an altitude of 1600–1700 meters<sup>7</sup>. Towards the end of the century Indian troops and labourers returning from Africa brought the sandflea to Bombay and later to Karachi.

It has long been known and reported that besides man various domestic and wild animals may be infected by the sandflea. Dogs, cats, mice, rats and especially pigs are important reservoir hosts for the infection of human beings. Future work is needed to find out how many species of sandfleas are involved.

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<sup>6</sup> The writer wishes to thank the National Maritime Museum in Greenwich for the information.

<sup>7</sup> The altitude at which *Tunga penetrans* is able to exist, depends on the distance of the locality from the Equator.

The question arises why the sandflea did not spread in Africa during the centuries before its reintroduction by the British ship 'Thomas Mitchell' in 1872. The explanation is that there was, apart from traffic on the old caravan routes, not very much communication between the different parts of Africa.

The various tribes had as a rule little contact with each other, except when they were at war or made slave raids.

The rapid spread of *Tunga* across the tropical and subtropical parts of the African continent from the West to the East Coast within about twenty-five years after its reintroduction in 1872 is remarkable.

On the other hand, it is interesting to observe the influence of improved living conditions and of the knowledge of how to remove the parasite from the skin on the prevalence of the infection. BÜTTIKOFER, 1890, on his second visit to Liberia, 1886–1887, found in Monrovia so many people infected with sandfleas that everywhere in the streets one saw persons walking painfully, often with bandaged feet. Nowadays with most people wearing shoes and with improved streets it is very hard as the present writer noticed to find a *Tunga*-infected person in Monrovia.

In summarizing the following may be stated: *Tunga penetrans* infection existed in South America (Peru) in pre-Inca times as proved by its representation in Mochica pottery.

The first published reference to the sandflea in tropical America is by OVIEDO, 1526; in Africa, on the other hand, the first report which undoubtedly refers to *Tunga* is that by BARBOT, 1732. There are even reports from the 14th and the 17th century which may refer to *Tunga* infection in Africa. It is in any case certain that sandflea infection on the West Coast of Africa existed in the eighteenth century and probably much earlier but only in restricted areas. Comparatively few communications, such as existed at that period, are the most likely cause for the limitation of the infection.

It is highly probable that *Tunga penetrans* was introduced many centuries ago from tropical America into Africa. This is indicated by the name 'chique' used in Senegal, which had already been employed for a long time in French Guiana and the West Indies. 'Chique' apparently derived originally from 'Sika', an American Indian word.

The reintroduction of *Tunga penetrans* in 1872 by the British ship 'Thomas Mitchell' was followed by a rapid spread of the sandflea along the African West Coast and subsequently along the old caravan routes across the tropical part of the whole continent.

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## VI

### *Fleas*

#### *Africa*

In Egypt fleas were known since antiquity. The papyrus Ebers (c. 1555–1335 B.C.) gives several prescriptions to expel fleas from a house, for example sprinkling the walls with natron water (EBBELL, 1937, p. 113).

Fleas existed in tropical Africa and South- and Central America when the first Europeans arrived (notes 1 and 2)<sup>1</sup>.

<sup>1</sup> The fleas were probably the cosmopolitan human flea, *Pulex irritans* Linnaeus, 1758, very numerous in North Africa, furthermore the fleas of dogs and cats and *Xenopsylla cheopis* Rothschild, 1903, the common flea on rats in the tropics, also *X. braziliensis* Baker, 1904, in tropical South America.

*America*

Fleas will have been carried by negro slaves to Central- and South America where they existed already since ancient times as proved by the representation of fleas in terracotta and stone in pre-Columbian art (plate XVII, figs. a & b).

There are references to fleas from the Western Hemisphere in the early Spanish literature.

OVIEDO's statement are given in note 2.

HERNÁNDEZ in his *Historia de los Insectos de Nueva España* states that the Mexicans used a decoction of tobacco which they spread over the walls in order to kill the fleas in a house (personal information by Dr. Somolinos d'Ardois, Mexico D.F.). The method is similar to that used by the Egyptians mentioned before.

FELIPE HUAMAN POMA DE AYALA, 1584–1614, refers to fleas.

BERNABÉ COBO reports that the moderately warm regions of the New World are heavily infested by both the common flea and the nigua (sandflea).

JORGE JUAN and ANTONIO DE ULLOA, 1748, vol. III, gave a similar report from Lima.

It may be mentioned that the Eskimoes apparently did not know fleas before the arrival of the white man (note 3)<sup>2</sup>.

*Notes*

1. "The people of this island are flea-ridden and the negroes have lice; but the white people do not suffer from them, except for finding an occasional bed-bug in the beds where they sleep." Quoted from *Descriptions of a voyage from Lisbon to the island of São Thomé*, written by an anonymous Portuguese Pilot, c. 1540, p. 165; in "Europeans in West Africa 1450–1560. Documents to illustrate the nature and scope of Portuguese enterprise in West Africa etc." Translated and edited by JOHN WILLIAM BLAKE, vol. I and II, London. Printed for the Hakluyt Society, 1942, vol. I, pp. 145–166.

2. "Pulgas hay, pero pocas, é no en todos tiempos; é son mucho menores por la major parte que las de Castilla; pero pican mucho mas é son péores." (There are fleas but not many and not in all seasons; they are much smaller in their majority than those of

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<sup>2</sup> The earliest fleas hitherto known are *Palaeopsylla klebsiana*, Dampf, 1911, and *Palaeopsylla dissimilis*, Peus, 1968, found in Baltic amber. They belong to the same genus but represent two very different species. They are about 50–60 million years old as proved by their inclusion in amber (DAMPF, 1911; PEUS, 1968).

Spain; but they bite much more and are worse). — OVIEDO, *Historia General* etc. Edit. R. Acad. de la Historia 1851, first part, lib. XV, cap. III, p. 455.

3. The Eskimoes, according to Nansen (see BODENHEIMER 1951, p. 281), did not know fleas before the arrival of the white man. They call them European's lice and eat them as delicacies. They even use special traps which are put between the clothes and the skin. (Regarding the use of flea-traps in Europe and China see HOEPPLI, 1959, p. 209.)

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## VII

### *Lice*

#### *Africa*

Lice existed in Africa since antiquity. Nits have been found on the hairs of an Egyptian mummy of the fourth century A.D. (EWING, 1924). PROSPERO ALPINI in *De Medicina Aegyptiorum*, Venice, 1591, mentions the frequency of lice in Egypt.

Louse infestation of negroes at São Tomé was mentioned about 1540 by the anonymous Portuguese pilot whom we have quoted in the previous chapter dealing with fleas.

A wooden statue of a kneeling woman holding on her left arm a child which is picking lice from the woman's head is kept in the Museum Rietberg in Zurich (plate XIX).

The eating of lice during delousing was rather common among certain African tribes (SIMMONDS, 1885). It was mentioned already regarding the Hottentots by P. KOLBEN, 1738, II, p. 179 (teste BODENHEIMER, 1951, p. 194). He reports their remark when asked how they could eat such vermin: "They suck our blood and we devour them in revenge."

The Pangwe of the Cameroons likewise had the habit of eating lice (G. TESSMANN, 1913-14, II, p. 187, 190, teste BODENHEIMER, 1951, p. 139).

There can be no doubt that negro slaves carried lice to the Western Hemisphere.

### *America*

In the New World lice occurred from ancient times. EWING, 1924, found nits on the hairs of pre-Columbian Peruvian mummies and lice and nits on the hairs of prehistoric American Indian mummies from the southwestern United States. The earliest lice found are ca. 4000 years old (EWING, 1926).

PEDRO WEISS, 1932, described and illustrated nits of lice from the hairs of mummies of about 200 B.C. found in the Páracas caves, Peru.

A louse plays a rôle in the *Popol-Vuh*, the very old famous mythological book of the Maya-Quiché (note)<sup>1</sup>.

A mochica huaco showing a woman delousing herself is kept in the Museo Nacional de Antropología y Arqueología in Lima (plate XVIII).

Several of the early Spanish chroniclers describing the Conquest refer to lice. The best known report is probably that by ANTONIO DE HERRERA, 1554, who states that when the Spaniards entered the palace of Montezuma in search for treasures, they found sacs which they believed contained gold. However, on opening them, they discovered that they were filled with lice which had been given to Montezuma as tribute<sup>2</sup>.

The custom of offering a tribute of lice as a sign of submission existed according to GARCILASO DE LA VEGA also in Peru. The Incas forced the Urus, who lived on the Lake Titicaca, to bring an annual tribute of lice.

TORQUEMADA mentions that Montezuma used old people who

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<sup>1</sup> The author is obliged to Dr. H. Figueroa Marroquin, Guatemala, for having drawn his attention to the *Popol-Vuh*.

<sup>2</sup> It should be mentioned that some authors suspect that the sacs contained dried female cochenille insects (*coccus cacti*) which were erroneously taken for lice by the Spaniards.

were unable to do other work to visit the houses and to delouse people. They collected the lice in little bags (information by Dr. Somolinos d'Ardois, Mexico D.F.). Fray BARTOLOMÉ DE LAS CASAS states that the Indians of Española had lice.

JUAN DE VELASCO (1727–1819), 1789, speaking of lice in Ecuador, mentions that they are more frequent in a cool and cold climate than in a hot one.

A. VON HUMBOLDT, 1816–31, in his studies of the equinoctial Andes, mentions the occurrence of lice in high altitudes.

It is reported by various writers that similarly as in Africa, people in the Western Hemisphere had the habit of eating the lice during delousing.

OVIEDO, speaking of the household of Montezuma, mentions 'Sanctos religiosos', a kind of priests. They were wearing long hair full of lice which they were catching and eating while murmuring prayers.

