

**Yaws : its nature and treatment an introduction to the study of the disease  
/ by J. Numa Rat.**

**Contributors**

Rat, Joseph Numa.

**Publication/Creation**

[London] : [Waterlow & sons], 1891.

**Persistent URL**

<https://wellcomecollection.org/works/wa6d93r7>

**License and attribution**

This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.



Wellcome Collection  
183 Euston Road  
London NW1 2BE UK  
T +44 (0)20 7611 8722  
E [library@wellcomecollection.org](mailto:library@wellcomecollection.org)  
<https://wellcomecollection.org>

PAM+  
WC425  
1891  
R23Y



# FRAMBÆSIA

(YAWS).

BY

J. NUMA RAT,

MEDICAL OFFICER, LEEWARD ISLANDS, WEST INDIES.

WITH

PREFATORY REMARKS BY

JONATHAN HUTCHINSON, F.R.S., LL.D.

---

LONDON :

WATERLOW & SONS LIMITED, PRINTERS, LONDON WALL.

1891.

THE UNIVERSITY OF CHICAGO

(WAY)

J. L. KELLY

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

1961

THE UNIVERSITY OF CHICAGO

1961



22102321750

# Y A W S:

ITS NATURE AND TREATMENT.

AN INTRODUCTION TO THE STUDY OF THE DISEASE.

BY

**J. NUMA RAT,**

MEDICAL OFFICER, LEEWARD ISLANDS, WEST INDIES.

**Respectfully Dedicated**

TO

**HIS EXCELLENCY SIR W. F. HAYES SMITH, K.C.M.G.,**

GOVERNOR AND COMMANDER-IN-CHIEF OF THE LEEWARD ISLANDS.

WITH

PREFATORY REMARKS BY

**JONATHAN HUTCHINSON, F.R.S., LL.D.**

---

LONDON:

WATERLOW & SONS LIMITED, PRINTERS, LONDON WALL.

1891.

## AUTHOR'S PREFACE.

HAVING had many opportunities of treating Yaws, during several years' residence in South America, the West Coast of Africa and the West Indies, the writer of these pages has compiled them in the hope that they will serve as an introduction to its study to those Officers of the Colonial Medical Service who possess no knowledge of the disease.

His account of its clinical history is founded on his own experience; and the cases, given in illustration of it, are some of those which have occurred in his practice. Material has also been brought together from other sources, so as to collect, in an easily accessible form, the principal facts and ideas which may help to throw light, from various points, on the nature and treatment of the affection.

A list has been given of works to which reference can be made by those who may desire to obtain a more intimate knowledge of the subject.

WELLCOME INSTITUTE LIBRARY	
Coll.	welMoMec
Call	pam +
No.	wc 425
	1891
	R23y

# REMARKS

PREFATORY TO

## DR. NUMA RAT'S ESSAY ON YAWS.

By JONATHAN HUTCHINSON, F.R.S., LL.D.

*Late President of the Royal College of Surgeons.*

---

**D**R. NUMA RAT, with whom I have not the pleasure of any personal acquaintance, has done me the honour of asking me to write an Introduction to his Essay on Yaws. For this purpose a proof copy of his essay has been supplied to me by the Crown Agents for the Colonies, with a request that there might be as little delay as possible. Between Dr. Rat and myself there has, therefore, been no opportunity for conference, either by correspondence or otherwise, and the following remarks have been penned quite independently of him. It must not be understood either that I adopt his views or he mine.

The decision as to the true nature of the locally restricted disease known as Yaws must be recognised as being one which is still surrounded by much doubt and difficulty. All the more recent observers who have studied the malady in its native haunts are, I think, unanimous in the opinion that it is not syphilis. Amongst these Dr. Numa Rat is one. The confidence with which this opinion is held depends, however, to a very large extent upon impressions received by actual observation rather than upon facts which can be stated in print and submitted to the judgment of a reader having no personal experience of the malady. Thus our author describes it as a disease which is communicated by contact, and which acknowledges a primary sore. After a definite interval a febrile stage follows, attended by an erythematous or scaly eruption, after which come the more typical appearances in the form of scattered fungating ulcers. Finally, after variable periods, of months or years, we have in many instances tertiary phenomena in the form of "gummata." To these facts, as to its natural course, we have to add that mercury and the iodides are specific remedies for the disease in all its later stages, and that for a permanent cure mercury is more to be trusted than the iodides. If, then, Yaws be not syphilis, it is clear that it offers a very exact parallel to it. They are diseases as like each other as are true measles and German measles. Indeed, in the latter instance we are not able to clench the statement of similarity by adducing proof of curability by the same specifics, as can be done in the case of Yaws and syphilis.

Our first duty after what has been said must be to examine the evidence which is relied upon when it is asserted that Yaws is not really a form of syphilis. Upon this point it must be admitted that the expressions of writers are not quite in unison. I have carefully compared the excellent essay on Yaws which is supplied by Dr. Hirsch\* with that which is now before me. In the former, one of the strongest arguments as to its difference from syphilis is that Yaws is a local rather than a constitutional disease, and above all, that it is spontaneously curable, and leaves no liability to subsequent or tertiary phenomena. Dr. Rat, however, makes no doubt whatever that it is a constitutional and febrile malady, and gives us case after case in which tertiary gummata were developed after periods of several years. Thus, in Case VII., a boy had Yaws in childhood and was the subject of gummata at the age of twenty-five. Cases V. and VIII. are very similar ones.

If, then, we take the facts as stated in the present Memoir as being the most recent, and as at least equal in accuracy to any preceding account of "Yaws," we have to understand by that name a disease which begins by a local sore, becomes constitutional, observes stages, and has both

---

\* See "Hirsch's Handbook of Historical and Geographical Pathology," published in translation by the New Sydenham Society, Vol. II., page 101.

secondary and tertiary phenomena. Having assumed these facts as established, we must return to the fundamental question, can it be proved that this malady is not, after all, syphilis, modified by race and climate? I will endeavour to state, in the first place, the arguments which seem to imply probability that it is a form of syphilis, and afterwards those which bear in the opposite direction.

### A SCHEDULE OF THE STAGES OF YAWS DURING THE FIRST YEAR.

(Compiled chiefly from DR. NUMA RAT'S Report.)

1ST MONTH.	An <i>Incubation Stage</i> of from three to ten weeks. No symptoms. Ulcers, excoriations and wounds are believed to facilitate the implantation of the virus.
2ND MONTH.	A primary lesion, which consists of a papule, which at the end of about seven days develops a pale yellow fluid at its apex. A scale is formed, and an ulcer results, with perpendicular edges and a clean base. The ulcer usually heals of itself in about a fortnight, but may last longer (page 8). The lips, the breast, the groin, perineum and genitals are the parts upon which primary sores most frequently occur. There is often considerable fever and severe pains in muscles, joints, &c. The fever is worse at night.
3RD MONTH.	As a rule, the primary lesion disappears before the secondary phenomena are observed. An eruption of little red spots covers the patient from head to foot ("like lichen tropicus.") It develops in a few days and begins to fade within a week. A few of the spots, however, do not disappear, but develop into papules (page 9) which pass into tubercles, and finally present papillary fungations like cauliflower buds. Non-suppurative periostitis may occur. There is no enlargement of lymphatic glands.
4TH MONTH.	The tubercles rapidly become paler and shrink until level with the skin. They may vary in number to any extent, there being sometimes only one or two. Several may coalesce and form a large patch of granulation tissue. They frequently unite to form rings round the eyes, nose, mouth, or anus. In some conditions they resemble "small carbuncles," and in others "the mucous patches of syphilis." The palms and the soles are often affected and in a peculiar manner (page 11).
5TH MONTH.	"The normal end of the tubercle is its disappearance by interstitial absorption at the end of about six weeks from the time of its development" (page 11). [Treatment by mercury ought to have been commenced, according to Dr. Rat's opinion, as soon as the tubercles were mature, and this practice may possibly have modified his estimate of the duration of the secondary eruptions.]
6TH MONTH.	Although in most cases the eruption has disappeared spontaneously by the end of the fourth month, yet in many (especially perhaps in feeble and under-fed patients) it may have persisted and become aggravated.
7TH MONTH.	In most cases the patient is well, but in some the eruption persists.
8TH MONTH.	In most cases the patient is well, but in some the eruption persists.
9TH MONTH.	In most cases the patient is well, but in some the eruption persists.
10TH MONTH.	"In unhealthy and ill-fed persons, without treatment, the average duration of the eruption is nine months," but "tubercles may continue or may disappear and be replaced by others during several years" (page 11).
11TH MONTH.	In exceptional cases there may still be patches of fungus growth, and great debility.
12TH MONTH.	It is only in exceptional cases that symptoms persist. For these treatment by mercury is essential.

### NOTES ON THE TERTIARY PERIOD OF YAWS.

It would appear that in a majority of cases in which symptoms ranked as tertiary occur they are continuous with those of the secondary stage, the patient having never been cured. In others, however, they supervene after a longer or shorter period of health. In the former case they consist chiefly of ulcers extending serpigiously and more or less deeply, and in the latter they begin as subcutaneous swellings, which are classed as "gummata." The leg is the part most frequently affected. Destructive ulceration of the nares, pharynx and soft palate is also one of the later manifestations of Yaws. It may occur twenty years after the last traces of secondary symptoms. Chronic periostitis may occur. There may be exfoliation of the smaller bones of the hands and feet. In severe cases, especially when the throat is ulcerated, or obstructed by growths of granulation tissue, there may be cachexia, but "it is surprising to what an extent tertiary lesions may exist without seriously impairing the health."

These tertiary symptoms are, according to our author, curable only by the judicious use of specifics (mercury and iodides), with the local application of iodoform, &c.

## FACTS IN FAVOUR OF IDENTITY OF YAWS WITH SYPHILIS.

1ST. *The stages observed by Yaws are very similar to those of syphilis.*—In order to bring out the facts more clearly, I have drawn up from the data supplied by Dr. Rat, in many respects confirmed by others, the preceding schedule of the stages of Yaws. It is arranged, as being most convenient to the reader, in the space-for-time method. I will now proceed to ask attention to the facts which appear to favour the opinion that syphilis and Yaws are one and the same disease. It would appear that in many cases the initial lesion is not easily identified, and in these, of course, the length of the incubation period cannot be accurately estimated. So far as the facts go, however, it would seem probable that about a month elapses between the reception of the virus and the development of peculiarities in the part inoculated. The stage of fever, osteocopic pains and eruption, follows in a few weeks. These are almost exactly the stage-periods of syphilis. The development of fungating rupial sores, which follow what we may call the exanthem eruption, occurs also just at the time when in syphilis the first eruption may slide, under ineffectual or prejudicial treatment, into rupia. (An exceptional but still a well-recognised event.)

2ND.—*The tertiary symptoms of yaws very closely resemble those of syphilis, and occur after intervals of much the same irregularity of duration which we notice in the case of syphilis.*—Thus in some instances they begin as soon as the secondary stage is well over, and in others they are delayed through many years of latency. Gummata in the cellular tissue and ulcerative destruction of the palate are precisely the occurrences most common in similar stages of syphilis.

3RD.—*The methods of cure as regards the constitutional and later stages of Yaws are precisely those adapted for syphilis.*—As I have already pointed out the strongest argument against the identity of the two diseases with former writers was the spontaneous curability of Yaws. We were told that without treatment it always got well, and that it had no sequelæ. This argument is, however, wholly overthrown by Dr. Rat, who not only describes the tertiary symptoms but alleges that they may last indefinitely unless they are cured by the very drugs which are found to be specifics for syphilis. The judicious rules as to treatment which he lays down are precisely those which many would propound as regards English syphilis. He is not a strong mercurialist, and has no notion of an abortive or early treatment, believing rather that the first stages are made worse by mercury, and reserving the remedy for the later ones. We must remember, however, that these are precisely the doctrines which until recently were extensively held as regards the use of the drug in syphilis. It may easily be the fact that when an abortive plan by small doses is carefully tried in Yaws it will be found to be as effectual in preventing the phenomena of that malady as it is in respect to those of syphilis.

4TH.—*The character of the secondary eruption would appear to vary much as in syphilis.*—Thus, while Dr. Rat calls it “erythematous” I find other writers speaking of it as “scaly” and “papular” (see Hirsch, page 102).

5TH.—*Its restriction to certain localities.*—Another argument in opposition to the idea that Yaws depends upon a specific virus distinct from that of syphilis may be based upon the fact that the disease (or perhaps we should rather say its peculiarities) appears to be restricted to certain races and regions. No Englishman comes back to us the subject of Yaws. It would appear that it is a malady which cannot leave its home. Now it is *a priori* far more likely that race and climate should be able to stamp such a disease as syphilis with peculiarity than that they should be able to confine to themselves the operation of a powerful specific poison. We have, so far as I know, no other instance of a specific animal poison which is restricted in its operation by race and climate.

*Papillary excrescences are known also in syphilis.*—The tendency to papillary outgrowth and the production of fungating excrescences which is the most obvious peculiarity of Yaws is by no means wholly absent in syphilis as seen in European practice. I have myself repeatedly asked attention to this tendency to outgrowth as sometimes seen on the tongue in the secondary stage of syphilis, whilst syphilitic warts and condylomata (a form of papillary outgrowth) have long been well known. The tendency to papillary outgrowth appears to be a peculiarity of the



individual who is under the influence of disease, and may easily be an appanage of race. The skin in the negro and other dark races, as is well known, has a large papillary development. Pruner has already suggested that this may explain the peculiarity of Yaws.