PEDRO MÁRTIR DE ANGLERÍA, 1520–26, referring to the Indians of Cumaná, states: "Se comen sin asco las arañas, las ranas y cualquier gusano, hasta los piojos." (They eat without loathing spiders, frogs and any kind of worms, even lice." ALDROVANDI, 1638, repeats this statement regarding lice.

PEDRO CIEZA DE LEÓN, when he visited Pasto, found that the Indians there were eating their lice when delousing.

MOUFET, 1634, p. 304, mentions Spanish reports that lice were consumed by the Indians in the West Indies.

PURCHAS, 1625–26, vol. III, p. 975, states that when the Indians of the Province of Cuenca are infested with lice "they dress and cleanse one another and they that exercise this, are for the most part women who eat all they can take."

The habit of eating their own head-lice is reported from the Indians of the Isthmus of Panama (DAMPIER, 1697) and from the Indians of the Amazon river (WALLACE, 1852–53).

It should be pointed out that besides the few early authors just mentioned, there are numerous others who also refer to the existence of lice in the New World (regarding the eating of lice, see BODENHEIMER, 1951, and HOEPPLI, 1959, pp. 360–363).

In concluding we may mention an apparently rather widespread superstition. It is recorded not only by OVIEDO in his *Sumario* and his *Historia General*, but also by CERVANTES in *Don Quijote* and by ABRAHAM ORTELIO in his *Teatro del Orbe*.

According to this belief people on a voyage from Spain to the New World loose their lice when the ship passes the Azores so that they arrive in the Western Hemisphere with very few or no lice. On the return voyage, however, at about the region of the Azores

the lice gradually reappear so that on their arrival in Spain people have about just as many lice as on their departure.

OVIEDO stated that by personal experience during four voyages made from Spain to the New World and back he convinced himself of the correctness of this belief.

### Note

The *Popol-Vuh* is a very old important document of Maya-Quiché literature. It combines mythology and history. The *Popol-Vuh* consists of four 'books'. In its present form it is a collection of manuscripts written at about 1530 by a christian Indian, DIEGO REYNOSO. The text is in the Indian language but in roman letters. It was found in the convent of St. Thomas of Chichicastenango by the Dominican monk Francisco Ximénez at the beginning of the eighteenth century; he translated it.

In the second part dealing with the twins Hunahpú and Ix-balamqué, who fight the forces of 'Evil', the *Popol-Vuh* tells the story of Ixmucané, a kind of goddess in the shape of an old woman who sends an important message by a louse to her grandsons.

The *Popol-Vuh* has been translated into several languages, a good translation is by RAPHAEL GIRARD, 1954, a Spanish edition is by VILLACORTA and RODAS, 1927.

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<sup>3</sup> Quoted from LUIS A. LEÓN, 1951.

## VIII

*Bedbugs – Cimex lectularius – C. hemipterus (rotundatus)*

*Cimex lectularius* likes the warm but not the tropical climate; in the tropics it is replaced by *C. hemipterus*.

*Africa*

Bedbugs were known in different parts of the world from antiquity, but were introduced into some countries comparatively late. In the Alsace (Strasbourg) *Cimex lectularius* was first observed in the eleventh century, its occurrence in France was for the first time reported in the 13th century (KEMPER, 1928). In England *C. lectularius* was probably unknown before the sixteenth century (MOUFET, 1634, cap. XXV, pp. 269–271). It may be added that according to FALLÉN, bedbugs were still unknown in Sweden in 1807. In the mediterranean countries, on the other hand, bedbugs were widespread and mentioned by a number of Greek and Roman authors.

Bedbugs were discussed by Aristotle (384–322 B.C.) and by Pliny (c. A.D. 23–79). They were also referred to by non-medical and non scientific writers, for example by Aristophanes (c. 450–386 B.C.) in his *Clouds* and in the *Satyricon* of Petronius (died A.D. 66).

The anonymous Portuguese pilot (ca. 1540) whom we have mentioned in connection with his statements on fleas and lice in São Thomé also refers to bedbugs.

Bedbugs played a rôle in the treatment of a considerable number of diseases and pathological conditions from ancient times until the beginning of the nineteenth century. Dioscurides, Pliny, Galen, Marcellus Empiricus, Aetius, Actuarius and MOUFET, 1634, p. 270, recommended them for the treatment of malaria, a recommendation which is also found in Indian medical literature (HOEPPLI, 1959, p. 17, 155, 185).

*America*

As Italy and the Iberian Peninsula had close relations in Roman times and as bedbugs at the time of Petronius were apparently very common in Italy, they will have existed also in Spain, so that later, at the time of Columbus and the Conquest, Spaniards carried them to the New World.

BERNARDINO DE SAHAGÚN, 1569, states: “Hay chinches en esta tierra como las de Castilla, y llamanlas texcan” (there are bedbugs in this country as in Spain and they are called texcan).

It is possible that SAHAGÚN refers also to *Ornithodoros* species which in some parts of Central- and South America are called 'chinchés' (information by Dr. Luis A. León, Quito).

HERNÁNDEZ, in his *Historia de los Insectos de Nueva España*, cap. XXVI, describes the Hoeitexca, which he states is a large bedbug which sucks blood and has a bad smell. It is difficult to know whether HERNÁNDEZ refers to the common bedbug which we know to-day. He assures (lib. I, cap. 49) that the Ahoapatli destroys lice and drives away bedbugs and that the Zayolizcan (lib. VI, cap. 14) likewise kills the bedbugs (information by Dr. Somolinos d'Ardois, Mexico, D. F.). It seems that HERNÁNDEZ, like SAHAGÚN, uses 'chinche' not only for bedbugs but also for other arthropods.

Similarly as we have found in Europe that some countries were free from bedbugs for a long time, we notice from early reports the absence of bedbugs also in some parts of South America, for example in Peru.

BERNABÉ COBO, 1653, reports: ". . . en este reino tan extendido como este del Perú no los (bedbugs) hay, no los he visto en mas de cincuenta años, si bien es verdad que se hallan en otras provincias de Indias, particularmente en Nueva España." (In this large kingdom of Peru there are no bedbugs, I have not seen them in more than fifty years; on the other hand, it is certain that they are found in other provinces of the Indias, especially in Mexico.)

According to DOHRN, 1879, bedbugs were introduced into Chile by Europeans towards the middle of the 19th century.

In consequence of the greatly increased communications, bedbugs were gradually found everywhere, even in countries like Peru where formerly they had been absent. JORGE JUAN and ANTONIO DE ULLOA, 1748, who on their voyage to South America visited Peru, reported that the inhabitants of Lima, especially in summer, suffered greatly by fleas and bedbugs.

It can hardly be doubted that the Spaniards during their Conquest introduced bedbugs into the Americas. It remains, however, doubtful whether bedbugs existed in America before Columbus. A special difficulty is caused by the fact that the early Spanish authors used 'chinche' and the Aztec word 'texcan' not only for the common bedbugs, *Cimex lectularius* and *C. hemipterus*, but also for other arthropods.

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## IX

*Porocephalus**Africa*

The African species *Porocephalus armillatus* lives as adult in the respiratory tract of snakes, pythons and puff-adders. The eggs are discharged either through the mouth of the snake or chiefly in the faeces. The eggs must reach the alimentary canal of a suitable animal, serving as intermediate host. The larval form has so far been found in a very wide range of mammals including man.

Within the intestine of the intermediate host, the eggs hatch, the larvae pierce the intestinal wall and reach the blood- and lymph-vessels. They are carried to various parts of the body and are found especially on the surface of the liver, in the lung, intestinal wall and on the mesentery. There they become enveloped by a capsule produced by the intermediate host.

The larval form has been found in negroes in different parts of Africa: Egypt, Senegal, Gambia, Sierra Leone, Gold Coast, Cameroons, Congo, furthermore in negroes of non-African countries who had previously been residents in Africa.

Besides *Porocephalus armillatus* other *Porocephalus* species have been described; L. W. SAMBON, 1910–1913, has given a critical review of all species described up to his publications.

The first record of *P. armillatus* was given by PRUNER, 1847. He found the parasite in Cairo at the autopsy of two negroes; one had died of peritonitis, the other of ulcerative colitis. The encapsulated larvae were situated on the surface of the liver, on the mucosa of the small intestine and on the mesentery. In the first negro, one parasite was found free in the duodenum.

In 1856 BILHARZ found three specimens encapsulated in the liver of a negro who had died of dysentery in Cairo. The parasites

had hooks which corresponded to those found previously in calcified cysts.

Early descriptions of *Porocephalus* infection were given by several other authors, among them by AITKEN, 1866, Jamaica; GIARD, 1896, Saint Louis, Senegal; CHALMERS, 1899, Accra, Gold Coast; BRODEN and RODHAIN, 1907, former Belgian Congo.

#### America

AITKEN's case is of special interest as it concerns a former negro slave who died in Jamaica in 1865 of peritonitis<sup>1</sup>. He had been enlisted about eight months previously from the slave depôt at Rupert's Valley, St. Helena, where slaves captured in slave ships were kept until disposed of.

At autopsy two encapsulated *Porocephalus* larvae were found in the right lung and between 20-30 more on the anterior and posterior surface of the liver.

So far all cases of *Porocephalus armillatus* infection were diagnosed only at autopsy.

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<sup>1</sup> Details of AITKEN's case are given by SAMBON, 1910, pp. 214-215.

## G Maculo — Bicho do cu

*Maculo*, inflammation of the rectum with relaxation of the sphincter, prolapse and gangrene, is only mentioned here as during the 17th and 18th centuries the belief was widespread that the disease was caused by some kind of insect. The itching and the pruritus around the anus which occurred in the first stage were regarded as due to some living organisms; in later stages ulcerations around the anus developed and myiasis might be present.

### *Africa*

The Portuguese name *maculo* is in the opinion of some authors (GUILLOT, 1950) a contraction of the Spanish *mal del culo*, an explanation not accepted by R. MENDOÇA, 1935, who assumed that the word is derived from the Bantu language. Other names are *bicho del culo* (bicho = vermin, insect), *bicho do cu*, *doença do bicho*, *corrução do bicho*.

Maculo is nowadays only of historical interest, although occasionally some cases with clinical symptoms corresponding to maculo are still found in West Africa<sup>1</sup>. African names are *chiufa*, *chinkumbi* and *kanyemba*.

The disease, which mainly affected negroes but occasionally also whites, especially of the lower classes, played a certain rôle in Africa.

Early descriptions from Africa were given by DAPPER, 1686, and by BARBOT, 1732.

### *America*

Maculo was much more important during the 17th and 18th centuries in the New World, especially in Brazil where it had been introduced by negro slaves.

The first description of maculo in Brazil is by PISO, 1648. Subsequently, a number of Portuguese physicians studied the disease in Bahia, the great Brazilian center of the slave trade (see O. DE FREITAS, 1935). Among the early authors are JOÃO RODRIGUES DE ABREU, 1714, LUIS GOMES FERREIRA, 1735, and A. J. ARAUJO BRAGA, 1783. GUMILLA in his *El Orinoco Illustrado* (sec. ed. 1745),

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<sup>1</sup> See ARGUMOSA, 1959, p. 130.

dealing with diseases of Venezuela, expressed the opinion that maculo was not caused by insects. UNÁNUE, 1815, described maculo from Peru.

It occurred as a rule among people, such as negro slaves, who were forced to live in close proximity under very bad hygienic conditions. It was apparently to some extent contagious. Evidently there were different aetiological factors such as amoebiasis, schistosomiasis and *Enterobius* infection.

The disease started with pruritus around the anus. At the same time there was a general mental depression and somnolence, accompanied by fever and severe headache. The patient had diarrhoea or sometimes constipation. Inflammation of the rectal mucosa rapidly developed, the anal sphincter became relaxed followed by a prolapse and gangrene of the rectum.

There also existed the opinion that in maculo the fat of the body was dissolved; therefore the French used the expression 'gras fondu' – 'melted grease' from the aspect of the evacuations.

If not treated properly at the beginning, the disease nearly always ended fatally, the patient dying with great pain.

Treatment consisted in introducing suppositories made of lemon peels and of applying drastic, astringent enemata such as infusions of tobacco-leaves, salt, vinegar, brandy, camphor, black pepper or gunpowder. In Brazil one used also 'herva do bicho' (*Polygonum acre*) and 'mangerioba' (*Cassia occidentalis*). COBO recommended a decoction of *Lucuma verde* – *Lucuma ovobata*. At the very first symptoms one used as a prophylactic measure suppositories of linen cloth with egg, rose-water, sugar and white of lead.

Maculo was conditioned by overcrowding, insufficient, bad food and very unhygienic living conditions such as the slaves had to endure. When the slave trade was abolished, maculo gradually disappeared.

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## PART THREE



## A Diseases and Mortality of White People on the Guinea Coast at the Time of the Slave-Trade<sup>1</sup>

Beware and take care of the Bight of Benin  
For if one comes out, twenty stay in<sup>2</sup>.

The Guinea coast<sup>3</sup> was one of the principal African regions wherefrom slaves were shipped to the New World and where innumerable negroes died as a result of bad and cruel treatment on the 'Path', the march from the interior to the coast and from diseases in the barracoons on or near the shore where they had to wait for the arrival of a slave ship to take them away. For comparison it is of interest to get information about the diseases and the mortality of white people on the Guinea coast on land and on ships. At that time they were in the great majority Europeans.

From the fifteenth century when the Portuguese explored the Gulf of Guinea up to the closing years of the nineteenth century, the Guinea coast had the reputation of being extremely unhealthy for white people (PAZ SOLDÁN, 1941). This evil reputation was fully justified as shown in the following.

Before Cinchona bark and later quinine gradually came into use during the nineteenth century, malaria alone caused the death of very many white people (PAZ SOLDÁN, 1941)<sup>4</sup>.

Besides malaria, dysentery, the 'bloody flux' claimed many victims, especially on crowded slave-ships where crew members got the infection from the slaves. There are many early reports on voyages with information about diseases. In notes 1-3 brief excerpts are given as examples from voyages made in 1552, 1577, and 1588. In the following it will be seen from DANIELL, 1849, that even three hundred years later, in the middle of the nineteenth

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<sup>1</sup> Diseases of white people on the east African coast at the time of the slave trade are not discussed here on account of the limited available space. References will be found in COUPLAND, 1938, and DAVIDSON, 1961.

<sup>2</sup> Old doggerel couplet from the days of the slave-trade.

<sup>3</sup> The Guinea coast included Upper Guinea from Senegambia to the Bight of Biafra and Lower Guinea from Calabar through Camerouns, Gabon, Loango to Angola.

<sup>4</sup> Portuguese, unlike other nations in Africa, used Cinchona bark widely after it had been brought by the Spaniards from South America to Europe.

century, malaria was still extremely prevalent and claimed many lives. DANIELL, 1849, p. 60, writes regarding the Benin river: "When I visited this river in 1839, I found two vessels moored a short distance from its mouth, one of which, within the space of five months, had buried two entire crews, a solitary person alone surviving; the other, which had entered at a much later period, had been similarly deprived of one half of its men, and the remaining were in such a debilitated condition, as to be incapable of undertaking any action or laborious duty. Another vessel sailed from this port, previously to my arrival, in such a deplorable state, as to be solely dependent on the aid of Kroomen to perform the voyage homewards."

MANNIX and COWLEY, 1962, in dealing with the Atlantic slave-trade, provided information on health conditions, sickness and mortality of crew members and slaves on slave ships. They also pictured the life of 'factors' on the coast.

Additional information will be found in JAMES POPE-HENNESSY, 1967.

GELFAND in his *Rivers of Death*, 1965, furnished an interesting review of the mortality rate by malaria on the principal British expeditions chiefly on the African west coast from the last quarter of the eighteenth to the second half of the nineteenth century.

An example of the extremely high mortality of Europeans in an African expedition in the first half of the nineteenth century, which is described by GELFAND, concerns the Niger expedition of 1832-34 carried out with the use of two steam-ships with sails: At the outset the total number of Europeans was 41; of these 32 died (apparently from fever).

Even the British Navy, which in the first half of the nineteenth century was very actively trying to suppress the slave trade<sup>5</sup>, had a high death rate among those serving on ships and those stationed on the West African coast. The mortality in the latter group was 54.4 per 1000 and in 1834 of 792 men serving on seven ships of the Navy 204 died (teste GELFAND, 1965, p. 22).

ALEXANDER BRYSON, who later became Director General of the Naval Medical Service, has the great merit of having emphasized the use of Cinchona bark and later quinine not only for the treatment of malaria but especially also as a prophylactic. The success of BRYSON's recommendations soon became evident.

The sanitary conditions for the crew and officers on slave ships were in general not very different from those on other vessels of the merchant marine. However, there existed certain additional

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<sup>5</sup> The Navy liberated 57,000 slaves between 1825 and 1845.

risks connected with the slave trade. Although the captains tried to remain on the African coast as short as possible, slave ships, in order to obtain the required number of slaves, often had to wait for months until they were filled. In the meantime they frequently remained in the mouth of rivers surrounded by swamps swarming with malaria-carrying mosquitoes. When there were no 'factors' who provided larger numbers of slaves, 'boating', especially on the coast of Upper Guinea, was carried out. Members of the slaver's crew had to go in small boats up the rivers in order to buy slaves inland. It is obvious that this 'boating' system, as it was called, was extremely unhealthy. The small boats had no cover so that in the rainy season the crew was drenched and remained wet for days. They were not only exposed to mosquitoes but, when going on land, might get tick-fever (relapsing fever). There was no proper water supply and by drinking infected water, people got dysentery and occasionally even Guinea worms, which might show themselves long after the vessel had left the African coast.

On board the slave ships' crew and officers frequently became infected by the slaves. Dysentery was greatly feared as it caused many deaths. As an example the 'St. John' (1659) may be mentioned, which is discussed by MANNIX and COWLEY, 1962, p. 63. The vessel went first to the Bight of Biafra and then to the Cameroons. On the return voyage dysentery broke out and the captain and many of the crew died. The surgeon also died and likewise the ship's cooper with the result that the water casks could not be repaired. Only 85 of the original 390 slaves survived.

The cleaning of the rooms where the slaves were kept, full of excrements and other filth, was not only nauseating but also dangerous for those of the crew who had to carry out the task which involved the risk of infection.

Smallpox was another disease which was very much dreaded as it not only often killed a high percentage of the slaves but also members of the crew who were not vaccinated.

The sailors on slave ships often suffered from scurvy on account of their monotonous inadequate saltmeat diet. Scabies was frequently transmitted from slaves to the crew.

On slave ships sanitary conditions and living conditions in general depended as on other merchant marine vessels primarily on the captain. As might be expected, captains of slave ships were with a few notable exceptions often of a hard inhuman kind and had no feeling for the suffering of others. Some were even sadistic monsters who treated not only the slaves but also the crew in an incredible way. Flogging of crew members was common and occa-

sionally resulted in death<sup>6</sup>. It should, however, be pointed out that there were some exceptional captains who were respected and liked by their crew and even to some extent by their slaves (see MANNIX and COWLEY, 1962, p. 139).

Big companies taking part in the slave trade, kept middle-men, so-called 'factors', in small stations on the coast or along rivers. These 'factors' bought slaves from the local merchants or 'kings' and tried to keep them in larger and smaller barracoons ready to be shipped whenever a slave vessel arrived.