#### REASONS FOR BELIEVING THAT YAWS IS DISTINCT FROM SYPHILIS.

*The unanimity of opinion on the part of local observers.*—We must certainly place first amongst the reasons for believing that Yaws and syphilis are distinct maladies the conviction expressed by those who, like Dr. Numa Rat, have had abundant opportunities for observing both.\* It is remarkable that almost all local observers assert non-identity, whilst most European pathologists, who have before them only printed evidence, incline to believe in essential identity. Amongst the latter, and with Copland and Lancereaux, I should certainly incline to rank myself were it not for the personal convictions of men like Dr. Rat, who have had opportunities for seeing and comparing the two diseases which have not fallen to my lot.

*That it is a disease that usually begins in childhood.*—It is admitted that it may be contracted at any age, but, whilst in Europe syphilis is most frequently contracted by adults, Yaws, amongst the people liable to it, is most frequently contracted by children. Now, it is to be admitted that children are just as liable to contract syphilis as adults, and in order to estimate the value of the argument we require to know the social differences of the two communities. In Europe the cleanliness and care with which children are as a rule tended prevents their contracting syphilis in any large numbers. A few do by accident become infected, and it is probable that those who thus suffer in childhood are far less liable than others to contract the disease in adult life. Thus if it should chance to be the fact that amongst the poorer Africans of the districts where Yaws occurs the precautions against accidental inoculation of a disease such as syphilis are less well observed, it might easily follow that more would have it in childhood and fewer in adult life. On this point we need more precise information than we possess as to the conditions under which young children became the subjects of Yaws. Is it usual to be able to trace the source and mode of contagion? What is the character of the initial lesion?

*That it is not transmitted by inheritance.*—More evidence is required on this point, and I have already suggested some fallacies.†

*That some of the phenomena which occur in syphilis are not met with in Yaws.*—Amongst these Dr. Rat enumerates lesions of the mucous membranes in the early stage, alopecia, affections of the eye, orchitis, and paralysis of ocular muscles. It must be remembered, however, that some of these are not common in syphilis, and that it is very possible that more extensive observation may yet discover them in association with what is called Yaws. Race may also have something to say as to their supposed absence. They are not conditions upon the absence of which much stress can be placed.

*That it is very rarely attributed to sexual intercourse.*—The primary lesion is sometimes, but not frequently, met with on the genitals. Its more common sites are the lips, the breast, or the limbs. The reply to this argument is that, inasmuch as Yaws usually follows accidental infection in childhood (fifty per cent. of the children suffering in some districts), we ought

\* Dr. Hirsch writes "In the opinion of nearly all observers, Yaws is a peculiar and specific infectious morbid process, a disease sui generis, which has nothing whatever in connection with syphilis." New Sydenham Society's Translation, page 103. (The italics are as in the original.)

† At page 62 Dr. Rat confutes the statement of previous observers that Yaws is common in young infants. His statistics, and they are supported by those given by Nicholls and Tulloch, shew that the period most liable is that between five and ten, and next that between ten and twenty, and that the first quinquennium has a much smaller proportion. Tables C, D, E and F, pages 60 and 61, must be held to prove the rarity of the disease in the first year of life, and at the same time that it appears to make but little difference whether or not the parents have had the disease. We must admit that there is no proof of any inherited form. There is, however, again a possible fallacy which must be taken note of. Syphilis is usually inherited from parents who have quite recently had the disease, and we are accustomed for practical purposes to limit the period of possible transmission to two years. If then Yaws be syphilis, and if in a Yaws community nearly 60 per cent. of the children (see page 61) acquire the disease in the first quinquennium, and are exempt afterwards, then it is clear that we ought not to expect hereditary transmission as a frequent occurrence. In saying this, I most freely admit that there ought to be some tolerably definite examples of inheritance every now and then. Cases must occur in which individuals become parents soon after the acquisition of Yaws, or even whilst the secondary symptoms are extant. A collection of half-a-dozen such, with the definite statement that the infants born under such conditions remained healthy during the first year of life, would go far to sustain scepticism as to hereditary transmission.

not to expect infection at that age to occur on the sexual parts. If it be syphilis, it is clearly for the most part syphilis *sine coitu*. The following statements read very suspiciously.

“When a papule develops on the lip, neck, shoulders, or breast of a woman who is nursing a child suffering from Yaws, or if a child who is being nursed by an infected mother, or when the same appears on the lips or genitals of a person cohabiting with another who is affected with the disease, and such a papule proceeds to ulcerate, there are sufficient grounds for assuming the probability of infection, and for consequently isolating the person in whom such a lesion presents itself” (page 49). These are obviously precisely the expressions which would be applicable to the primary lesion of syphilis.

*The primary sore is never an induration.*—Here again we must remember that the primary sore occurs erratically, and on parts other than the genitals, and that many, or even most, of the erratic chancres of true syphilis are destitute of characteristic hardness. It is on the genitals almost solely that the more characteristic chancres are encountered. If, in the event of a Yaws sore occurring on the genitals, it were at the same time attended by induration, it would, we may fairly suggest, be probably diagnosed as syphilis, and not Yaws.

*That it is not attended by characteristic enlargements of the lymphatic glands.*—It is not asserted that the glandular system wholly escapes, but that it suffers in much less degree than in syphilis, and none of the adenopathies are what is called characteristic. Dr. Rat's words are (page 33), “There are no alterations in the structure or function of these organs which can be considered as the special result of the Yaws poison.” He fully admits that the glands may enlarge in connection with ulcerations, and says that they may present, under such circumstances, “a comparatively soft unyielding painless mass, without any tendency to inflammation, induration or suppuration.” Such expressions as these diminish considerably the importance of the asserted distinction between Yaws and syphilis, that the one has enlarged glands and the other not. With the exception of the indurated glands which constitute the primary bubo, the implication of the lymphatic system in syphilis is probably far less definite and less characteristic than is generally supposed. Even the bubo is often omitted, so that here again the difference between the two appears to be, after all, only a question of degree.

*That it is much more readily susceptible of spontaneous cure than is syphilis.*—The force of this statement, which, in the pages of Hirsch and others, seems almost conclusive, is very greatly reduced by Dr. Rat's report. This latter, although it by no means makes Yaws as severe a disease as syphilis, yet clearly establishes the fact that the differences are only in degree. It asserts strongly that some forms of Yaws are incurable, excepting by the use of specifics.

#### CONCERNING THE RELATIONS OF SOME OTHER DISEASES TO YAWS AND TO SYPHILIS.

At page 18, Dr. Rat deals with certain other diseases which it is necessary to diagnose from Yaws. Of Pian, a disease of the French West Indian colonies, he writes: “It is evident from this account that it is the same disease as Yaws.” The account referred to is: “Pain in the limbs with fever, red spots on the skin, which become scaly, an eruption consisting of fungous excrescences of varying size and colour, some being as large as the hand and discharging a thick sanious matter. The later lesions are excrescences on the soles and palms, from which a purulent secretion escapes, or inflammation and consequent thickening of these parts; pains in the bones, followed by enlargement or softening of the same; ulcers over various parts of the body; destructive ulceration of the bones, of the face, palate, &c.” It will occur to most readers of such a description that, if it proves the disease so described to be Yaws, it raises, at the same time, a strong suspicion that both are syphilis.

The Peruvian Verrugas, on evidence which no one will doubt, is asserted to be wholly distinct from Yaws. There can be no doubt that Verrugas is a disease which attacks new comers and foreigners more readily than natives. It is strictly endemic, but may be brought away by a European returning home.\* It has no initial lesion or primary sore, nor does it display stages. It is in all probability due either to some poison taken in the food or to some parasite. Its only feature of similarity to Yaws is that both produce fungating or papillary outgrowths.

\* Of this witness the case of the man who was the subject of the beautiful plate illustrating Verrugas, published by the New Sydenham Society.—Plate XLI.

Concerning the nature of the Button Scurvy of Ireland, Parangi of Ceylon, the Delhi boil, Sibbens, Radesyge, Mal de Chicot, and Mal de Scherlievo our author has nothing to tell us from his own knowledge, but quotes from Hirsch, and other authorities, such statements as best assist in the comparison of them with Yaws. Premising the caution that we must not trust too much to reputed facts, and reminding Dr. Rat that he has himself, in regard to Yaws, confuted several statements of his predecessors, it may be remarked respecting this group of endemic maladies, all more or less resembling both syphilis and Yaws, that its mere existence favours the suspicion that syphilis may receive modifications in connexion with race and social habits. The Delhi boil we may dismiss, as being wholly different, whilst of the Radesyge, Sibbens, Mal de Chicot and Mal di Scherlievo, we may say that there is but little doubt that these names were given to true syphilis. Concerning Parangi there is perhaps more doubt, so good an authority as Dr. Kynsey holding, from personal observation, that the two diseases are distinct. Yet in each and all of these affections there are features remarkably similar to those of Yaws. All are said to occur chiefly amongst the poor and neglected, and in all a tendency to overgrowth of papillæ is witnessed.

#### DOES THERE EXIST A FAMILY OF SYPHILOIDS?

The question remains to be asked as to whether there exists a family of diseases allied to syphilis but not identical with it. Dr. Rat, is himself, quite willing to entertain the question whether Yaws may not be the parent form of what we now know as syphilis, and suggests that some, at least, of the diseases just named belong to a "syphiloid group." In examining such a question as this, we must be very careful to define our terms, or we may easily add to the confusion of a perplexing subject. Do we mean by "syphiloids," diseases which have the same laws of development as syphilis itself but are really quite distinct from it, or do we mean modifications of one and the same malady brought about by such influences as race, climate and social habits. It is quite certain that in the same community syphilis does receive modifications from the peculiarities of constitution of those in whom it occurs. It is easily conceivable that transmitted from person to person, through many generations in one and the same race (the Cingalese or the Negro, for instance), the disease might acquire some minor persisting features of difference. It is possible that Parangi in Ceylon, and Yaws in Africa may be syphilis so modified. We should be going, however, much further than any facts in our possession warrant if we were to suppose that syphilis so modified could become a disease capable of existing side by side with its progenitor in an independent position. If Yaws be only syphilis modified by race, or syphilis only Yaws under the influence of European civilisation, then we should certainly not expect that the two could co-exist. This last fact is, however, the assertion of local observers. Dr. Rat distinctly asserts in his synopsis of "General Differences," on page 23, that "syphilis may be contracted by those suffering from Yaws," and that conversely "Yaws may be contracted by those suffering from syphilis." If these statements are to be taken in their full apparent significance, if we are to understand by them that syphilis runs its usual course in a patient who has recently suffered from Yaws and *vice versa*, then we have clinical proof that the two have attained specific distinctness, and at the same time most will, I expect, be willing to admit that it becomes extremely improbable that the two have ever, within historic periods, been other than specifically distinct.

In order to arrive at a satisfactory solution of this and other cognate questions we need more detailed information as to the peculiarities which syphilis displays in relation to race, and more especially in those countries where these "syphiloid" maladies prevail. It is the knowledge that local residents possess this information which induces us to attach so much importance to their opinions when they assert, in contradiction to the general bearing of the evidence, that the two maladies are distinct.

If, however, we are to accept in Yaws and Parangi diseases related to syphilis, but which have acquired the position of species, and may now be propagated independently of it, then it would certainly follow that we should expect that they would no longer be restricted to race or to locality. Yet nothing that is well marked in the form of Yaws finds its way to Europe, and in the countries where it prevails Europeans appear to escape almost wholly.\*

\* The information given by Dr. Rat is not so full as could be desired, but we assume from his silence that he has not seen it. All the cases given are in Negroes, Mulattoes or Caribs, &c.

In concluding my introductory remarks I have to express the opinion that the profession is indebted to Dr. Rat for a very important contribution to our knowledge respecting Yaws. His essay abounds with facts of great value, and evidently stated with complete impartiality. For myself, I feel strongly that I owe him an apology for the circumstance that my preface has assumed rather the qualities of a criticism, and that too in some measure adverse to one of his principal propositions. This has, however, been unavoidable, and it will, I feel sure, be readily pardoned by one whose "sole motive in writing is the hope of benefit to humanity by the discovery of truth respecting a loathsome and painful disease."

In the hope of giving some little assistance to future investigators I venture to make the following suggestions for enquiry:—

Does Yaws ever occur in Europeans? and if so, does it shew any differences from the disease as seen in Africans? Cases should be recorded in detail.

What are the statistics as to the frequency of syphilis in districts where Yaws is common? Are the two diseases usually in inverse ratio of frequency?

Do well-marked examples of inherited syphilis occur frequently in the Yaws districts?

Are infants who have suffered from definite inherited syphilis liable to contract Yaws?

Are there many cases in which it is impossible to decide whether the symptoms are due to syphilis or to Yaws? Are differences of diagnosis on this point common amongst medical men?

How short may be the interval between a well-marked attack of Yaws and one of syphilis?

If a woman, the subject of Yaws in an early stage, say, within a year of contracting it, become pregnant, what is the result to her foetus? Do recently infected women ever bear healthy children?

What are the peculiarities of syphilis in the dark races? Is a well-indurated chancre often seen? Do bullet buboes occur?

In cases of tertiary symptoms from supposed Yaws, such for instance as ulcerations of the palate, is it often the fact that syphilis can with confidence be excluded. May not such cases as those given at pages 38 and 39 have been instances of the co-existence of Yaws with syphilitic taint?

In the secondary stage of Yaws is there often any affection of the tonsils or pharynx? The omission of the usual sore throat of syphilis, in cases of Yaws, seems to me, as the case stands, one of the strongest facts in support of the theory of their non-identity.