Many of these factors were uneducated, degraded people who had no other amusement than heavy drinking and native women. This, together with the hot climate and their exposure to malaria, dysentery and other diseases, ruined them sooner or later. However, like in the case of captains of slave ships, there were a few 'factors' who, very different from the rest, were interested in the native people and their customs, and in the flora and fauna. A few wrote interesting reports which were published and are of permanent value. Here only two outstanding ones may be mentioned: WILLEM BOSMAN, a Dutch trader who became chief 'factor' for the Dutch West India Company at the castle of Elmina. He spent fourteen years toward the close of the seventeenth century in West Africa, travelling along the Guinea coast. He visited Benin and the king of Whydah, who supplied him with a thousand slaves a month. He wrote *A New and Accurate Description of the coast of Guinea* in the form of twenty letters. It was published in Dutch in 1704 and in French and English in 1705.

JEAN (or John) BARBOT designated himself as Agent-General of the Royal Company of Africa and Islands of America at Paris. He made at least two voyages to Guinea between 1678 and 1682. He travelled extensively for his company and made detailed notes of the people and of everything he saw, so that his publication is of considerable interest. As he was by profession interested in the slave trade, he also gave valuable information about details of the trade. He was fully aware of the shortcomings of the negroes, but on the other hand pointed out the often bad and even scandalous behaviour of the foreigners. His work: *A Description of the Coasts of North and South Guinea* was published in volume V of Churchill's *Voyages*.

For more details regarding BOSMAN and JEAN BARBOT, see MANNIX and COWLEY, 1962, and POPE-HENNESSY, 1967.

It is obvious that explorers and other travellers in unknown regions were exposed to greater risks to their health than persons

<sup>6</sup> For details, see THOMAS CLARKSON, *Abstract of the Evidence*, 1791; also MANNIX and COWLEY, 1962, pp. 141-152.

who lived their regulated life in a place where they could obtain medical help in case of need.

However, the example of Freetown in Sierra Leone in the eighteenth century as described by STORRS, 1929, shows that even under such conditions the mortality rate was very high. STORRS based his statements on COLBERY's *Travels in Africa in the Years 1785-1787*, the publication of a French visitor to Sierra Leone. According to COLBERY malignant fevers and dysentery were frequent and very dangerous, especially for newcomers and intemperate Europeans. He believed that the heavy drinking of strong liquors common at that time among British sailors and soldiers contributed much to their high mortality rate. STORRS checked the records of the Colony of Sierra Leone for the eighteenth and the early years of the nineteenth century and found that the average tenure of office of the officials from the Governor downwards was until well into the nineteenth century less than twelve months; either they died or returned home as invalids.

In the cathedral of Freetown, according to STORRS, memorials to governors and other high officials and to officers of the garrison show that almost all of them died before the age of forty, and save a few who died of wounds all succumbed to diseases connected with the fatal climate and their exposure to infections.

From the information outlined in the foregoing one may draw the conclusion that up to the second half of the nineteenth century the Guinea coast was one of the most unhealthy parts of tropical Africa as far as the white race was concerned. On the other hand, the native Africans on the Gulf of Guinea were strong and healthy. Kroomen worked on many foreign ships including later those of the British Navy and other Africans accompanied Europeans on their expeditions; they remained healthy, whereas many Europeans, especially newcomers, fell ill and often died.

### Notes

1. "A voiage made out of England unto Guinea and Benin in Affrike, at the charges of certaine marchants Adventurers of the Citie of London, in the yeere of our Lord 1552." (It was the first voyage to Guinea and Benin.)

Two ships and a pinnace sailed from Portsmouth. They had seven score men and two captains. They anchored before the Benin River, the crew fell ill, sometimes 3, 4 even 5 died in one day.

"And of sevenscore men came home to Plimmouth scarcely forty, and of them many died."

The voyage of M. Thomas Windam to Guinea and the kingdom of Benin Anno 1553. In RICHARD HAKLUYT: The Principal Navigations, Voyages Traffiques & Discoveries of the English Nation, in Twelve Volumes. Vol. VI, Glasgow 1904, pp. 141–154.

2. “The third and last voyage of M. William Towrson to the coast of Guinie, and the Castle de Mina in the yeere 1577.”

They had three ships and a pinnace. On the home voyage they had to abandon one ship near the Cape Verde Islands as it had sprung a leak.

When they checked their men, they found that in all the three ships were not above thirty sound men, near Eglant they had not above six mariners and six merchants in health. They lost sails as no men were left to serve them. – In RICHARD HAKLUYT: The Principal Navigations etc. vol. VI, Glasgow 1904, pp. 231–252.

3. “The voiage set forth by Mr. John Newton, and Mr. John Bird marchants of London to the Kindome and Citie of Benin in Africa, with a ship called the Richard of Arundell, and a pinnesse, in the yere 1588, briefly set downe in this letter following, written by the chiefe Factor in the voyage to the foresaid Marchants at the time of the ships first arrivall at Plimouth.”

They were at Benin presented to the King and traded pepper for elephants teeth.

“In this time of our being at Benin (our natures at this first time not so well acquainted with that climate) we fell all of us into the disease of the fever, whereupon the Captaine send me downe with those goods which we alreadie had received to the rest of our men at Goto: (on the Benin River) where being arrived, I found all the men of our pinnesse sicke also . . . I myself was also in such a weake state that I was not able to returne again to Benin.”

He sent the surgeon and another man to Benin who found the captain and the son of Mr. Bird dead and a third man dying. They had to stop taking cargo. – – – –

The remaining men gradually got better but on the Azores . . . again fell ill and some died.

Signed “Yours to commaund  
Anthony Ingram”

In RICHARD HAKLUYT: The Principal Navigations etc. in Twelve Volumes. Vol. VI. Glasgow 1904. pp. 458–461.

Additional information on diseases of white people in Africa at the time of the slave trade will be found in publications listed in Part I *Different kinds of Early Documentation* (Notes and References).

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## **B Representation of Parasitic Diseases and Parasites in Early African and pre-Columbian American Art**

### *General Statements*

Within the frame of this publication even a very brief outline of early African and American art cannot be given. Only a few points which have a direct bearing on the subject under discussion will be mentioned.

Among the works of art – sculptures and paintings – created in the course of time in many countries, there are comparatively very few representing parasitic infections and diseases due to parasites. The obvious explanation is that certain diseases or pathological conditions such as paralysis of facial muscles, club-foot, tumors, blindness are easily noticed and were reproduced. On the other hand, most parasitic diseases or infections have no external characteristics which were widely known and could be shown in a work of art. When, however, external characteristics existed in parasitic infections, they were, similarly to the case of non-parasitic diseases, utilized by the artist for reproduction; examples are elephantiasis, gangosa, uta and syphilis.

### *I. Early African art*

Representations of parasitic diseases in the art of ancient Egypt and in early African art south of the Sahara are discussed separately on account of the numerous fundamental differences.

#### A. Egypt

There are a number of statues and reliefs showing signs of non-parasitic diseases and pathologic conditions, for example Pott's disease, atrophy of leg muscles, umbilical hernia, achondroplasia, blindness (many illustrations in GHALIOUNGUI and EL DAWAKHLY, 1965). Representations of parasitic infections, on the other hand, are very rare.

*Different Infections*

## Schistosomiasis

GHALIOUNGUI, 1962, 1963, as mentioned before, described reliefs of two tombs of the Ancient Empire in Sakkarah with figures showing certain pathological changes which GHALIOUNGUI believes are probably caused by schistosomiasis (see chapter on blood-flukes).

## Elephantiasis

In the Egyptian Museum in Cairo there is a statue in painted sandstone of Pharaoh Mentuhotep III (1998–1991 B.C.) of the XIth dynasty with a great symmetrical enlargement of both legs. As elephantiasis usually does not affect both legs equally, it is doubtful whether the statue represents a case of elephantiasis as assumed by RIAD, 1955, p. 62.

## Tick infestation

D. R. ARTHUR, 1965, published and illustrated what is possibly the oldest record and the oldest figure of ticks. It concerns a fragment of the head of a hyaena-like animal from an Egyptian tomb dating from the eighteenth Dynasty, about 1500 B.C. ARTHUR pointed out three excrescences on the inside of the ear and gives reasons for considering the possibility of these excrescences representing ticks. (For additional details, see chapter on ticks.)

## B. Africa south of the Sahara

The literature on African art has become very large and only a few publications with numerous bibliographic references are given in the following: ELISOFON and W. FAGG, 1958; GABUS, 1967; GOLDWATER, 1964; HIMMELHEBER, 1960; HOLAS, 1960; LEUZINGER, 1959, 1963; PAULME, 1956; WILLETT, 1967.

*General remarks*

Regarding statues, two different ways of representation can be distinguished:

a. The *pole style*, a kind of cubism, essentially a composition of spheres, cylinders and cones. By the pole style it is possible to attain the greatest power of expression by means of the simplest forms and a minimum of surfaces. The figure gives the impression of a compact block and is constructed from stereometric forms.

b. The *round style*, a realistic and expressive style. The artist, however, is not merely copying nature. Everything essential is accentuated in an expressive way, the natural proportions are disregarded, the head is frequently oversized<sup>1</sup>.

Frontal posture is the rule. The figures do not show movement to a great extent. They appear generally immobile but often with a certain dignity, especially the ancestral statues.

Some sculpture is highly abstract, for example that of the Bakota in Central Africa. Sculpture of the Yoruba and Ekoi tribes, on the other hand, is more naturalistic. Essentially different are the terracotta heads of the Nok culture and the bronze heads of Ife.

The great majority of African figures and masks are wood carvings. The single figure is shown standing, sitting or kneeling. The figures vary in size from half life-size to small statuettes which were kept in the family home. The larger figures were placed in shrines or on graves.

The ancestral figure is of special importance. It is the dwelling place of the spirit of the dead who can protect and assist, and also punish a person. The ancestral figure requires respect, it receives offerings and by incantation and magic, it is supposedly possible to communicate with the dead.

Other figures represent great chiefs of the past, mythological heroes and demons.

'*Fetish*' figures are regarded as having magic power in themselves. They can protect and help the owner but also attack an enemy. The fetish is usually a small wooden figure which may be decorated by painting, by glass beads and feathers. Some fetish of the Senufo are covered by a piece of cloth so that only the feet of the wooden figure are visible, feathers are fixed on the top of the head. The power of the fetish is often supposedly contained in some magic substance placed in a hole in the fetish figure or put in a small sack attached to the figure. The owner tries to please the fetish by rubbing it with palm oil, by painting it or by giving it various offerings.

'*Amulets*' may be of very different shape and material; they are chiefly worn for protection.

'*Masks*' play a very great rôle in the life of the negroes. Most African masks are carved from wood. Occasionally other materials were used; metal masks, chiefly of bronze, were used by the Senufo. Among tribes which are famous for the carving of masks

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<sup>1</sup> The remarks on style are based on E. LEUZINGER, 1963, pp. 20-23; see also VON SYDOW, 1930.

are the Baule, Guro, Senufo, Dan and Kran in the Ivory Coast, the Bambara in Mali, the Ogowe River and Cameroon tribes and the Bayaka and Bapende in the Congo. (See: HARLEY, 1950, and HIMMELHEBER, 1960.)

The design of the mask may be abstract or realistic, it may have been originally determined by magic and myth or more rarely by symptoms of diseases. The masks are often painted brown or black, with or without additional colours. Ibo and Ogowe tribe masks, representing dead people, are frequently white. Masks may be overlaid by various materials.

Different from the statues with their static quiet dignity, the masks have an underlying dynamic quality. They are worn with a gown which covers the bearer completely. They are full of magic power and when worn at ceremonial dances are regarded as being the spirit of the ancestor or of the demon which they represent. Masks should inspire fear. The bearer after dancing and moving in various ways often speaks in an unnatural voice, supposed to be that of the spirit.

Masks are used for many purposes; here we are only concerned with their relation to medicine. Masks with realistically represented signs of a certain disease are regarded as being able to cause and to cure it and are therefore used for treatment. Unrealistic masks likewise are supposed to cure diseases by magic (note 1).

A person wearing a mask and gown should neither be recognized nor touched. Masks, when not used, were usually kept in a certain place under the custody of a respected number of the community, frequently a blacksmith.

From the foregoing it will be understood that for our purpose, the early representation of parasitic diseases, statues in a realistic style and likewise realistic masks are of special interest.

Representations of parasitic diseases in Negro art in as far as they are known at present date from the time of the Nok culture (c. 500 B.C.—A.D. 200) to the twentieth century.

### *Different Infections*

#### *Gangosa, Nasopharyngitis mutilans (tertiary yaws)*

The mutilations of nose and mouth due to tertiary yaws were reproduced in terracotta heads and wooden masks. A terracotta head, 10.2 cm high, is kept in the Ife Museum, Nigeria (plate V). It has been dated provisionally as belonging to the 12th–14th centuries and resembles some of the small terracotta heads from

Esmeraldas, northern Ecuador, representing face mutilations caused by American leishmaniasis (plates II, III, and IV).

The most impressive representation of gangosa in African art is found in realistically carved masks of different regions on the West African coast, especially in southeastern Nigeria (plate VI). They have been described in some detail by SIMMONS, 1957, from the Ibibio tribe in the Ikot Ekpene district of the eastern region of the Federation of Nigeria. Masks showing gangosa lesions are mentioned also by STEINMANN, 1943, by HARLEY, 1950, and by HIMMELHEBER, 1960.

In a larger collection of these masks, it is not difficult to trace the different stages of the mutilations due to gangosa. There are also unrealistic masks apparently inspired by gangosa (plate VII).

### *Sleeping sickness – trypanosomiasis*

In endemic regions the natives knew for centuries by experience that sleeping sickness was nearly always fatal. Amulets were worn for protection against sleeping sickness. The Wellcome Historical Medical Museum in London has an amulet made from an iron sheet, folded and ridged to imitate the tip of an antelope horn, supposed to have been made by the Bapende.

On plate I we illustrate an unusual wooden Fetish statuette from Gabon used for magic treatment of sleeping sickness. The figure is a realistic representation of a very emaciated woman.

(The figure has already been reproduced by HOEPLI and LUCASSE, 1964).

### *Elephantiasis – Wuchereria bancrofti infection*

We give representations of elephantiasis of the scrotum from different periods.

a. The Museum of Jos, in Northern Nigeria, has a terracotta statuette (torso) with a considerable enlargement of the scrotum (plate IX). This figurine is very simplified and belongs to the Nok culture (c. 500 B.C.–A.D. 200). The area in which this culture has so far been found lies across the Niger and Benue valleys mostly north of their confluence (B. E. B. FAGG, 1959 [J. hist. Soc. Nigeria, 1, No. 4]).

b. The torso of a terracotta statuette of a fettered man with great enlargement of the scrotum is kept in the Museum of Ife in Nigeria (plate X). It is 28 cm high and probably contemporary with the naturalistic art of Ife, provisionally dated 12th–14th cen-

turies. The fetters of the legs are lying over the enlarged scrotum. They are formed like flat-sectioned metal strips, almost certainly iron. The figure is from the grove and shrine of Osongongon Obamakin (information kindly supplied by Mr. B. E. B. Fagg and Mr. F. Willett). It has been reproduced by WILLETT, 1967, plate 40. He gives on figure 7, page 63, also the picture of a hand and a foot from a terracotta sculpture of a person with elephantiasis.

c. Yoruba bronze<sup>2</sup> figure in the British Museum of a sitting man, 20 cm high, in the style of Abeokuta with elephantiasis of the scrotum (plate XI).

The figure is about 80–100 years old. A practically identical bronze figure is kept in the Wellcome Historical Medical Museum in London.

d. Ashanti goldweight, 6 cm long, brass. A naked beggar with great enlargement of the scrotum is sitting with outstretched legs on the ground; the left arm is broken off at the elbow; a large bowl is standing between his feet. Pitt Rivers Museum Oxford (Plate XII). For Ashanti Goldweights, see M. WEBSTER PLASS, 1967 (note 2).

e. Treatment of elephantiasis scroti. Group of three small brass figures, size 7×8 cm (plate XIII). A man with enlarged scrotum is standing above a kettle. His right arm is held by his wife, the left one by a male person, probably the medicine-man. This group of small brass figures was found in the local market in Fouban in the Bamun area of Cameroons. Collection of Dr. L. J. Bruce-Chwatt, London (Modern).

### *Worm infection*

Fetish statuette used for treatment of worm infection (plate XIV). It is a conventional figurine from the Congo in the pole style.

### *Delousing*

A sitting woman is holding her child on her left arm (plate XIX). The child is evidently occupied with picking lice from the mother's head. Height 56 cm. North-western Baluba, eastern Congo. The statue belongs to the Rietberg Museum in Zurich and has been reproduced in: African Sculpture, a Descriptive Catalogue by E. LEUZINGER, 1963.

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<sup>2</sup> Bronze: Most of the African 'bronzes' are not bronzes in the strict sense of the word, but are 'brass' in various compositions, or more rarely copper (see WILLETT, 1967, p. 55).

### *Ticks*

A highly simplified terracotta tick dating from the Nok culture (c. 500 B.C.—A.D. 200) is kept in the Museum of Jos in Nigeria (plate XX).

The publication by D. R. ARTHUR, 1965 (dealing with art in Egypt) has already been mentioned. The author found three excrescences on the ear of an animal head in a tomb of the eighteenth Dynasty (about 1500 B.C.) and considers the possibility that they represent ticks.

### *Addendum*

#### *Terracotta pots to hold medicine powder*

Pot to hold medicine powder for the treatment of scabies (plate XXI). These pots are made by the Cham people in Bauchi Province, Northern Nigeria. The powder is put in the pot and blown by the medicine man on the patient. The pots have different shape for different diseases and are still made at present (note 3).

#### *Representation of slaves*

Elephant tusk with carvings of slaves secured with chains; spiral arrangement of the carvings, made probably between 1800–1850 for some foreigner (plate XXII). British Museum, London (see also FAGG, FORMAN and FORMAN, 1959).

Bronze-statuettes of a naked young negro with hands fettered behind his back (plate XXIII). Alexandrian art, Egypt, second century B.C. Musée du Louvre, Paris.

Numerous illustrations of African slaves are found in Beardley. *The Negro in Greek and Roman Civilization*, New York, 1967 (first published 1929).

## *II Early American art*

Only Mexico, Ecuador, and Peru are considered.

Reproductions of parasitic diseases and parasites in Mexican art are very rare. We mention a mural painting showing skin lesions, possibly due to syphilis, yaws, or exanthematic typhus and reproductions of fleas in terracotta and stone.

In Esmeraldas, the northern province of Ecuador, many small terracotta heads and also statuettes were found, some with realis-

tically reproduced mutilations of the face probably due to leishmaniasis.

Peruvian ceramic art of the well known Mochica pottery (note 4) has created most interesting reproductions of people and various scenes of life of the pre-Inca period, c. A.D. 400–900. Among the anthropomorphic vessels – ‘Huacos’ – there are numerous specimens showing different pathological conditions and diseases including parasitic infections (DIETSCHY, 1938, pp. 2012–2017; MARTÍNEZ DURÁN, 1964, pp. 87–91).

### *Different Infections*

#### *Uta – American Leishmaniasis<sup>1</sup>*

American leishmaniasis in different forms existed from Mexico southward to the northern part of Argentina with numerous cases of uta in Peru. Uta was already described in 1571 by PEDRO PIZARRO (1917).