# YAWS: ITS NATURE AND TREATMENT.

## PART I.

1. Origins of the words "Yaws" and "Pian."
2. Names of Diseases resembling Yaws.
3. History of Yaws.
4. Geography of Yaws.
5. Bibliography of Yaws.

### ORIGINS OF THE WORDS "YAWS" AND "PIAN."

**Y**AWS is the colloquial name in the British, and Pian in the French West Indies, for the disease for which Sauvages coined the word "Framboesia."

The origins of these names appear to be doubtful. It is stated in the Cyclopædia of Practical Medicine that Yaws is "a word that has its origin in the vernacular dialect of Guinea and other parts of Africa, where it has been used to designate the fruit of the *rubus idœus* (raspberry)." Hirsch writes as follows: "The words 'Yaws' and 'Pian,' as Mason tells us, are the colloquial names used in the West Indies for strawberries by the West African negroes and natives, the names having been applied to the disease, owing to the resemblance of the growths on the skin to that fruit."

These are strange statements. I have never heard, and I have never met anyone who has heard, a strawberry called Yaws or Pian in the West Indies.

In Webster's Dictionary the word Yaw is given as a verb, meaning "to rise in blisters, breaking in white froth as cane juice in the sugar works."

With regard to the word "Pian," Rocheford, in his *Histoire Naturelle et Morale des Iles Antilles de l'Amerique*, à Rotterdam, 1658, Chap. xxiv. p. 504, writes as follows: "The bad food on which the Caribs generally live is the cause of their being all subject to a serious complaint, which they called *Pyans* in their language." The Carib word for Yaws is really Yáya.\*

The colloquial names for the same disease in other countries are:—

France, Pian.	Angola, Momba.
Italy, Framboasia.	Dutch East Indies, Patch.
Spain, Frambuesa.	Ternate, Bobento.
Germany, Schwammformige Aussatz, Beerschwamm.	Fiji, Dthoko.
South America, Bubas.	Samoa, Lupani or Tono.
West Africa, Gattoo.	Ceylon, Paranghi.
Congo, Tettia.	Carib, Yáya.
	Calabar, Framosi.

Some diseases are said to be like Yaws, which are really very unlike it, such as the Verrugas of the Andes.

There is a variety of names for the disease on the West Coast of Africa. Hirsch, probably quoting from others, is responsible for the statement that "Gatoo" is a synonym for Yaws used on the West Coast of Africa. I have never heard the word.

By direction of the Right Honourable the Secretary of State for the Colonies, the following information was supplied by Dr. Farrell Easmon of the Gold Coast Medical Service.

(1) The Fanti name for Yaws is Dubi or Dube (pronounced Doobee or Doobay).

(2) The Accra name is Ajortor (pronounced Arjortor). The same name is applied to some forms of syphilis. (3 and 4) So far as I know, the name "Yaws" is not of West African origin.

(5) 'Pian' or 'Epian' is not, so far as I know, of West African origin.

(6) Synonyms of Yaws:—

Sierra Leone	} Ógódō	Kroo Soombah
Lagos		(Grand Cess)
Crepi	} Jahtor	S. Subaniné
Killa		(Sinoe)
Hausa Toujárā		Soosoo
Moshi Toomah		(Sierra Leone) } Dorgorteh
		Grushi Saukorrer"

The Hausa name is also pronounced Túnjere or Túmzere and, like the Accra, is used alike for Syphilis and Yaws.

The use of one name for the two diseases suggests that both are considered identical or very intimately related.

The name "Framboesia" was manufactured by Sauvages from the French framboise. Another term once employed to designate the disease, was "morula," from *morus*, a mulberry. It was given by Wallace (*Med. Chir. Transact.*, 1827, xiii., 469) to the button-scurvy of Ireland.

\* In the absence of a more plausible explanation, I venture to suggest that Yaws is derived from the Carib Yaya, in the same way that several words in use in the English West Indian Islands are derived from the Carib, such as tancier or tanya from taya, the Carib name for the vegetable. The word Pian or Pyan may have had its origin in the dialect of the wives of the Caribs, who formerly spoke a different language from that of their husbands, who had captured them in war. The word must have been Pya, to which the French nasal intonation was given by adding the final 'n.' Epian would be formed as the result of using the article 'le' or 'les' before Pya—le pyan or les pyans—and pronouncing the two as one word. It may be observed that even in the name Pya or Pyan, the sound 'ya' is preserved.

## HISTORY.

The thirteenth chapter of Leviticus contains descriptions of certain skin diseases, or of different forms of a skin disease, which have led some to suppose that Yaws was one of the affections from which the Israelites suffered in their journey through the desert. The word *Sâraath*, translated as Leprosy, evidently included diseases other than leprosy; for the periods of weeks assigned as indicating various stages of the malady could not have applied to so chronic a complaint as leprosy—such, at least, as it has been always described, and is now known to us. It is possible, therefore, that Yaws prevailed among the Hebrews during their migration from Egypt, though the account given in Leviticus can only be considered to refer to one of the later manifestations of the disease, viz.: deep-seated cicatrices on which fresh granulations have recurred. Dr. John Hume ("Edinburgh Medical Essays," 1744, vol. vi.) first advanced that idea, which was afterwards supported by Adams in his "Observations on Morbid Poisons."

The Sahafati of the Arabian physicians of the tenth century considered to be syphilis, by many, is another disease which is supposed to have been Yaws ("Theodoric," lib. viii., cap. xviii., *Venetis*, 1492-57). (Hirsch "Geogr. Pathol." p. 784.) This view was upheld by Dr. Hillary, who thought that the Arabian Leprosy, as described by Ali Abbas, was really Yaws ("Inquiry into the means of Improving Medical Knowledge." W. W. Hillary, M.D.).

Though only brought to the serious notice of Europeans since the discovery of America the disease has been prevalent for centuries, both in Africa and in other countries to which there had been no African migration; and it was then doubtless mistaken, and is even now in some places, for syphilis or leprosy, to which it bears certain resemblances.

It is impossible to decide whether Yaws was introduced into America by African slaves, or whether it already existed among its aboriginal inhabitants. It is certainly mentioned very soon after the discovery of the West Indies as affecting the aborigines as well as the Caribs and the Africans in those parts. Ovideo y Valdez (1478-1557), who went out to San Domingo as supervisor of the gold diggings, refers to it in his work "La General y Natural Historia de Las Indias," written in his capacity of historiographer of the Indies, which first appeared as a Summary in 1526. Pison also mentions it in his books "De Medicina Brasiliensi," lib. ii., cap. xiv., 1648. Rocheford, in his "Histoire Naturelle et Morale des Iles Antilles de l'Amérique," Rotterdam, 1658, chap. xxiv., p. 504, states: "The bad food, consisting of crabs and other insects (*sic*) on which they (the Caribs) live is the reason why they are almost all subject to a serious complaint which they call Pyans in their language, as the French are to the small-pox." Under the word "Yáya" (the Carib name for Yaws), Raymond Breton writes as follows, in his "Dictionnaire Caraibe Francois," Auxerre, 1665: "This is an indigenous disease which prevails as commonly in the islands as the Great Pox (*grosse vérole*) in France, and of which the savages cure themselves without trouble and risk . . . . It is but slightly dangerous, though very common amongst them." Labat ("Nouvel voyage aux isles de l'Amérique, 1694," *Martinique*, 1866, chap. iv., p. 131) refers to the disease in the following words, "the Caribs are very subject to 'l'epian.' It must be confessed that this disease is peculiar to America and that it is indigenous there; all who are born there, blacks or Caribs, of whatever sex they may be, are attacked by it almost at birth, though their fathers, their mothers, and their nurses may be quite healthy, or, at least, may appear so." Pison, in his above-named treatise (1648), was the first who drew serious attention to the disease. It was even then asserted that Yaws was peculiar to Africans only, though the authors above-mentioned had explicitly declared it to be prevalent among the Caribs and aborigines of the West Indies and South America; and it was not until Bontius, in his "Medicina Indorum, Lugduni Batavorum," 1718, cap. xiv., proved that an affection called the "Amboyna Pox or Pimple" had long been indigenous at Amboyna, Ternate, Timor, Celebes, Java and Sumatra, that the idea of Yaws affecting Africans only was generally admitted to be erroneous.

Yaws attacked the slaves on their passage from Africa to the West Indies and South America, and every estate of any consideration in those parts was compelled to have a building for the isolation of the cases which were constantly occurring. The sick were put under the care of an old woman experienced in such matters, and a definite line of treatment was ordered and practised. The Caribs also had their system of dealing with the affection.

These precautions helped to keep in check and even to lessen the prevalence of the disease, which was found to have subsided considerably, in such places as Jamaica, after the Emancipation in 1838. But when the negroes obtained their liberty, when there was no one to attend to the sick, and these were free to travel in every direction, the contagion spread to an extent that caused considerable anxiety during 1854 and the following decade.

A reference to its bibliography will show that much has been written scientifically on the subject from the year 1744, when Dr. John Hume gave his experiences of the disease, in the "Edinburgh Medical Essays," up to that following the Emancipation, 1839, when Dr. Maxwell's work, "Observations on Yaws and its influence in originating Leprosy," appeared. Experiments on the nature, and action of the Yaws virus were made and reported by Dr. Thomson ("Edinburgh Medical and Surgical Journal") in 1819 and 1822, and in 1848 by Paulet ("Arch. Gener. de Médecine"), both these authors furnishing valuable information with regard to the contagious character of the affection and its period of incubation.

In Labat's reference to the disease, the resemblance which Yaws bears to syphilis led him to the conclusion that Yaws was identical with the latter affection. The epidemic of syphilis which, originating in the armies before Naples, in 1493, spread so widely throughout Europe, is

stated by some to have been the Yaws, brought to Italy by the Spanish soldiers who had returned from America. But, as these soldiers did not reach Italy, until 1495, and the epidemic began early in 1493, the Yaws of the West Indies does not appear to have had anything to do with the introduction of syphilis into Europe. If syphilis did not originate in Europe, there is far greater probability of its having been brought there by the Moors who settled in Spain, seeing that Yaws and syphilis had both existed in Africa long before the discovery of America.

Attempts have been made to distinguish between Yaws and the disease described by French writers as Pian or Epian, and again, between American and African Yaws; but the different accounts given really refer to different stages or special manifestations of the same disease now known either as Yaws, Pian, or Frambœsia.

Other diseases resembling Yaws have prevailed as epidemics in Europe and Canada. In 1694, a disease called Sibbens or Swins (Swin, Celtic for raspberry) appeared on the West of Scotland, where it is supposed to have been imported by Cromwell's soldiers; and those who had seen both Yaws and Sibbens concluded that they were one and the same. The "Button Scurvy" of Ireland, the "Radesyge" which appeared in Sweden and Norway in 1710, whence it spread to Jutland and Holstein, and the coast of Finland, the "Mal de Chicot," in Canada, which began on the banks of Lake Huron, 1710, and other epidemics of the present century, known as Falcadina, Male di Scherlievo or Gronemico or Fiume, &c., according to the localities in which they were first observed, are other diseases intimately resembling Yaws, but, with the exception of the first, with certain differences to be noticed when treating of the nature of the latter affection.

Yaws has never entirely disappeared from the West Indies. Under favourable circumstances, in such places as Barbados and Antigua, it is said (truly or not) to have completely or almost completely disappeared, but in others and notably in Dominica, it has spread more extensively than formerly in localities which are mountainous and damp, and where the people are isolated, badly housed and badly fed. As an endemic, under ordinary circumstances, it is generally accepted as an unavoidable evil; but it sometimes assumes proportions, as an epidemic, which cannot be disregarded. In consequence of the severity of an epidemic of Yaws in Dominica, in 1871, the Government of that island established two Yaws Hospitals to segregate those already affected, and thus protect the rest of the community. Any hope, however, entertained of completely expelling the disease from the island by this means or by others subsequently adopted has not been realized. The attempts at isolation hitherto made in the other West Indian Colonies, even in such prosperous places as Trinidad, have never been on a sufficient scale to arrest the spread of the contagion, still less to ensure its extinction, and the same remarks apply to the West African and other British dependencies where the disease prevails.

An enquiry into the nature of Yaws was made by Dr. Gavin Milroy, in the West Indies, in 1871, and in his report to the Secretary of State for the Colonies are recorded the experiences of the Chief Medical men of the British West Indies in those days, the views most fully given being those of Dr. Bowerbank, of Jamaica, and Dr. Imray of Dominica. Dr. Milroy deduces the following opinions from the facts laid before him:—

"From all the evidence that has now been adduced, we may fairly infer that, although there yet remains much respecting the origin and attributes of Yaws requiring more accurate investigation than has yet been applied to the subject, everywhere it is fostered, if not engendered, amid poverty and its ordinary accompaniments of squalor and semi-starvation. Proofs of this were given me alike in Berbice, Dominica and Jamaica."

"Yaws is thus, obviously, another member of that multiform brood of evil, known by the family name of 'Mal de Misère.' Cases are certainly extremely rare among the cleanly and well-conditioned."

"What is the exact part that contagion plays in the development and spread of the disease is a point which still, I think, waits for further and more searching enquiry. The disease appears to be comparatively rare in towns, and to be relatively most common and persistent in mountainous and other out-of-the-way localities where the people are left much to themselves, and not within the reach of frequent medical oversight. For many years past, the number of resident medical men in Jamaica has been very much less than it used to be. In 1834 there were rather more than 200, at the present time the number is not above 60 in actual practice; of these, more than one-half are under Government control. Thus a large portion of the population is obviously under very imperfect medical legislation. How to supply this serious default rests with the Government; it can only be met by measures of enlightened liberality, inducing qualified professional men to take up their residence in the island, and encouraging them in every way to have their attention directed to the prevention, no less than to the curative treatment of disease."

"From numerous incidental observations already made, it will have been seen that, in my opinion, to judge aright of the causes of the existence of leprosy and of Yaws in a country, it is needful to study these diseases, not merely as distinct nosological entities, but also in connection with the general health-condition of the inhabitants, and with the type or leading character of the other endemic maladies most prevalent among them. Such information can only be obtained through the action of the Government, viz.:—By the annual registration of births and deaths, and secondly, by the regular publication in the Official Gazette of each colony of the Annual Reports of the Medical Officers of all the Institutions for the care and relief of the suffering poor."

"The want of some authentic record of the general health and of the prevailing diseases in a Colony from one year to another is a serious defect which might be easily corrected in future



(especially now that so many of the Medical Men have become Government Officers) with great public advantage. I found it impossible to obtain exact particulars respecting epidemic visitations, even as to their dates, that had occurred within the last ten or twelve years. All soon becomes conjecture, and the teachings of past experience are positively nil."

#### GEOGRAPHY.

As has been already stated, Yaws was long supposed to be peculiar to Africans only; but Oviedo, Raymond Breton, Rocheford and Labat (op. cit.) mention its prevalence among the Caribs and other Indians of those days, such as those who dwelt on the banks of the Mississippi, and Bontius (op. cit.) describes it as having been indigenous, long before he wrote, at Amboyna, the Moluccas and other eastern islands, where it attacked the Malays rather than the Africans. A similar affection also exists among the natives of the Samoa Islands, where there are no Africans.

It is now known to prevail in the West Indies, North America, Mexico, Central America, South America, the West Coast of Africa, the East Coast of Africa, in the islands of the Mosambique Channel, including the Comoros and Madagascar, Ceylon, the Coromandel Coast, the East Indian Archipelago, New Caledonia, Loyalty Islands, Samoa or Navigator's Islands, Fiji, and in the central parts of Africa, such as Ashanti, Bornu, Timbuktu, &c. It doubtless also exists in many other eastern countries, such as Egypt, where it is mistaken for and treated either as syphilis or leprosy.

It is said to be seldom met with on the northern and north-eastern coastlands of Africa. "Guyon ('Mem. de méd. milit.),' Baudouin and Furnari have observed a few cases among the Arab population of Algiers. Pruner states that Yaws does not occur at all in the basin of the White Nile as far up as 5° N.; he has seen a few cases, however, among natives of Egypt, of Abyssinia, and of the Arabian coast;" (Hirsch, Geog. and Hist. Pathol., p. 105, note 3). As regards the western coast of Africa, it is known to prevail between the Senegal river and Cape Negro in Benguela.

It appears to be rarely seen in India. Hirsch (loc. cit.) writes as follows: "On the other hand it appears to be very rare on the mainland of Hindostan and of further India. In the exceedingly copious medico-topographical literature of these countries I have found one notice of Yaws by Huillet, relating to its rather common occurrence among the Hindoo population of Pondicherry. Charlouis mentions that he had seen two cases of Yaws in European children, and all the other notices of it from India likewise relate to merely occasional cases. From further India there is not a single reference to this disease known to me."

The accounts of its prevalence in North America are not sufficiently explicit to arrive at a satisfactory conclusion on the subject. It may be inferred, however, from what is reported, that the disease exists to a greater or less extent among the negroes in North America in the warmer latitudes, and especially in the Southern States. Judging, however, from its limitation to tropical regions in the southern hemisphere, it is not likely to extend very far north of the equator. Hirsch does not mention its occurrence in North America. Lancereaux asserts that it is met with in "most of the colonies to which negroes are carried, especially in the Southern States of America." But, as the author proceeds to state that it is found in "the whole of South America," when it really does not extend south of Brazil, his account of the geography of the disease cannot be depended on for extreme accuracy. Duhring mentions some of the places in which it prevails, but makes no reference to North America.

With regard to South America, Yaws is not met with further south than Brazil, where it is widely prevalent. In Venezuela it chiefly exists in the south-western states in damp, hilly, and isolated regions. There is a disease which is endemic on the western slopes of the Peruvian Andes, known as Verruga Peruviana,\* which is confounded by some with Yaws, but which is very distinct from the latter, as will be seen from the description of the former to be given further on in treating of diagnosis.

#### CHRONOLOGICAL BIBLIOGRAPHY.

##### 16th and 17th Centuries.

1535. *Oviedo*. "La General y Natural Historia de Las Indias." Sevilla 1535, lib. II., Capítulos 13, 14.  
 1648. *Piso*. "De Medecina Bræsilium," lib. II., fol.  
 1648. *Ditto*, lib. II., cap. XIV.  
 1658. *Rocheford*. "Histoire Naturelle et Morale des Iles Antilles de l'Amérique." Rotterdam, 1658, chap. XXIV., p. 504.  
 1665. *Raymond Breton*. "Dictionnaire Caraïbe François." Auxerre, word "Yáya."  
 1694. *Labat*. "Nouveau Voyage aux Isles de l'Amérique." Paris, 1722, 6 vol. in 12, second edition; Paris, 1742, 8 vol. in 12. Saint Pierre, Martinique, 1866.

\* The case treated by Professor Hutchinson and stated by Duhring to have been Yaws, was really, as stated by Hutchinson, one of Verruga Peruviana.

## 18th Century.

1705. *Hans Sloane*. "Voyage aux Iles de Madère, la Barbade, Saint Christophe, la Jamaïque, &c." Londres. 1705-1725.
1718. *Bontius*. "Medecina Indorum." Lugduni Batavorum, 1718, cap. XIX.
1742. *J. B. Dazille*. "Observations sur les Maladies des Nègres." 2 vols. in 8vo. Paris, 1742 and 1776.
1742. *T. Winterbottom*. "An Account of the Native Africans in the neighbourhood of Sierra Leone, &c." Vol. II., chap. 8, 1742, and vol. II., p. 139, 1803.
1742. *Allamand*. "In Nov. Act. Natur. Curios. Academ." Leopold IV., 88, 1742.
1759. *Hillary*. "Observations on the changes of the air and the Concomitant Epidemical diseases in the Island of Barbadoes." London, 1759. 2nd Edition, 1761, p. 339.
1764. *Grainger*. "Essay on West India diseases." 8vo. London, 1764, p. 55.
1767. *Bancroft*. "An Essay on the Natural History of Guiana." 8vo. London, 1767 and 1769.
1770. *Schilling*. "Diatribes de Morbo quem Yaws dicunt." Utrecht, 1770, in Schlegel Thesaur. II., part I., 217 (Baldinger Syl. III.). 8vo. Ultraj., 1770.
1770. *Desportes*. "Histoire des Maladies de St. Dominique." Paris, 1770, II. 61, 85.
1773. *Boyle*. "An Account of the West Coast of Africa." 1773, p. 387.
1773. *Bruce*. "Travels to the Sources of the Nile." 1773, III., p. 36.
1776. *Arthaud*. "Traité des Pians au Cap. Français," in 4to., 1776.
1777. *Bajon*. "Mémoire pour servir à l'histoire de Cayenne et de la Guyane." Paris, 1777, 1778.
1783. *Perilhe*. "Précis théorique et pratique sur le Pian et la Maladie d'Amboine." Paris. 8vo. 1783.
1788. *Swediaur*. "Practical observations on Venereal Complaints." Edin., 1788, p. 248.
1789. *Thomas, Ed.* "Dissertatio de Frambœsia." (Hafn. 8vo.), 1789.
1791. *Ludford*. "Dissertation de Frambœsia." Edin., 1791.
1791. *Nissæus*. "Spec. de nonnullis in Colon, Surinam observ. morbis." Harderov, 1791.
1796. *Rodschied*. "Med. und Chirurg. Bemerkungen uber Rio Essequibo." Francfort, 1796 p. 226.
1796. *Sprengel (K.)*. "Beiträge zur Geschichte der Arzneikunde." Halle, 1796, Vol. I., fasc. iii.
1796. *Hunter*. "Diseases of the Army in Jamaica." London, 1796.
1797. *Kunsemüller*. "Spec. de Morbo Yaws, &c." Halle, 1797.

## 19th Century.

1802. *Camper*. "Traité pratique des Maladies des pays chauds." 1802.
1803. *Collins*. "Practical Rules for the Management and Medical Treatment of Negro Slaves in the Colonies."
1804. *Chopitre, E.* "Aperçu sur le Pian et les Maladies dont il est suivi." Paris, 4to.
1804. *Macé, P.M.* "Dissertation sur le Yaws, Pian au Frambœsia." Paris, 4to.
1809. *Savaresq*, "De la fièvre jaune, &c." Naples, 1809, 92.
1813. *Thomas, R.* "The modern practice of Physic ((Frambœsia or the Yaws, p. 540). 4th edition. London, 8vo.
1816. *Alibert*. "Dict. des Sc. Med. (Art Frambœsia)." XVI. Paris, 8vo.
1817. *Williamson*. "Medical and Miscellaneous Observations relative to the West Indies."
1819. *Dancer*. "Medical Assistant or Jamaica Practice of Physic." 3rd edition.
1819. *Thomson, James*. "Observations and Experiments on the nature of the Morbid Poison called Yaws." (Edinburgh Journ. XV.) Edin. 8vo.
1820. *Thomson*. "Treatise on the Diseases of Negroes in the West Indies."
1821. *Frank, Jos.* "Pax. Med. Univ." Vol. III., cap. XXXVI., de Morbo rubro, Yaws, &c. Taur. 8vo.
1822. *Thomson, James*. "Observations and experiments on the nature of the Morbid Poison called Yaws." (Edinburgh Journ. XVIII.) Edin., 8vo.
1826. *Lagneau*. "Dict. de Méd. (Art. Pians." t. XVI. Paris 8vo.
1827. *Rankine*. "Edin. Med. and Surg. Journal." XXVIII., 283.
1831. *Mason*. "Edin. Med. and Surg. Journal." XXXV., 52.
1831. *Boyle*. "Med. Hist. account of the Western Coast of Africa." London, 387.
1835. *Segond*. "Journ. hebdomad. de méd." No. 23.
1835. *Corneiro*. "In Revist. med. flum." No. 3.
1835. *Joy*. "Cyc. of Pract. Med. (Art. Yaws)." Vol. IV., London, 8vo.
1836. *Segond*. "Journ. hebdomad. de méd." No. 23.
1836. *Corneiro*. "In Revist. med. flumin." No. 23.
1836. *Robertson*. "The Pathology of Yaws in Jamaica," Physical Journal.
1839. *Mazucell*. "Observations on Yaws and its influence in originating Leprosy."
1840. *Leacher*. "Guide Méd. des Antilles, &c." 2nd edition, Paris, 1840, 278.
1843. *Hille*. "In Casper's Wochenschr. für die ges. Heilkde." 1843, No. 6, 92.
1843. *Waitz*. "On Diseases incident to Children in Hot Climes." Bonn, 1843, 282.

1845. *Furnari*. "Voyage méd. dans l'Afrique septentrional." Paris, 1845.  
 1845. *Fox*. In Wilkes' "Narrative of the U.S. Exploration Expedition." Philadelphia, 1845, III., 316.  
 1845. *Ferrier*. "Répertoire général d'Anatomie et de Physiologie pathologique." IV., 170-18.  
 1845. *Baudouin*. "Gazette Méd. de Paris."  
 1846. *Sigaud*. "Du Climat, et des Maladies du Brésil, &c., 117, 375, et Ann. des Maladies de la peau," t. II., p. 83.  
 1847. *Bryson*. "Report on the Climate and Diseases of the African Station." London, 1847, p. 260.  
 1847. *Duncan*. "Travels in West Africa." London. II., p. 96.  
 1847. *Bruner*. "Die Krankheiten des Orients." Erlang. p. 174.  
 1848. *Rendu*. "Étude Topographique et Médicale sur le Brésil." Paris, 88.  
 1848. *Lemprière* In Pinkerton "Collection of Voyages." XV., 689.  
 1848. *Löffler* In "Beiträge zur Arznei Wissenschaft," &c. 1.  
 1848. *Nielen*. "Verhandel der Weese," &c. Haarlem. XIX., 135.  
 1848. *Paullet*. "In Arch. gén. de Méd." Août. p. 305.  
 1852. *Ritchie*. "Monthly Journal of Medicine." May.  
 1853. *Guyon*. "Recueil de Mem. de Méd. Milit." XXIX., 159, et "Gaz. Méd. de Paris," 446.  
 1855. *Heymann*. "Darstellung der Krankheiten in den Tropenländern." p. 219.  
 1855. *Dumontier*. "Nederlandsch Lancet." September.  
 1855. *Gomez*. "Memoires de l'Académie des Sciences de Lisbonne." IV., 1.  
 1855. *Rechouz*. "Journal de Physiologie." No. 4.  
 1858. *Copland*. "Diet. Pract. Med." London, 1858. Vol. III., part II., p. 1336.  
 1859. *Pop*. "Nederl. Tijdschr. voor geneesk." 1859. III., 213.  
 1860. *De Rojas*. "Essai sur la topogr. hyg. et méd. de la Nouvelle Calédonie." Paris, 1860 p. 20.  
 1861. *Rollet*. "Arch. gen. de Méd." Fevr. 1861.  
 1865. *Chassaniol*. "Arch. de Méd. Nav." Mai., 1865. 515.  
 1867. *Grenet*. "Journal des Connaiss. Méd-Chir." No. 15. 404.  
 1867. *Van Leent*. "Arch. de Med. Nav." October, 1867. 249.  
 1868. *Huillet*. "Arch. de Méd. Nav." Jan., 29.  
 1868. *Roquete*. "Arch. de Méd. Nav." Mars. 161.  
 1868. *Lancereaux*. "A Treatise on Syphilis: Historical and Practical." New Syden. Society. London. Vol. I., p. 30.  
 1870. *Van Leent*. "Arch. de Méd. Nav." January 15.  
 1872. *Pedrelli*. "Annotaz. stor. clin. sul Pian." &c. Bologna. 1872.  
 1872. *Bourel Roncière*. "Arch. de Méd. Nav." 1872. Juill. 49.  
 1873. *Tilbury Fox*. "Skin Diseases." London.  
 1873. *Gavin Milroy*. "Report on Leprosy and Yaws in the West Indies." London.  
 1876. *Gavin Milroy*. "Report on Leprosy and Yaws in the West Indies." Medical Times and Gazette, November, 514.  
 1876. *Keelan*. "Lancet," August, 201.  
 1877. *Gavin Milroy*. "Lancet," February, 169.  
 1878. *Könegar* in "Virchow's Archiv," 1878. Bd., 72, 419.  
 1879. *Nicholls*. "Brit. Méd. Journ.," December.  
 1880. *Van Leent*. "Arch. de Méd. Nav." Nov., 425.  
 1880. *Bowerbank*. "Med. Times and Gazette." April, 368.  
 1880. *Nicholls*. "Med. Times and Gazette." January, 5, 33.  
 1880. *Encyclopædia Britannica*. Ninth Edition. Art., "Yaws."  
 1881. *Kynsey*. "Report on the Parangi Disease of Ceylon." Colombo.  
 1881. *Charlouis*. "Vierteljahrschr. für Dermatologie und Syphilis." VIII., 431.  
 1882. *Pontoppidan*. "Vierteljahrschr. für Dermatologie." IX., 201.  
 1883. *Quain*. "Dict. of Med." London.  
 1883. *Holmes*. "Syst. of Surgery." London.  
 1885. *Hirsch*. "Geogr. and Hist. Pathology." Eng. Trans. London.  
 1887. *McCall Anderson*. "A Treatise on Diseases of the Skin." London.