Huacos showing destruction of nose and lips in various stages may be seen in a number of museums in America and Europe. They attracted special attention in the last decade of the nineteenth century and caused a considerable controversial literature. Some huacos possibly represent punitive mutilations. (See ASHMEAD, 1898, 1900, 1901 and the chapter on cutaneous leishmaniasis.)

A Peruvian huaco with changes which may be regarded as due to uta is illustrated on plate IV.

Destruction of the nose in a terracotta figure and a small terracotta head from Esmeraldas, representing leishmaniasis, are shown on plates II and III.

#### *Bubas: Syphilis – Yaws*

A fragment of a mural of about A.D. 200–300 in a ruined building at Atetelco–Teotihuacán shows a human figure with deformed legs and dark spots over the entire body (plate VIII). These spots apparently represent an exanthema or multiple ulcers and are the reason why the figure is known as the ‘*Buboso*’ among the local people.

As smallpox and measles were introduced into Mexico only in the first half of the sixteenth century, the picture of the ‘*Buboso*’ which was painted between A.D. 200 and 300, cannot represent

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<sup>1</sup> Espundia closely related to uta does not require a separate discussion in as far as representation in art is concerned.

these two diseases. Typhus<sup>2</sup> was endemic at the time of Cortés; we know that several severe epidemics of not determined diseases existed in Mexico, centuries before the Conquest and *matlazahuatl* (typhus) may have been one of them.

It is impossible to make a differential diagnosis from the highly stylized mural which could represent exanthematic typhus, syphilis or yaws. The picture is of unusual interest. Should future research show that typhus can be excluded, the mural might be one of the earliest representations of *bubas*, a treponema infection (note 5).

It should be added that WEISS and GOLDMAN, 1954, described from two pre-Columbian anthropomorphic ceramic vessels ulcerative lesions in the upper third of a leg which the authors regarded as possibly representing syphilitic gummata.

### *Ascaris*

The *Historia General de las Cosas de Nueva España* by FRAY BERNARDINO DE SAHAGÚN contains in the *Codice Matritense del Real Palacio* two pictures (plate XV), one of a man and the other of a dog, discharging large intestinal worms, apparently *Ascaris*, as far as one can judge from the rather primitive illustrations (note 6).

### *Elephantiasis – Wuchereria bancrofti*

A small clay figurine found together with six others buried under the floor of a sanctuary in a temple of about A.D. 500 in the ruins of Dzibilchaltun (northern Yucatán) shows enlargement of the scrotum as far as one can judge from the photographic reproduction in the publication of ANDREWS, 1959 (see chapter on elephantiasis). All seven figurines exhibit some deformity.

### *Nigua – Sandflea infection. Tunga penetrans*

Representations of *Tunga penetrans* infection in Mochica pottery are very rare. At present the writer knows only of three huacos showing people examining the soles of their feet with small holes wherefrom sandfleas supposedly have been removed.

The first illustration of such a vessel was given by TELLO, 1924, p. 65. Two similar vessels from Pachacamac and Marque, Peru,

<sup>2</sup> Exanthematic typhus was called by the Spaniards '*tabardete*' or '*tabardillo*'; the Indian name was '*matlazahuatl*'.

are kept in the American Museum of Natural History in New York. They have already been reproduced by MOODIE, 1923, and are illustrated here on plate XVI.

### *Fleas*

A large pre-Columbian terracotta flea is kept in the private Rafael Larco Herrera Collection in Lima, Peru<sup>3</sup>.

The Museo de Antropología e Historia in Mexico D.F. possesses several reproductions of fleas. The flea shown on plate XVII, fig. a, is of terracotta of about A.D. 300–800. Plate XVII, fig. b, shows a larger flea in white stone of about A.D. 1200–1500.

### *Louse infection – Delousing*

A Mochica huaco belonging to the Museo Nacional de Antropología y Arqueología in Lima is illustrated on plate XVIII. It shows a woman with large lice on her gown. Her protruding canine teeth indicate that the lice will be killed. This vessel was already illustrated by TELLO, 1924, p. 24.

The increasing interest in pre-Columbian American art has stimulated a considerable number of publications. We mention here only: CHRISTENSEN, 1955, LEHMANN, 1959, and DISSELHOFF and LINNÉ, 1960. D'HARCOURT, 1939, dealing with medicine in ancient Peru, included references to works on the representation of diseases in art. These four mentioned publications have large bibliographies.

### *Discussion*

In comparing early African and pre-Columbian American art regarding representation of parasitic infections and parasites we find some terracotta sculptures with reproductions of face mutilations due to gangosa and uta respectively in very similar execution.

On the other hand, African masks reproducing gangosa have no counterpart in American masks regarding American leishmaniasis.

The writer has not found figures showing elephantiasis of the scrotum in Mexico, Ecuador and Peru such as were produced by African artists since the time of the Nok culture, about 2000 years ago<sup>4</sup>.

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<sup>3</sup> The writer regrets that the owner did not allow to take a photograph.

<sup>4</sup> See chapter on elephantiasis (Dzibilchaltun).

It has been mentioned before that elephantiasis has not been described by the early Spanish chroniclers dealing with diseases of the native population shortly after the Conquest. Some modern authors therefore doubt that *Wuchereria* infection existed in Central- and South America before the arrival of the Spaniards with their slaves (ASHBURN, 1947).

Certain ectoparasitic infections and ectoparasites have been reproduced by American and African artists. Mochica vessels show pediculosis and nigua infection; reproductions of fleas have been found in Peru (terracotta) and in Mexico (terracotta and stone). On the other hand, a highly simplified terracotta tick of the Nok period was discovered in northern Nigeria, and excrescences on the ear of a hyaena-like animal from an Egyptian tomb dating from the 18th Dynasty (about 1500 B.C.) may possibly represent ticks.

Delousing is shown in an African realistic wooden statue and in Mochica pottery.

The mural of a 'buboso' dating from A.D. 200–300, discovered in Atetelco (Teotihuacán) leaves the question open, whether it represents a case of syphilis, yaws or exanthematic typhus. It is of special interest as it is probably the earliest picture of its kind.

### *Notes*

1. Masks, both abstract and naturalistic ones, were used for magic treatment of diseases in many parts of the world, for example in Ceylon, India, Indonesia, Brazil, among the Red Indians of North America and Eskimos, in the Altai (Siberia) and in Tibet. The Kabeua in north-west Brazil used a mask in the shape of a blue butterfly which was supposed to represent the demon of malaria and to be able not only to cause the disease but also to cure it (STEINMANN, 1943).

2. In this connection it may be mentioned that negro art has produced various non-parasitic insects. Bronze objects excavated at Igbo-Ukwu, Eastern Nigeria, are decorated with crickets, flies, and various kinds of beetle (FIELD, 1940; SHAW, 1960; WILLETT, 1967). Scorpions and cicadas are represented in Ashanti gold-weights (HIMMELHEBER, 1960; WEBSTER PLASS, 1967).

Regarding American art we have already mentioned the design of a swarm of mosquitoes on Mimbres pottery.

3. Mr. B. E. B. Fagg, in a letter to the author, dated 14th December 1962, quoted with his kind permission, stated the following:

“On the question of the decorated vessels used for medicinal purposes, these are from the Tangale Waja Independent District of the Gombe Division in Bauchi Province and made by the Cham

and Longudu. There is practically no possibility at the moment of ascertaining how far back this pottery tradition of the Cham is likely to go, but in any case it would be very difficult to assume that the specific diseases you mention were related to an absolutely specific type of pottery which would not have changed over the years.”

The pots in their different forms are interesting and unusual, but as seen from the quoted letter, cannot be used as evidence that a specific disease existed in the fairly remote past.

4. Mochica is also known as Muchik. Mochica pottery has been found in the main valleys of the north coast of Peru. Mochica style may be regarded as a unified group in which early, middle and late stages are included. The characteristic anthropomorphic huacos are stirrup-spout vessels; outstanding among them are portrait heads.

5. In the *Codex Telleriano-Remensis* patients of the smallpox epidemic of 1538 are pictured covered by black spots. Smallpox was introduced into Mexico in 1519; some years later the introduction of measles followed.

Another disease, ‘matlazahuatl’, exanthematic typhus, was endemic at the time of Cortés. In the *Codex Magliabecchi* an Indian suffering from matlazahuatl is shown with brown spots over the entire body (SOMOLINOS D’ARDOIS, 1961, plate 3). Typhus was already known to the Spaniards, and the first book of medicine published in Mexico, the *Opera medicinalia* of FRANCISCO BRAVO, is chiefly dealing with typhus.

6. The Sahagún codices are a group of manuscripts written by the Franciscan friar, BERNARDINO DE SAHAGÚN (1499–1590). He arrived in Mexico in 1529 and having mastered the language of the Indians, he devoted many years of his life to the preparation of his work. He obtained personally his information from the Indians and checked his statements very carefully. His work is very accurate and reliable. A detailed discussion of SAHAGÚN’S manuscripts was given by GUERRA, 1966. Here it will be sufficient to mention that there are essentially three different manuscripts: The first one written between 1558–1560 is known as *Primeros Memoriales* or *Tepepulco MS.*; the second are the *Codices Matritenses* or *Tlatelolco MS.*; the third one is the *Florentine Codex* or *Tenochtitlan MS.* It should be kept in mind that the various editions show certain differences. Regarding the numerous editions and translations into different languages, the reader is referred to GUERRA, 1966.

Our pictures of a man and a dog discharging large intestinal worms are copied from the facsimile edition of the *Codice Matri-*

*tense del Real Palacio* published by FRANCISCO DEL PASO Y TRONCOSO in 1906 at Madrid. They correspond to the figures on plate XCV with number 341 and refer to the text of chapter V of book XI, section 13<sup>5</sup>.

It may be added that the *Hortus Sanitatis* of JACOB MEYDENBACH, first published in Mainz in 1491, gives a somewhat similar picture of a man in a squatting position from whose anus large worms are passing out.