## PART II.

## CLINICAL HISTORY.

*Definition*.—A tropical, endemo epidemic, chronic, diathetic, exanthematous, neoplastic, contagious, non-infectious, inoculable disease, unattended by specific adenopathies, and ushered in, after an incubation period averaging from three to ten weeks, by fever and muscular and articular pains which may be severe or scarcely perceptible. The eruption, at first papular, gradually develops into tubercles consisting of encrusted masses of cellular tissue which, originating in the

derma, protrude through the epidermis, discharge a non-purulent, acid fluid, and usually disappear by interstitial absorption in from three to twelve months. Under unfavourable circumstances, the neoplastic growth infiltrates the surrounding tissues both superficial and subcutaneous, undergoes necrosis, and excites destructive inflammation of the deepest tissues, occasionally involving even the bones.

*Stages.*—The clinical history of the affection suggests a division into four stages which may be described as follows:—

(1.) *The Incubation Stage.*—Between the moment of the reception of the virus and the development of the initial lesion at the seat of contagion.

(2.) *The Primary Stage.*—Between the appearance of the local, initial lesion and that of the general, superficial, eruption.

(3.) *The Secondary Stage.*—Between the commencement and termination of the general superficial eruption.

(4.) *The Tertiary Stage.*—That of deep seated lesions, such as exedent ulcers, periostitis, gummata, &c.

#### INCUBATION STAGE.

In determining the duration of this stage, observers have generally taken the time elapsing between the moment of inoculation or contagion and the first manifestation of the skin lesion, whether local or general; but it is evident that, as the local lesion (at the point of contagion) normally precedes the general eruption by a considerable interval, the appearance of the former should be taken to represent the termination of the incubation period.

Any attempt to estimate the term of incubation of a disease by clinical observation of ordinary cases is so obviously liable to error that dependence, in this matter, should rather be placed on the teachings of inoculation experiments which are themselves, however, not entirely free from a similar objection. In places in which Yaws is endemic, apart from the possibility of inheritance, it is difficult to decide whether the person inoculated had not been previously infected, or, again, whether the disease has been caused by the virus experimentally introduced, or by subsequent accidental contagion through the wound of inoculation. To be exact, therefore, such experiments must be performed under circumstances which are so seldom obtainable, that it is only by observing the results of a very large number of them that any approximately reliable conclusion can be arrived at. A sufficient number of such experiments has not yet been recorded; but from those that have been made it may be deduced that the incubation of the Yaws virus averages from three to ten weeks, the former being the most usual duration of that period. Cases have been recorded in which a shorter or longer interval has elapsed between the supposed moment of infection and the earliest cutaneous manifestation of the disease; but, allowing the probability of such exceptional instances, there are possible errors, in connection with these observations, in addition to those already cited, which should not be disregarded. The course of every disease is subject to modifications due to causes acting directly or indirectly on the system; and among these may be mentioned the health of the patient, the subjection of the mind or body to unusual or unusually prolonged influences, the supervention of another disease, &c. In the case reported by Thomson, of yaws following variolous inoculation after an interval of two months, the variola appearing first, the development of the more chronic was doubtless retarded by the presence of the more acute and more active affection.

There are other circumstances which must, also, be taken into consideration in estimating the length of the incubation period, viz.: the age, nationality and physical condition of the supplier of the virus and of the recipient of it; and, with regard to the virus itself, its amount, its direct source, and its age, on which two latter circumstances its activity depends. With respect to the nature of the tissue inoculated or infected, it is plain that the rapidity with which the virus is absorbed must depend on the permeability of the seat of contagion, such conditions as extensive excoriations and large ulcers, &c., affording special facilities. When a concomitant affection has modified the course of the disease, there is the probability also of a corresponding influence having been exerted on the Yaws virus which has altered its activity. We know, too, that the virulence of epidemics varies with times and circumstances, and that infectious diseases attack virgin communities with exceptional violence. Similar conditions may, therefore, operate to alter the nature of the virus of an affection like Yaws, and results obtained in places where the disease has been newly or comparatively newly introduced may, for that reason, differ from those observed in others in which it has been long endemic. Some of the circumstances already mentioned would explain differences in the incubation period in the same locality: and such differences would again depend on that important factor, individual susceptibility.

There are no special symptoms to be recorded in connection with the incubation stage. Being unaware of the changes taking place in his system, the patient takes no note of any derangement of his health which may occur during this period, or, should he do so, attributes them to an incipient catarrh, or malarial fever, or to disordered digestion. While the little attention paid to such deviations from health makes it most probable that the subjective symptoms, in cases of ordinary infection, can only be trifling, it is impossible to suppose that a disease which is capable of affecting the system so profoundly can occupy it for several weeks without inducing considerable changes in one or more of its tissues. In cases of inoculation which have come under my notice, the following symptoms were observed. The skin is dry; its papillæ are unusually prominent; there is a loss of pigment in certain portions of the skin at different parts of the body, but chiefly in the neighbourhood of the site of inoculation, producing light coloured

patches of variable size which appear yellow in the African; and the upper cells of the epidermis become dry, causing the latter to shrivel, and giving the patient's skin the appearance of being irregularly encrusted with salt. This condition, presumably due to atrophic changes induced through nervous agencies, is probably always present in a greater or less degree; but, as it is sometimes limited to only a small surface around the infected point, it may escape notice. It is often, however, a very prominent symptom which persists, in some cases, long after the eruptive stage, as an indication of the imperfect development of the disease or of its latency in the system. Palpitation of the heart is readily induced during this stage, whenever the patient exerts himself, especially when climbing, or when mentally excited. There is, also, giddiness, chiefly after arising from a stooping posture. Œdema of the limbs and eyelids is sometimes present. These are indications of the anæmia produced by the disease, and manifesting itself under the microscope by an abnormal preponderance of white blood corpuscles.

#### THE PRIMARY SORE.

Though instances are recorded in which, after inoculation, the general eruption of Yaws appeared without the development of any lesion at the site of contagion, and in most of the cases in which the disease is accidentally contracted there is no record of a local change to indicate the point at which the virus entered the body, yet there is a primary lesion connected with Yaws which is as characteristic of the affection as the chancre is of syphilis. There is no doubt that, as is often the case with regard to the latter disorder, the local lesion escapes notice, especially among the uncleanly and those subject to skin eruptions, or, if noticed, may not have been considered in any way connected with the later symptoms of the disease. And further, the tissue change at the point of contagion may not have been sufficiently prominent to challenge attention, consisting perhaps of a slight subcutaneous growth of granulation tissue inappreciably raised above the level of the skin.

When fully developed, the initial cutaneous lesion of Yaws consists of a papule which, at the end of about seven days, develops a pale yellow fluid at its apical third. After about seven days more, the fluid dries, and, on the removal of the scab thus formed, an ulcer is revealed, with perpendicular edges and a clean base lined with granulation tissue. In the course of the following fortnight, the ulcer heals by contraction from the circumference to the centre, leaving a very slight superficial cicatrix lighter at first in colour than the adjacent skin, but gradually assuming the complexion of the patient. The ulcer may last two months before healing of itself. Occasionally the papule disappears entirely by ulceration of its substance, a circular, or elliptical clean shallow sore being formed which may attain the size of a florin and heals by granulation. Another form sometimes assumed by this lesion is that of a subcutaneous tubercle which does not generally proceed to ulceration, but disappears by absorption during which the epithelium on its surface perishes and forms a thin white scale. Occasionally the papule is deep-seated and becomes large enough to be considered a subcutaneous tubercle. In course of time, a pustule forms over it, which, on rupture, reveals several minute orifices in the skin through which the subjacent pus escapes.

The above is the nature of the local lesion when produced by inoculation or by accidental contact of the virus with a slight incised or punctured wound or an abraded surface; but when the contagion has entered the body through a granulating wound or an ulcer, the disease manifests itself at the point of entrance, in the form of a non-encrusted mass of granulated tissue similar to that of the tubercles of the secondary stage. When the virus has been applied to, or has come, by chance, in contact with an ulcer, the character of the latter is altered, after the usual incubation period; the sore becomes pale and fungating, and discharges a yellowish fluid. The sites at which the initial papule is most frequently developed, are the lips, the breast (especially about the areola), the groin, the genitals and the perineum.

#### THE SECONDARY STAGE.

The commencement of this period is best calculated in connection with the first appearance of the local lesion, inasmuch as, owing to special circumstances, the ulceration or other condition induced by the latter may not have ceased before the development of the secondary symptoms. Usually, however, in an otherwise healthy subject, the primary lesion disappears a fortnight before the beginning of the secondary stage.

The cutaneous eruptions of this stage are either preceded or accompanied by fever and muscular and articular pains of varying intensity. In those instances in which there is said to have been no febrile disturbance it must have been so slight as to have escaped observation. It should be remembered, also, that in most of those countries in which Yaws prevails, the inhabitants are so subject to fever that its occurrence is regarded as not worth noticing or mentioning, patients often seeking relief for the pains which accompany the fever, the existence of which itself is only elicited after much questioning.

When the fever comes under observation, it is found to be paroxysmal, generally a quotidian. The patient complains of feeling cold on the surface, while there is a sense of heat internally. This condition, beginning a little before sunset, continues through the night, and is not followed, as in ordinary ague, by sweating. It is attended with the headache, pains in the small of the back and limbs, characteristic of malarial fevers; but, in some instances,

these symptoms in Yaws are of far greater intensity than in the latter affections. There may be in addition, formication, shooting pains all over the body, but especially in the limbs and intercostal spaces, and occasionally cramp in the calves. When the pains are severest, they are like those which accompany dengue; the patient is then compelled to remain for weeks in bed, unable to move the limbs, as if the joints were affected with rheumatism. The pains which are less during the day, become more severe at night, with the return of the fever.

The urine, though scanty and high coloured during the fever, is abnormally abundant in the apyretic intervals. It is sometimes albuminous, and especially so in those cases in which the pains in the back and limbs have been severe. In three instances I have noticed hæmaturia. In these the fever was unusually high, and the eruptions assumed a carbuncular form at certain parts of the body.

Beyond a tendency to constipation, there is nothing remarkable as regards the action of the bowels in adults. In children, diarrhœa is not an uncommon occurrence.

Epistaxis, in both adults and children, and convulsions, in infants, are symptoms sometimes noticed at this period.

The duration of the fever and pains varies. They sometimes persist until the tubercles have disappeared; but they generally cease in two or three weeks.

On its first appearance, in a typical case, such as is often seen in a healthy child in Africa, the secondary eruption is not unlike lichen tropicus, the patient being covered from head to foot with minute red spots, and the skin presenting the appearance of having been irritated by long-continued excessive perspiration. The rash begins on the head and develops from above downwards. The scalp is very slightly affected. At the end of the third day, the body is completely covered with the red spots. From their first appearance, the spots have been becoming more prominent, and about the fourth day, some of those over the head and face are sufficiently large to be described as conical papules, while those on the body and limbs attain similar proportions during the fifth and sixth days. The greater portion of the rash begins to fade after the third day, only a comparatively small number of the red spots developing into papules. The percentage of those which become papules varies considerably; and their number depends on the patient's previous and actual physical and mental condition and surroundings. Debility or a concomitant constitutional disease may interfere with the proper development of the eruption, which may also be retarded or almost entirely suppressed by exposure to cold or mental shock.