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<sup>5</sup> The writer is greatly obliged to Dr. G. Somolinos d'Ardois, Mexico D.F., for having procured the photographic copies.

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## CONCLUSIONS

From the study of early documentation of human infections and diseases caused by zooparasites in Africa and the Western hemisphere and their transmission by the slave trade, the author draws the following conclusions:

*Autochthonous in Africa:* Sleeping sickness, cutaneous leishmaniasis, malaria, amoebic dysentery, louse-borne relapsing fever and African tick fever, yaws, endemic and venereal syphilis.

Infection with *Ascaris*, *Enterobius*, *Trichocephalus*, *Ancylostoma duodenale*, *Necator americanus*, *Wuchereria bancrofti*, *Loa loa*, *Dracunculus medinensis*, *Onchocerca volvulus*, *Schistosoma haematobium*, *Schistosoma mansoni*, *Taenia saginata*, *Hymenolepis nana*, Leeches.

Mosquitoes, Sandflies, Surret flies (*Tabanidae*), Tsetse flies (*Glossina sp.*), a blood-sucking fly larva, the Congo floor maggot of *Auchmeromyia luteola*, myiasis due to the Tumbu fly *Cordylobia anthropophaga*, *Sarcoptes scabiei*, *Ornithodoros sp.*, fleas, lice, bedbugs, *Porocephalus*.

*Autochthonous in America:* Cutaneous leishmaniasis, relapsing fever, carate, yaws, endemic and venereal syphilis; infection with *Ascaris*, *Trichocephalus*, *Onchocerca sp.*; Mosquitoes, Sandflies, larva of *Dermatobia cyaniventris*, *Sarcoptes scabiei*, *Ornithodoros sp.*, lice, fleas, *Tunga penetrans*.

*Doubtful whether the following infections existed in America before the arrival of the Spaniards and their African slaves:* Malaria, amoebic dysentery, *Wuchereria bancrofti*, bedbugs.

*Slaves introduced the following infections, some of which occurred already in the Western Hemisphere before the Conquest:* Malaria, amoebic dysentery, yaws, endemic and venereal syphilis – *Ascaris*, *Enterobius*, *Trichocephalus*, *Ancylostoma duodenale* and chiefly *Necator americanus*, *Wuchereria bancrofti*, *Dracunculus medinensis*, *Onchocerca volvulus*, *Schistosoma mansoni*, tapeworms – *Sarcoptes scabiei*, lice, fleas.

*A parasite introduced by African slaves into the Western Hemisphere which gradually died out: Dracunculus medinensis.*

*Addition*

1. African slaves with sleeping sickness in its initial stage were occasionally shipped to the West Indies and the American continent where they died in due course. Likewise slaves with *Loa loa* infection were sent to the Western Hemisphere. The infection did not spread and after cessation of the slave trade no more *Loa*-infected negro slaves were observed in the New World. One may assume that they all had contracted the infection in Africa.

2. Bedbugs did apparently not exist in Central and South America before the Conquest. They were probably introduced by the Spaniards and Portuguese. For a considerable time parts of South America, for example Peru, were free from bedbugs, which in the course of time by increased communications spread everywhere.

3. The sandflea, *Tunga penetrans*, occurred originally in South and Central America, wherefrom it was carried to a few limited regions in Africa probably already in the seventeenth century, possibly earlier. It did not spread in Africa up to 1872, as the infected places were small and had practically no communication with the surrounding regions. In 1872, *Tunga penetrans* was re-introduced by the British ship *Thomas Mitchell* from Rio de Janeiro to Ambriz (Angola) and with the increased communication at that time spread rapidly, first along the African West Coast and later across the continent to the East Coast.

4. A number of comparatively small scattered communities of African negroes, such as Balboa found on his march to the Pacific, existed in Central and South America in pre-Columbian time. These negroes were probably gradually exterminated by the local Indians or vanished by intermarriage.

5. Foreigners at the Guinea coast, connected with the slave trade, had a high mortality rate due to diseases, especially malaria and dysentery. These diseases played still a very important rôle regarding foreign expeditions in the 19th century.

6. African and pre-Columbian American artists reproduced the signs of a number of parasitic diseases and parasites in terracotta, wood, bronze (brass) and stone.

In Africa reproductions of elephantiasis scroti in terracotta and bronze were especially frequent and go back 2000 years to the time of the Nok culture (c. 500 B.C.–A.D. 200). There are naturalistic wooden figures showing sleeping sickness and delousing apart from many simplified fetish figures. Face mutilation by Gangosa was frequently reproduced in wooden masks and also

in terracotta heads. A highly simplified terracotta tick, kept in the Jos Museum in Nigeria, belongs to the Nok culture.

Excrescences on the inside of an ear of a hyaena-like animal from an Egyptian tomb of about 1500 B.C. at Western Thebes may represent ticks.

In America pre-Columbian artists reproduced in Mochica vessels face mutilations, some probably due to leishmaniasis (*uta*), furthermore infection with lice and *Tunga penetrans*. Face mutilations caused by leishmaniasis are also shown in terracotta heads from Esmeraldas, northern Ecuador. Fleas were reproduced in terracotta and stone in Peru and Mexico.

A mural of about A.D. 200–300 in a ruined building at Atetelco-Teotihuacán, Mexico, shows a person with an exanthema which may represent bubas or exanthematic typhus.

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## ILLUSTRATIONS

PLATE I

Fetish statuette, wood, representing sleeping sickness. Height 22 cm. Realistic representation of a highly emaciated woman with umbilical hernia; left forearm missing. The feet have not been carved out, the lower parts of the legs fuse with the base. The figure shows traces of colouring. Style ossyeba or post-ossyeba of Pahouin art. The statuette which is certainly old, was found in 1929 in the possession of a Pahouin witch doctor of the Eboulamon region of the Abanga river in Gabon. Collection of Mr. J. M. Pitres, Bruges, Gironde, France.



PLATE I

PLATE II

Figure (torso) terracotta, leishmaniasis, destruction of nose. Height 12 cm. Esmeraldas, Ecuador. Museum Rietberg, Zürich, RSA 208. Photo B. Moosbrugger. Courtesy of the Museum Rietberg.



PLATE II

PLATE III

Head, terracotta, leishmaniasis. Height 7 cm. Destruction of nose and lips. Collection of Dr. Luis A. León, Quito, Ecuador.



PLATE III

PLATE IV

Head, Mochica pottery, destruction of lips. Height 20.5 cm. 4th century A.D. Northern Coast of Peru. Courtesy of the Museo Nacional de Antropología y Arqueología, No. 35/1389 (Al. II 1500). Lima, Peru.



PLATE IV

PLATE V

Head, terracotta, with mutilated face, probably representing Gangosa. Height 10.2 cm, about 12th–14th century, found in the Iwinrin Grove at Ife. Ife Museum. Reproduced by permission of the Director of Antiquities of the Federal Republic of Nigeria.



PLATE V

PLATE VI

Mask, wood, ulceration on left cheek. Yaws? Private collection. Lagos, Nigeria.



PLATE VI

PLATE VII

Mask, wood, mutilated face, unrealistic, possibly inspired by Gangosa mutilations.  
'Goun, Gran Popo – Dahomey. Collection Musée de Dakar, Sénégal. Cliché I.F.A.N.,  
photo D. Cherif.' Courtesy of the Musée de Dakar.



PLATE VII

PLATE VIII

'Buboso.' Fragment of a mural in a ruined building at Atetelco-Teotihuacán, Mexico. 2nd-3rd century A.D. The dark spots may indicate exanthematic typhus or bubas. The feet are pathologic. Together with the dark spots they may give the impression that a case of leprosy is represented. Leprosy, however, was only introduced into Central America at the time of the Spanish Conquest.



PLATE VIII

PLATE IX

Figure (torso), terracotta, Nok culture (ca. 500 B.C.–A.D. 200). Height 11.5 cm, elephantiasis scroti. Museum of Jos, Nigeria. Reproduced by permission of the Director of Antiquities of the Federal Republic of Nigeria.



PLATE IX

PLATE X

Figure (torso), terracotta, elephantiasis scroti. Height 28 cm. The legs are fettered and the chain lies over the scrotum. The figure is probably contemporary with the naturalistic art of Ife, provisionally dated 12th–14th centuries. The figure is from the grove and shrine of Osangongon Obamakin and is kept in the Ife Museum. Reproduced by permission of the Director of Antiquities of the Federal Republic of Nigeria.



PLATE X

PLATE XI

Yoruba bronze figure of a sitting man with elephantiasis scroti in the style of Abeokuta. Probably about 80 years old. Height 20 cm. British Museum, London. By courtesy of the Trustees of the British Museum.



PLATE XI

PLATE XII

Ashanti Goldweight, brass, 6 cm long. A naked beggar with elephantiasis scroti is sitting with outstretched legs on the ground, holding a bowl between his feet, left arm broken off (Pitt Rivers Museum Cat. No. 1947.7.15.1). Reproduced by permission of the Curator, Pitt Rivers Museum, Oxford.



PLATE XII

PLATE XIII

Group of three figures showing treatment of elephantiasis scroti; brass. The patient is standing above a kettle, supported on his right by his wife, while a male figure, apparently the medicine man, holds his left arm. Size  $7 \times 8$  cm. Found at the local marked in Foumban, in the Bamunarea of Cameroon. (Modern.) Collection Dr. L. J. Bruce-Chwatt, London.