On the seventh day from the first appearance of the secondary eruption, the apical third of the papule begins to acquire a pale yellow tint. This change is first seen in the papules on the head and proceeds downwards, becoming general and complete at the end of the ninth day. The alteration in colour is not due to the presence of lymph or pus, but to a substance apparently in no way different from the inspissated secretion of the sebaceous follicles. The appearance thus produced on a black skin is very singular, and gives the idea of a number of minute pieces of yellow wax, about the size of a small pin's head, having been stuck on, at intervals, over the patient's body.

The next step in the progress of the eruption is the development of the papules into tubercles. The papule gradually expands and assumes a cylindrical shape. The pale yellow substance at the upper third, enlarges also in proportion, becomes dome-shaped, and gradually thickens until it assumes the appearance of a thick yellow crust, like that of eczema. An average tubercle when fully developed, measures a quarter of an inch in diameter and an eighth of an inch in height. When the crust is removed from its summit, a mass of granulation tissue is seen covered with a creamy secretion. It was to allow of the passage of this granulation tissue that the papule expanded in the way above described. The crust is formed by inspissation of the creamy secretion which adheres, as it thickens, to the sides and under-surface of the pale yellow substance at the apex of the papule. Whenever removed, the crust is reformed by this secretion from the granulation tissue of the tubercle; and, when the discharge is abundant, the excess exudes as a pale yellow fluid from beneath the crust.

The name "*Frambœsia*," manufactured from the French *framboise*, was given by Sauvages in 1761, to the disease, from the fancied resemblance of the tubercle to a raspberry. It would be difficult, however, to imagine anything more unlike raspberries than a crop of Yaws tubercles, covered with their thick yellow crusts. In cases in which there is but little anæmia, the tubercle on removal of its scab, is exactly like proud flesh covered with a creamy fluid, and in these, the term "*frambœsia*" may be considered appropriate; but, as in the majority of instances, there is considerable anæmia, and in all, the tubercle becomes gradually paler, what is usually seen when the scab is removed, is a lump of fawn-coloured tissue which becomes lighter in colour as the disease advances. In old standing cases, the granulation tissue becomes bloodless and white like cartilage. With their yellow crusts slightly raised above the skin the tubercles are remarkably like the tops of a cauliflower which has become yellow from being kept in pickle. If an eighth of an inch were pared off the top of a pickled cauliflower, and pieces of it, a quarter of an inch in diameter, were stuck on a person's face, at distances of an inch apart, a very fair representation would be obtained of a crop of Yaws in full bloom. Sometimes, however, the crusts have a more even surface than that of a cauliflower, and resemble yellow wax or amber.

The development of all the papules into tubercles, in a favourable case, occupies about a fortnight. During the following four weeks, the tubercles become paler and shrink from their summit towards the skin until the scab rests against the latter. At the end of that time, the scabs have become brown and thin, and fall off, leaving at their former sites, maculæ which are

at first paler than the neighbouring integument. In the black and brown races they eventually become darker, but, in the yellow and white, they continue lighter than the adjacent skin.

The tubercle consists of the ordinary granulation tissue of wounds. It secretes a fluid which, normally, is creamy in appearance, and, in otherwise healthy subjects, exudes very slightly from beneath the scab. The fluid is intensely acid at first, when escaping from beneath the scab; but, as the tubercle becomes older, it becomes neutral. When by the removal of the scab, the granulation tissue of the tubercle is exposed to the air, pus is formed on its surface and mixes with its natural secretion. This neutralises the acidity of the latter. But as soon as the scab is again formed, the acidity of the exuding fluid is readily ascertained. The eruption is almost always attended with itching which is at times very distressing to the patient.

The skin of a person affected with Yaws exhales, during this period, an odour which may be described as sour and musty, and which becomes offensive in proportion to the severity of the eruption.

The maculæ left by the tubercles persist for years and are seldom effaced. They are chiefly to be seen about the chin and lips and over the lower jaw, and can be easily discerned even in the darkest-skinned negro.

The general condition during this stage is that of anæmia with such symptoms as amenorrhœa, dyspepsia, &c.

The preceding is an account of the course of the secondary period of the disease in an acute attack in an otherwise healthy person, and under the most favourable circumstances; but the symptoms of this stage are subject to variations due to the nationality, age, and constitution of the patient. They are also influenced by a concomitant disease, undue exposure to cold immediately before or during the eruption, mental disturbance, any debilitating cause, and by the nature of the treatment adopted.

*Nationality.*—It was long thought that the disease was peculiar to the Africans, but, as already pointed out in the historical sketch of the affection, it has been found to attack Caribs, East Indians, &c., and to be endemic in places in which there has been no African migration. Experience, also, has shewn that, under favourable circumstances, Africans remain free from the disease. There appears, however, to be a greater susceptibility to the disease in Africans and those of mixed African blood than in other races; and this may be explained by that asthenic condition of the negro's skin to which are due its excessive vulnerability and consequent liability to ulceration. Whether its later lesions are more pronounced among Africans, owing to racial peculiarity, it is not possible to determine from present experience. The disease having prevailed principally and longest among them, its more serious effects have been most noticeable among those of that race; but that it may attack other nationalities with great virulence is proved by those epidemics among East Indians which checked, for a time, the Coolie immigration to some of the West Indian Islands. It is probable therefore, that, though the African may be more susceptible to the contagion, the course of the disease is far less dependent on nationality than on the circumstances about to be considered.

*Age.*—The most favourable time of life for the development of the disease is doubtless the period of infancy and, next to it, that of childhood. In places in which it is endemic it generally attacks children, and experience shews that the disease then runs a milder course than in the later years of life. So convinced of this are parents in certain parts of Africa, that every facility is given to contract the disease during infancy, and even inoculation is resorted to in order to ensure this. The course of the disease, in a healthy infant, under favourable circumstances, is such as has been already described; but, even in infants, it is subject to variations depending on their physical condition and surroundings. While, in infancy and childhood, the disease is most likely to run an acute course and not to recur, in adults it has a tendency to assume a chronic form and produce those later lesions which constitute the tertiary period.

*Constitution.*—Any disease which affects the whole system, such as scrofula, tubercle, syphilis, &c., aggravates the secondary symptoms of Yaws. Instead of disappearing by interstitial absorption, the tubercles, in unhealthy persons, may coalesce and produce wide-spreading, though superficial ulcers.

*Concomitant Diseases.*—An acute exanthematous disease, such as variola or measles, supervening during the secondary stage of Yaws, may check or postpone the eruption which will only develop or return on the disappearance of the obstructing affection. Other diseases exert a similar influence, though in a less degree. Diarrhœa, for example, if severe, may arrest or retard the eruption, and, if chronic, may alternate with it. Extensive ulcers interfere with the normal course of the secondary stage, the tubercles appearing when the ulcers heal and *vice versa*.

*Exposure to cold.*—Undue exposure to cold, in this as in other diseases, may partially or entirely suppress the eruption, which will only develop fully when the system has recovered from the effects of the depressing influence.

*Mental Disturbance.*—Any shock to the mind may act in the same manner as undue exposure to cold.

*Treatment.*—Injudicious treatment may affect the course of the eruption. The premature administration of such drugs as mercury and iodine may interfere with the process by which the virus is expelled from the body, and cause the disease to assume a chronic character. Powerful purgatives, also, by their depressing and derivative effects, may exercise an unfavourable influence. The eruption is encouraged on the other hand, and the expulsion of the virus facilitated by whatever tends to improve and maintain the general health and favours a vigorous action of the skin.

*Variations in the development of the eruption.*—The variations in the nature and development of the secondary eruption are as follows:—The tubercles may be larger or smaller, fewer or more abundant than normal, being generally most numerous when smallest. They may vary in number to any extent, there being sometimes only one tubercle. Several may coalesce and form a large patch of granulation tissue (under a single crust) which may occupy the whole forehead or cheek or chin, or extend along the entire outer aspect of the upper or lower limbs, below the elbow or knee. They frequently unite to form rings round the eyes, nose, mouth or anus, always preserving their crusts, except in the last-named locality, where the latter are generally rubbed off by friction and the tubercle assumes the appearance of the mucous patches of syphilis.

In favourable cases, the secretion from the tubercle is plastic, moderate in quantity and readily inspissates to form a crust. In scrofulous and otherwise unhealthy patients, it is thin and abundant, and exudes freely from beneath the crust. It is generally seen to be creamy white on the surface of the granulation tissue, when the scab is removed from the tubercle; but, in debilitated subjects, it is of a dirty brown colour. As it flows from beneath the crusts it is usually a pale yellow fluid like serum; but when it escapes from a large patch of coalescent tubercles on the lower limb, it sometimes assumes a reddish or even a purple tint from the presence of red blood corpuscles, the quantity of the exudation and its depth of colour being increased by the dependent position of the leg.

In place of a single, general crop of tubercles, these may appear at certain spots only, and disappear to break out again at others, on repeated occasions. This frequently occurs when, as has been already explained, the eruption alternates with an ulcer or with attacks of chronic diarrhoea; but these paroxysmal outbursts of tubercles may exist without such alternations, being apparently induced by such affections as malarial fever or by such conditions as the erysipeloid inflammation of the skin which attends elephantiasis.

Circumscribed inflammation of the skin sometimes accompanies the tubercles, producing subcutaneous suppuration and a condition similar to that which obtains in the case of carbuncles. The parts thus affected are most commonly the buttocks, shoulders, and back of the neck.

The normal end of the tubercle is its disappearance, by interstitial absorption, at the end of about six weeks from the time of its development; but, in those among whom the disease generally prevails, *i.e.*, the unhealthy, ill-fed and badly housed, the average duration of the eruption is about nine months, when no treatment has been used. Judicious remedies, nourishing food and healthy surroundings tend to shorten this period; while, under unfavourable circumstances, the tubercles may continue or disappear and be replaced by others during several years.

The tubercles may ulcerate, forming comparatively shallow ulcers, the dimensions of which depend on the number which had previously coalesced. Such ulcers are covered with yellow or greenish yellow or brownish crusts, the colour varying with the age of the ulcer and the physical condition of the patient. They are not difficult to heal under appropriate treatment, during which they cicatrize at the end of a few weeks. The scars they form are of the same colour as the adjacent skin, and are either level with it or only slightly raised and covered by a thin, shiny cuticle like a mucous membrane, or resemble the irregular and elevated cicatrices of scrofulous ulcers. These shiny scars are sometimes the result of external applications by which premature cicatrization has been induced, and they suggest the probability of the continued presence of the disease in the system in a latent form.

*Tubercles, &c., of the palms and soles.*—The palms and soles are not exempt from the eruption; but, on account of the thickness of the skin over them, the tubercles do not protrude here with the same facility as at other parts of the body. In those who go barefooted or whose hands are hardened by manual labour, the lumps of granulation tissue cannot penetrate to the surface. They become compressed and hardened; and they can sometimes be felt in the palm like large sized shot. In the feet they cause pain by the pressure on the nerves, especially in walking. This gives the patient a very uncertain tread; and, from the fancied resemblance of his gait to that of the crustacean, the disease, when it attacks the sole, is known as "the crab." When the skin has been pared off at the tender points, the tubercles beneath are found to be of exactly the same nature as they are elsewhere, but sometimes harder when they have been long subjected to pressure. In cases in which the top of an old tubercle of the sole has been frequently destroyed by caustic, on removing the thickened epidermis over it, the recurrent mass is seen to rise from the bottom of the cavity thus formed as a diminutive red cone of flesh, smooth and firm, about a quarter of an inch in height, with a base an eighth of an inch in diameter.

Occasionally the tubercle in the sole ulcerates, and produces a deep narrow perforating ulcer which is usually situated in the ball of the great toe.

The irritation, caused by the presence of the tubercles, develops a chronic inflammation of the skin of the palm and sole, which produces fissures and exfoliations of the epidermis. The latter, under such circumstances, presents the appearance of having been nibbled at by an insect, or of having been perforated at numerous points. Though these lesions of the palm and sole may not occur for several months after the tubercles have disappeared from the rest of the body, they are included among the symptoms of the secondary stage, as frequently having their origin during that period.

The same coalescence of tubercles, which has already been noticed as occurring over other parts of the body, sometimes takes place beneath the thickened epidermis of the sole. These tubercles, after a time, force their way to the surface (usually at the heel), and the appearance is then presented of a mass of granulation tissue with a very irregular surface and several inches in diameter, standing an inch or more above the level of the adjacent skin. As this occurs only in



very anæmic individuals no scab is formed over the tubercles, which are very pale, soft and watery.

*Arrested development of the secondary eruption.*—There are two conditions of the skin observed during the secondary stage of Yaws which seem to indicate an arrest in the development of the tubercles. One of these has been already described as that scurfy state which always precedes, and sometimes persists during the disease. It is accompanied by a disappearance of pigment at certain points which produces patches that are yellow in the case of the negro, and lighter than the adjacent skin in other races. Here and there the dead epithelium rests on slightly raised reddish lumps about the size of a split pea. Another is an eruption of papules mostly limited to the extensor aspects of the limbs below the knee and elbow. They are formed at the roots of the hair follicles, each having a yellowish white thick fluid in its apical third through which a hair protudes. Either of these eruptions may replace the usual one, but they frequently exist simultaneously with it, persisting occasionally long after its disappearance. They end by interstitial absorption, and the former sites of the papules are sometimes indicated by maculæ similar to those which follow the tubercles.