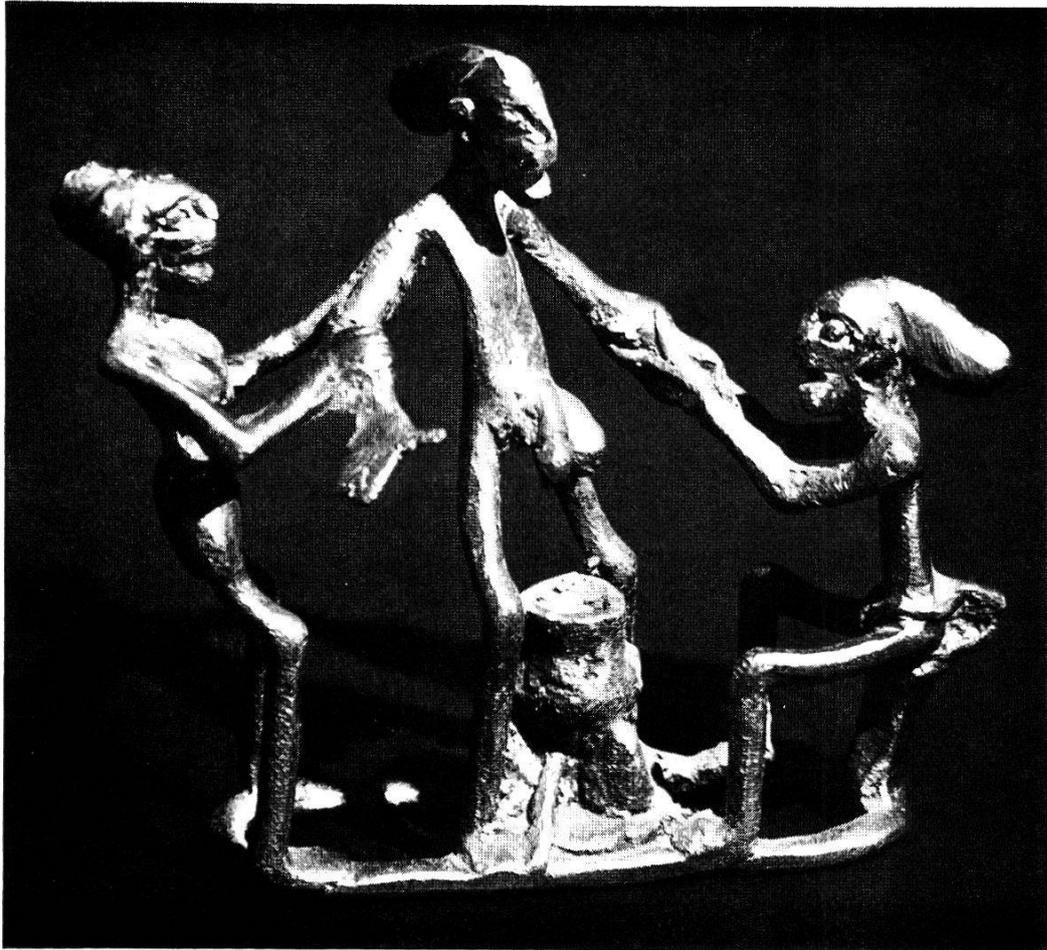


PLATE XIII

PLATE XIV

Fetish statuette, wood, used for treatment of intestinal disturbances, supposedly due to worms. Height 25 cm. Tribe Suku. Locality: Kimbongo. No. 2249 of the collection of the Jesuit Fathers in Leuven, Belgium.

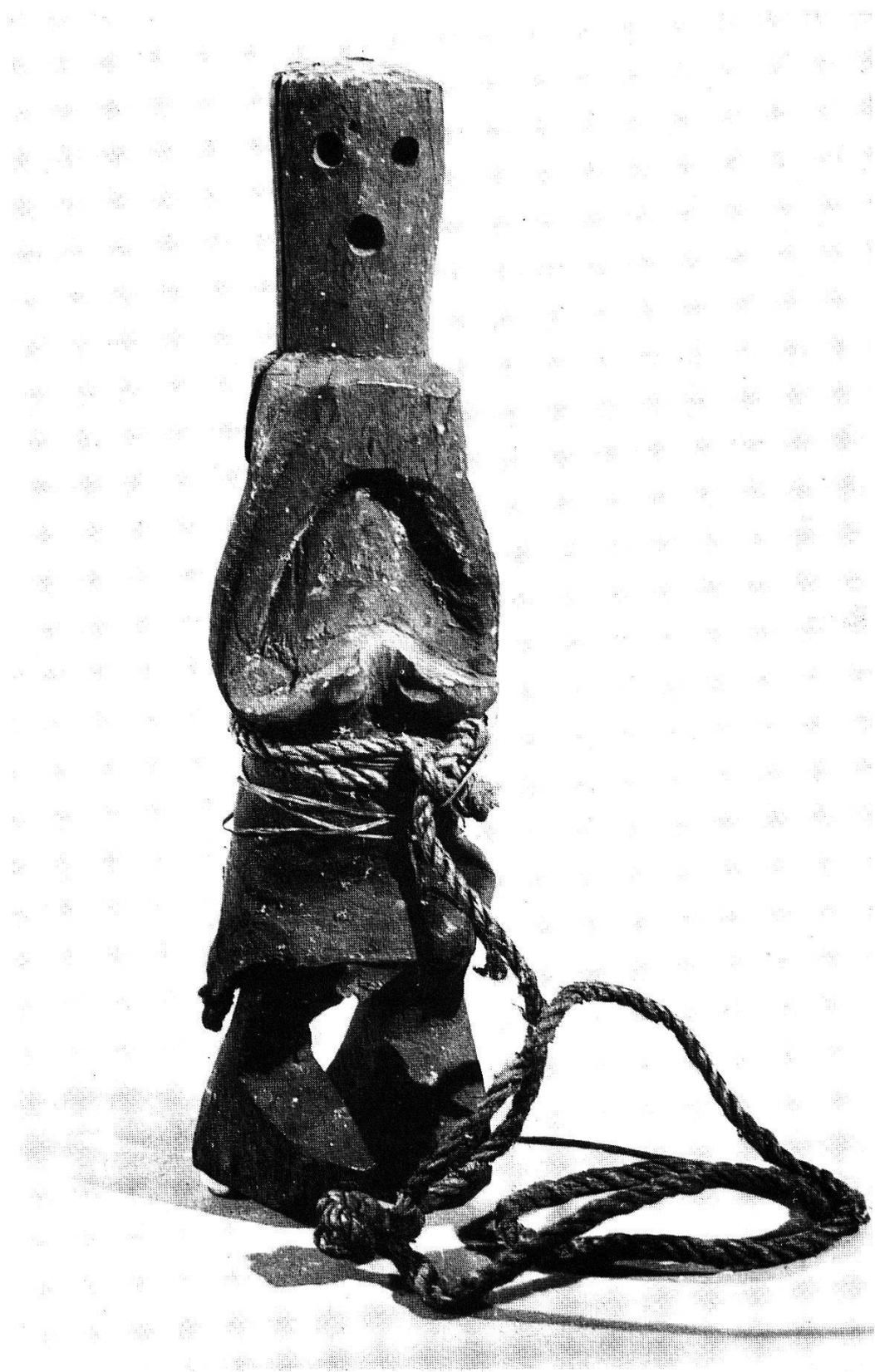


PLATE XIV

PLATE XV

Man and dog discharging intestinal worms. Illustrations in the Codice Matritense del Real Palacio of Bernardino de Sahagún's *Historia General de las Cosas de Nueva España*. Reproduction from the facsimile edition, prepared by Francisco del Paso y Troncoso in Madrid in 1906. (Fototipia de Hauser y Menet.)



PLATE XV

PLATE XVI

Two pottery vessels, from Pachacamac and Marque, Peru. Two persons examining the soles of their feet showing holes wherefrom sandfleas have supposedly been removed. Kept in the American Museum of Natural History, New York. Courtesy of the American Museum of Natural History.



PLATE XVI

PLATE XVII

Two fleas. Above: Flea in terracotta. Height 20 cm. Western Mexico, ca. A.D. 200–800.  
Below: Flea in white stone. Length 50 cm. Mexico, ca. A.D. 1200–1500. Courtesy of  
the Museo Nacional de Antropología e Historia, Mexico D.F.



PLATE XVII

PLATE XVIII

Delousing. Woman with large lice on her garment. They supposedly dropped from her hair while she was delousing herself. Mochica pottery, fourth century A.D., northern coast of Peru. Measurements: 227 mm × 107 mm. Courtesy of the Museo Nacional de Antropología y Arqueología, No. 1/2862 (802). Lima, Peru.



PLATE XVIII

PLATE XIX

Delousing. Mother and child; wood. Height 56 cm. A mother is holding her child on her left arm. The child is evidently occupied with picking lice from the mother's head. North-western Baluba, from an area west of Kongolo, eastern Congo. Museum Rietberg, Zürich (RAC 106). Photo E. Hahn. Courtesy of the Museum Rietberg.



PLATE XIX

PLATE XX

Tick, very simplified, terracotta. Nok culture, length 13 cm. Museum of Jos, Nigeria. Reproduced by permission of the Director of Antiquities of the Federal Republic of Nigeria.



PLATE XX

PLATE XXI

Cham medicine pot for curing scabies, terracotta. Height 20 cm. An elongated spherical yellowish-red vessel with rounded base. The upper two thirds of the pot are covered with small irregular bosses. The straight narrow neck ends in a rimless mouth on the side of which projects a (?) bird's beak set between eyes. Museum of Jos, Nigeria (Cat. No. Jos P. 542). Reproduced by permission of the Director of Antiquities of the Federal Republic of Nigeria.



PLATE XXI

PLATE XXII

Slaves fastened by a chain. Carving on an elephant tusk in spiral arrangement; probably made for a foreign resident, ca. 1800–1850. British Museum London. By courtesy of the Trustees of the British Museum.



PLATE XXII

PLATE XXIII

Young negro with his hands fettered behind his back. Bronze, Egypt, Alexandrian art, second century B.C. Height 13.2 cm. Photo Chuzeville. By courtesy of the Musée du Louvre, Paris.



PLATE XXIII