The persistence of the squamous eruption and of papules about the elbows and knees are indications of the continued presence of the disease in the system. Minute vesicles sometimes cluster together to form patches of irregular shape about one-eighth of an inch to half an inch in diameter. As the eruption dries and disappears it leaves, as in the case of the fully developed tubercles, maculæ which are darker or lighter than the surrounding skin, according to the complexion of the patient. The eruption in this form is generally limited to the limbs.

#### LESIONS OF THE MUCOUS MEMBRANE.

Occasionally, during the secondary stage, tubercles develop in the nasal fossæ, causing pain in the nose and forehead, and an offensive discharge from the former. Portions of the crust of the tubercle may be removed by blowing the nose violently.

A similar development of tubercles sometimes occurs in the auditory meatus, producing the symptoms of otorrhœa.

#### LESIONS OF THE MUSCULAR SYSTEM.

Reference has already been made to contractures of the flexor muscles of the limbs which, commencing in the secondary stage, or even before it, persists throughout, and sometimes beyond that period. I have never been able to verify the actual cause of this condition, and to ascertain whether it has a nervous or direct muscular origin, but analogy would lead one to imagine the formation in the deeper tissues of neoplastic growths, similar to the cutaneous tubercles, which interfere with the normal movements of the muscles.

#### LESIONS OF THE OSSEOUS SYSTEM.

Slight, non-suppurative inflammation of the periosteum covering the cranium, clavicle, sternum, ribs, ulna, tibia, and metatarsal bones may be noticed during the secondary period. This condition is characterised by tenderness on pressure, and slight redness and elevation of the skin at the affected parts, and leaves no induration.

#### LESIONS OF THE HAIR AND NAILS.

There is neither alopecia nor change in the appearance of the hair; but it disappears at the sites of the ulcerated tubercles when the hair follicles have been destroyed. The matrix of a nail sometimes inflames, causing the latter to become shrivelled or irregular. This change is often attended by a corresponding inflammation of the skin of the tips of the fingers or toes, which becomes thick and yellow.

Such is the course of the secondary stage. In those who are healthy, with favourable surroundings and without treatment of any kind the disease ends here; but, under opposite conditions, that period is yet to begin during which Yaws reveals itself under the most varied and terrible aspects. Even in the earlier part of its course, there is a great difference indeed, between that benign form which consists in the development and disappearance by absorption of a certain number of tubercles, attended with scarcely any febrile disturbance, and that type of the disease which afflicts the unhealthy under unpropitious circumstances. Instead of a slight *malaise*, the patient may be kept in bed by daily attacks of severe fever, attended with pains which deprive him of the use of his limbs. Instead of a disseminated eruption progressing rapidly and favourably towards absorption, and disappearing in a few weeks, numerous tubercles may coalesce and form extensive patches of fungous growths from which a blood-stained serum is constantly exuding, and which may last for years, crippling the sufferer and slowly weakening his system; or repeated crops of tubercles or persistent ulcers, or an alternation of ulcers and tubercles may as effectually deprive him of all energy. Even in this secondary period of the disease, girls

and boys may be found sitting in their wretched homes with limbs helpless from want of use and wasted away by unceasing exudations from large masses of fungous granulations. But, sad as may be the results of the severer symptoms of the secondary period, they are far less serious than the ravages of the disease in the tertiary period about to be described.

#### TERTIARY PERIOD.

If Yaws consisted simply of the ordinary symptoms of the secondary stage, it would certainly be a sufficiently unpleasant, though not dangerous affection; but the preceding description shews what sufferings and injuries to the system may be produced even during that period, when the lesions associated with it assume their severest forms. The following account of the tertiary symptoms, however, will shew how much more serious still and how much more terrible the disease may become when it has attained the last stage of its development.

When, either from individual predisposition, constitutional debility, injudicious treatment, or insufficient or improper food, the system is unable to expel the disease during the secondary period in which the lesions are limited to the skin and other superficial tissues, the deeper structures then become invaded, and those changes are brought about by which extensive destruction of deep tissues are effected.

#### LESIONS OF THE SKIN.

As already explained, instead of disappearing by interstitial absorption, the tubercles, during the secondary period, may coalesce and produce comparatively superficial ulcerations which, under favourable circumstances, may rapidly heal. It happens, however, that, in unhealthy subjects, under adverse conditions, one or several of the ulcers may become chronic and extend deeply into the subcutaneous tissues. These differ from the ordinary superficial ulcers of the secondary stage by having no crusts; and they vary in character with the condition of the patient. As they generally occur in the scrofulous, they usually present the appearances common to that disease, viz., jagged or undermined edges with a fungous base; and they are followed by raised, irregular, radiating cicatrices slightly paler than the adjacent skin. Their commonest sites are the neck, front of the elbow, wrist, back of the hand and instep. They sometimes produce great distortion of the parts affected. The hand may be drawn to one side, or the elbow permanently flexed; or the skin on the back of the hand or the instep may become so contracted as to draw the hand back or compel the patient to walk on his heel with his toes upturned.

There is a superficial serpiginous form of ulceration which occurs at this period, beginning perhaps several years after the disappearance of the secondary tubercles, which generally attacks the front part of the leg, below the knee only, but may cover it entirely. It begins in the form of small subcutaneous tubercles about the ankle whence it spreads upwards along the front of the leg, and slowly invades the flexor aspect. It may proceed beyond the knee and affect the inner surface of the thigh. These tubercles differ from those of the secondary period in that they are much smaller, are subcutaneous and ulcerate, leaving indelible cicatrices. They are hard, red and about the size of a split pea. Several of them appear at the same time about the ankle, arranged at intervals so as to form an interrupted circle or semi-circle. As they progress, they become inflamed, and gradually ulcerate very slightly at their summits, discharging a very plastic fluid which rapidly concretes into a brownish crust. In course of time they coalesce and complete the circle or semi-circle, so that, when the crust dries and falls off, a pink circular or semi-circular, elevated, permanent, band-like cicatrix, about a sixteenth of an inch in width, is revealed. If the crust is removed before cicatrization is completed, clean shallow depressions are formed on the summits of the tubercles. As the first tubercles heal, others develop at a distance of about a quarter of an inch beyond them in the form of a semi-circle, whose extremities are in contact with the first circle or semi-circle of tubercles. The later tubercles run a course similar to that of their predecessors, and are in turn followed by others which form semi-circles beyond and at either side of them, so that the leg presents after cicatrization a series of contiguous semi-circles consisting of slightly elevated band-like scars about a sixteenth of an inch in width.

In connection with these subcutaneous tubercles and interspersed among them, there are others chiefly situated about the ankle which present all the appearances of those of the secondary stage. They may be seen varying according to their age, some red, others fawn-coloured, others pearly white. The lumps of granulation tissue in these tubercles do not develop gradually, as in those of the secondary period, from papules, but break directly through the skin; and, when red, their colour is in striking contrast with the white of the dead epidermis around them.

The appearances above described are not generally noticed at first; for the whole leg may be covered by the coalescent crusts of the ulcerated tubercles. On the removal of these crusts, the semi-circular disposition of the tubercles is observed.

The most characteristic ulcers of this period are those originating in dome-shaped subcutaneous nodules, which are similar in appearance to the gummata of syphilis, and vary from a quarter of an inch to an inch in diameter. These are generally situated over the instep and about the ankle and most commonly over the external malleolus, though they may be met with over any part of the leg below the knee. They also occasionally occur on the upper limb, in situations corresponding to their usual sites on the lower one. They differ in structure from the

gummata of syphilis in particulars to be detailed in considering their anatomy. They resemble cysts in outward appearance, but they are found on manipulation to be less circumscribed and movable and more intimately connected with the surrounding tissues. Though not as firm as a fibrous tumour, they are not doughy like a lipoma, but convey to the touch the impression which might be expected from a subcutaneous mass of granulation tissue firmly and broadly based upon the deeper tissues. They are perfectly painless before they ulcerate, and they may remain unchanged for a period varying from a month to a year or more. At the end of an uncertain time, the skin over the nodule becomes red and tender, softens and ulcerates from the centre towards the circumference, the granulation tissue beneath being thus gradually revealed. The latter is then seen undergoing a softening process and discharging a fluid similar in all respects to blood-stained serum. By the disintegration of the nodule, a clean ulcer, of the same diameter as the latter and about half an inch in depth, is produced, with a granulating base and perpendicular or undermined edges. Such an ulcer generally lasts from three to four months, but may persist for a year or more or may become chronic and incurable. Healing proceeds from the circumference towards the centre, the edges subsiding and contracting and finally uniting and bridging over the cavity formed by the destruction of the nodule. Over the depression thus left the epidermis perishes, while, beneath it, fresh tissue grows towards the surface and raises the skin to its former level. The scar left is small compared with the size of the nodule, and is very slightly lighter in colour than the surrounding skin.

The above is a sketch of the most usual course of the nodule, which, however, occasionally disappears by absorption. Instead of healing in the manner already described, the ulcer, especially in scrofulous subjects and in those in whom the skin is, from any cause, in an asthenic condition, remains open and scabs over, and it may then persist for months or years, healing, after a time, or penetrating deeply into the tissues down to the tendons and bones, and causing deformities varying in severity according to its site and the extent of the tissues destroyed.

These ulcers are very prone to recur, unless, as to be explained in dealing with the subject of their treatment, the granulation tissue of which they are composed is entirely destroyed by caustic before they are allowed to cicatrize. Any portion of the neoplastic growth that may remain among the tissues develops, and, by its degeneration, produces fresh ulcers.

Shortly after a nodule has ulcerated and cicatrized, or even before this, another may appear in the immediate neighbourhood, or even at a considerable distance on the same or on another limb. The interval between the appearances of any two nodules varies from a few days to several months. Occasionally, before the ulcerated nodule has healed, several smaller ones develop around it; or a large number of them may appear together about the same spot, inflame, coalesce and form an extensive and obstinate ulcer.

Pale sodden ulcers, surrounded by œdematous tissue, occasionally attack the lips, cheeks, and the skin over the lower jaw. These generally occur in the scrofulous, and have a tendency to spread superficially. They sometimes invade the mucous membrane of the nose, but very rarely that of the lips.

Reference has already been made to the deep narrow ulcers of the sole which, originating in the tubercles of the secondary period, may not appear until the tertiary stage. They are most commonly found about the ball of the great toe; and they heal by a process of contraction similar to that described in connection with the ulcers derived from the disintegration of nodules.

The inflammation of the skin of the palm and sole, before mentioned as occurring during the secondary period, may become chronic and extend to the next stage. In addition to the fissures and exfoliations of the epidermis, there may be circumscribed inflammation of the true skin, attended by a feeling of burning and formication, with pain on pressure over the affected part. After a few days, a pustule appears, and, on removing the epidermis, the suppuration is found to be superficial or subcutaneous, the pus, in the latter instance, escaping through several orifices in the true skin. When superficial, the inflammation may quickly disappear, though it has a tendency to recur at the same point; but, when deep-seated, the result is generally ulceration and considerable destruction of the subcutaneous tissues.

Occasionally all the tissues of the foot become chronically inflamed. A condition very like that of madura foot is then produced without the fungous growths connected with that affection. The foot slowly enlarges to a considerable size, the swelling not extending beyond the ankle. After a time, small tubercles, consisting of red granulation tissue, protrude at several points through the skin. They soften and ulcerate, and, through the apertures thus left, a yellow or reddish yellow serum persistently escapes. The hand is sometimes similarly affected, though not as often as the foot. Great deformity results from this condition, which appears to involve even the bones themselves.

#### LESIONS OF THE MUCOUS MEMBRANE.

Destructive ulceration of the nares, pharynx and soft palate is one of the later manifestations of Yaws. The affection generally begins as a tubercle at one of the parts above mentioned. When it originates in the nose, the early symptoms are those of *ozæna*; and the ulceration spreads from this organ to the palate and pharynx. It often, however, avoids the nares and commences in the soft palate. The ulceration of the tubercle extends thence, destroying the uvula and velum palati, and the septum nasi, and deeply scoring the pharynx.

This ulceration may occur twenty years after the last traces of the secondary symptoms, even though the disease had lasted a short time only, and had been apparently effectually

expelled from the system, and though the patient may be robust and in apparently good health. It generally begins about the age of puberty, in those cases in which the earlier symptoms occurred during childhood; but it may, also, commence in childhood and soon after the secondary period.

These lesions, whether occurring in the nose or throat, are preceded by a slight fever, generally an intermittent of the quotidian type, which begins towards sunset. After a week the patient either develops the symptoms of ozæna or complains of sore throat. On examination, the tubercle may be readily detected in the anterior nares, or may be discovered by means of a speculum in the posterior nares, or the throat may appear congested with the uvula elongated and œdematous. In the latter instance, a mirror will reveal the tubercle behind the uvula. After about a month, ulceration begins; and, in a month or six weeks more, the uvula, velum palati and septum nasi have disappeared, and the pharynx is deeply grooved and covered with a greenish white, tenacious secretion. The throat may be attacked independently of the nose, and *vice versa*; but, when the ulceration begins in either, it usually extends to the other.

The ulceration generally ceases about the palate, after destroying the uvula and velum palati; but it usually lingers chronically about the posterior nares and pharynx.

Adhesions may occur between the velum palati and the pharynx, and the posterior nares may be blocked by an excessive growth of granulation tissue which may also project downwards as far as the œsophagus, leaving a very narrow passage by which respiration and deglutition are performed with great difficulty.

The percentage of those attacked with the milder form of this ulceration is considerable in some localities in which Yaws is endemic. In a district with a population of about 2,000 sixty persons thus affected have come under my notice, and possibly many more in the same place were similarly afflicted. It appears to be specially prevalent in certain parts and rare in others. The above figures refer to a certain quarter of the Windward district of Dominica, in which it is exceedingly common, and to which it seems to be entirely limited in that island. It is, on the other hand, very rare in South America and the West Coast of Africa, where comparatively few cases came under my observation.

#### LESIONS OF THE OSSEOUS SYSTEM.

The nodules which have been described as occurring under the skin, are found also under the periosteum, over the clavicle, sternum, ulna, tibia, and the metacarpal and metatarsal bones. They seldom suppurate or ulcerate in these situations, but they usually disappear by absorption or persist indefinitely. They generally inflame, when situated over the external malleolus, and discharge a yellow serum. Unlike the subcutaneous, the subperiosteal nodules are attended, at their inception, with considerable pain, which gradually abates as they become absorbed, but persists and increases when they inflame.

There is a diffused chronic periostitis at the parts above-mentioned, which is noticed at this period, and which is characterised by repeated attacks of pain along the subjacent bones. It sometimes extends to the deeper tissues, causing destruction of the smaller bones of the hands and feet, with considerable distortion of those parts.

Dactylitis is another result of this inflammation; the finger presenting the appearance of the syphilitic or scrofulous affection.

Some of the joints are occasionally affected with a chronic inflammation which is not accompanied by redness of the skin, and is attended with but little pain when at rest, though with considerable swelling. This occurs in anæmic subjects; and the joints most usually affected are those of the hand and knee. The condition is very like that of the white swelling of scrofula; but the subjects of the affection are entirely free from any of the symptoms of that disease.

#### LESIONS OF THE MUSCULAR SYSTEM.

The contractures of the flexor muscles, already mentioned as originating during the secondary, may extend to the tertiary period.

There is also a myositis of the limbs peculiar to this stage of the disease which may cause either atrophy or permanent contracture. A burning sensation, formication, numbness, and pain of the muscles are the symptoms of this condition, which is sometimes so severe as to prevent all motion of the limb, which feels as if affected by paralysis; the changes induced in the muscles by disease and want of use causing a wasting of the limb, which gradually arrives at a condition best described as "nothing but skin and bone."

After repeated attacks, at intervals of about three weeks, of burning, formication, numbness, cramp and pain of the flexor muscles, attended with quotidian ague, a contracture of the limb gradually supervenes and becomes permanent. In the case of the lower limb the contraction compels the patient to walk on the ball of his great toe.

#### LESIONS OF THE NERVOUS SYSTEM.

I have not been able to obtain any direct proof of the presence of chronic neuritis during the tertiary period of Yaws; but I have noticed cases in which there was persistent or paroxysmal

deep-seated pain along the courses of the larger nerves of the limbs, and others in which, without any signs of leprosy, there was a contraction of the ring and little fingers, apparently caused by some change in the ulna nerve, though there was no enlargement to indicate neuritis.

#### GENERAL CONDITION.

With such symptoms as have been described in connection with the tertiary period of Yaws, the system, it would be thought, could not be otherwise than profoundly affected. In severe cases, the general condition is indeed that of pronounced cachexia, but it is surprising to what an extent these tertiary lesions may exist without seriously impairing the health. This is especially noticeable in cases of ulceration of the nose and throat. When this condition is accompanied by pain and difficulty of swallowing, debility and anæmia result from want of rest and insufficient food; but, as soon as the local affection is relieved, the patient rapidly regains strength and flesh, and, if the nose is not ulcerated externally, there may be nothing in the patient's general appearance to indicate that his system is in any way diseased. The least severe cases, however, are attended, at this period, with anæmia, and, though nothing may point to this, the tissues are in a condition which render them liable to the repeated development, among them, of those neoplastic growths by the degeneration of which the changes already described are eventually effected. An individual in whom any of the tertiary symptoms of Yaws have appeared, may be certain of being affected at intervals by the same or by a series of others of greater or less severity, while living under conditions which cause the health to deteriorate.

Anasarca, the result of anæmia, is an occasional symptom of this period.

---

### PART III.

1. Diagnosis.
2. Heredity.
3. Is Yaws contractable a second time?
4. Yaws in the Lower Animals.
5. Ætiology.
6. Modes of Contagion.

### DIAGNOSIS.

Some skin diseases have been declared to be the same as Yaws, which, however, are totally different from it in many respects. Amongst others, the *verruca peruviana* has been confounded with *frambœsia*; but the description here given of the former will shew how great a difference exists between the two affections.

The button scurvy of Ireland and the *parangi* of Ceylon both resemble Yaws sufficiently to be considered identical with it; and I purpose quoting accounts of these diseases which cannot fail to interest those who are already acquainted with Yaws, as it occurs in other places.

Yaws was, for a long time, thought to be merely an endemic form of syphilis common to the negro. This idea, as Hirsch remarks, probably originated with Oviedo's account of the disease as he found it in San Domingo. Labat (*op. cit.*) writes "The '*épien*' is really what the French call '*mal de Naples*' and what the Italians have named the '*mal français*.' Everyone knows it under the name '*mal venerien*,' and it ought justly to be called the '*mal Américain*,' because it is born in that country, and it is from there that the Spaniards, the first conquerors of this new world, took it to Europe."

This belief in the syphilitic nature of Yaws has found many adherents in all times, and is even now held by some observers. Copland includes it among the syphiloids, and Lancereaux does the same. Sydenham considered Yaws and syphilis to be one and the same disease. The '*Encyclopédie Méthodique*' art, '*Pian*' (tom. VII. p. 2), asserts the identity of Yaws and syphilis.

In the following pages will be found the syphiloids, such as *sibbens*, *mal de chicot*, *falcadina*, &c., with which Yaws can be compared; and the diagnostic differences between Yaws and syphilis, &c., are there also given.

### EPIAN OR PIAN.

*Pian* or *épien* is the name of a disease in the French West Indian Colonies which has been said to be different from that known as Yaws. The description of it given by French writers leaves no doubt, however, that they are one and the same disease. The following is a summary of the earlier symptoms mentioned by French physicians as occurring in *pian*.

Pains in the limbs with fever. Red spots on the skin, which becomes scaly. An eruption consisting of fungous excrescences of varying size and colour, some being as large as the hand and discharging a thick sanious matter.

The later lesions are excrescences on the soles and palms from which a purulent secretion escapes, or inflammation and consequent thickening of these parts; pains in the bones, followed by

enlargement, caries or softening of the same; ulcers over various parts of the body; destructive ulceration of the bones of the face, palate, &c.

It is evident, from this account of pian, that it is the same disease as Yaws.

#### VERRUGA PERUVIANA.

(*Hirsch's Geog. and Hist. Pathology.*)

This disease differs from Yaws in the following respects.

- (1.) It attacks the whites much more frequently than the indians or negroes.
- (2.) It is far more fatal than Yaws, the mortality, in cases of epidemics, rising to 40 per cent.
- (3.) Its contagiousness is doubtful.
- (4.) It is contracted by strangers, after a short residence in places where it is endemic.
- (5.) It occurs only in "deep cleft, narrow valleys."
- (6.) The eruption is preceded by a "cramp-like feeling of contraction in the gullet (very characteristic)."

(7.) The fully developed "verruca" consists of "tumours of cylindrical or hemispherical or conical shape, the size of a raspberry or filbert up to that of a pigeon's egg. The surface appears to be cleft like a wart, and blood in larger or smaller quantity begins to pour from the fissures and cracks. These bleedings are often difficult to stop, and they are sometimes so copious that anæmia quickly ensues."

(8.) "In many cases warts occur also on the mucous membranes—on the conjunctiva, in the mouth, nose, pharynx and larynx, and in the vagina; in these situations they give rise to bleeding likewise, and if we may infer from hæmorrhages occurring by the mouth and anus in the course of the disease, the mucous membrane of the stomach and intestine would appear to be also a seat of the tumours."

#### BUTTON SCURVY.

(*Hirsch's Geog. and Hist. Pathology, New Syd. Soc. Translation, page 112.*)

"Having been usually preceded for a longer or shorter period by an intense itching of the skin, coming on particularly at night, the disease is ushered in by an outbreak of small round spots, which gradually raise themselves above the skin and grow into tumours in size from a pea to a nut. The colour of these tumours is at first dark red but becomes paler, the epidermis over them becoming at the same time thinner and thinner, and finally disappearing altogether; a granulating surface now protrudes and secretes a serous fluid, which becomes a dry crust on the summit of the tumour, and is quickly reproduced if it be taken off. The excrescence is elastic to the feel and somewhat painful on pressure; the skin around it shows no kind of morbid alteration. The number of such nodules in the same person varies from one to fifty, or even more. The favourite seats of the exanthem are the palms of the hands and the inner sides of the thighs and arms; more rarely the hairy scalp, and sometimes even the scrotum and perinæum, where it might be very easily mistaken for condylomata. When the tumours have lasted some time, they begin to shrivel, the scabs fall off and disclose a red spot, which shortly assumes the colour of the skin. Only in the event of suppurative disintegration of the tumours, which seems to be on the whole rare, is there a cicatrix formed in the skin."

"The duration of the malady is usually many months, and it appears to depend as much upon the long persistence of individual nodules as upon recurrences. It is only the exhaustion following a very copiously developed exanthem or one of long persistence that makes button scurvy dangerous to the health or life; in the great majority of cases the general well-being appears to have been in no wise affected, and symptoms of constitutional disturbance were never observed. Concerning the anatomical structure of the tumours, Wade, Corrigan, and Kelly agree in saying that they should be considered as hypertrophic growths of the papillæ of the corium."

"When and where it first shewed itself in Ireland is not known; this much only is certain that it has been more rarely seen in recent times than formerly, and it must now be quite extinct, if we are to judge from the silence of Irish practitioners about it at the present day. All the authorities above mentioned agree that the disease is certainly not of the nature of syphilis, as was formerly supposed, that it has just as little in common with scurvy, but that there is discoverable in its type a striking likeness to Yaws. The disease was at one time erroneously mixed up with siccens, the endemic syphilis of Scotland."

"Button Scurvy has been observed mostly in the southern countries of Ireland, and as a true endemic only in the interior among the country people. There are no doubts among the observers as to its contagiousness, whether by direct means, or indirect, more particularly by conveyance of the tumour-secretions by means of articles of clothing."

## PARANGI.

*(McCall Anderson.)*

Parangi is an endemic disease of Ceylon, where it appears to have existed for many centuries. Kynsey describes it as "a specific disease, produced by a variety of causes, all contributing to debility of the general system, and traceable to poverty, innutritious food, impure water, and residence in unsanitary dwellings in malarious localities; propagated by contagion, generally through an abrasion or sore, but sometimes by simple contact, without any solution of continuity being present or recognisable; marked by an ill-defined period of incubation, by certain premonitory symptoms referable to the general system, by the evolution of successive crops of a characteristic eruption, passing on in severe cases and in weakly subjects into unhealthy and spreading ulcers, whose cicatrices are very prone to contraction; running a definite course; attacking all persons irrespective of age; and amenable to appropriate treatment."

The disease is found mostly among the poor and dirty.

It consists of four periods (1) an incubation period, during which a single sore is noticed, and which lasts from two weeks to two months, (2) a second stage (attended with fever and pains in the joints and terminating in the appearance of an eruption) which occupies from two to eight days, (3) a third stage, during which the eruption develops and ends, and which has an average duration of six months, and (4) a fourth stage, viz., that of sequelæ, which may continue for several years.

"The cutaneous eruption is described as being frequently squamous, accompanied with fissures of the skin, which becomes the seat of ulcerations; or it may exhibit the appearance of inveterate lepra or psoriasis; or it may be vesicular, pustular, or pustulo-tubercular, and covered with an elevated scab as in rupia. These varieties may be seen together, in the same case, it being impossible to determine which appeared first. The body and limbs are generally the seat of numerous superficial ulcerations running into each other so as to form extensive sores: they commence in the cracks of the squamous surface, or in the seats of the pustulo-tubercular eruption; or they originate from the breaking of boils or small indolent abscesses; they are irregular in shape, but generally circular with raised edges, an uneven surface, the discharge being scanty, thin, and ichorous. It frequently happens that, as the ulceration is healing in one part, it is spreading in another. In children especially, ulcerations at the juncture of the skin and mucous membrane are common; and condylomata around the anus are frequent."

"Dr. Danforth thus describes the sequelæ:—'At last, symptoms of a formidable nature supervene, and all sorts of deformities occur. The nose, palate and cheeks ulcerate; the nodes terminate in caries; the globular subcutaneous tumours soften and break; the fingers and toes mortify; the hands and feet lose their sensibility, whilst pricking pains are often felt in them; the feet enlarge by the thickening of the tissues, and blebs of various sizes form on them and lead to obstinate ulceration. The surface of the body acquires a peculiar earthy colour and a glazy appearance. Not unfrequently it is covered by dry scaly epidermis. The patients may finally sink from exhaustion or from diarrhoea, or some attack of pulmonary disease.'

"Dr. Danforth states that the disease is improved by the observance of good hygienic rules; that mercury is of the greatest service in the disease under cautious management; that many cases have been relieved by the employment of perchloride of mercury, in conjunction with iodide of potassium and sarsaparilla. He states that the natives believe the disease to be venereal, and he proposes to call it the "Vanin plague."

## DELHI BOIL.

*(Leloir et Vidal.)*

It exists in Algeria, Tunis, Egypt, Syria, Arabia, Persia, India and Afghanistan. It may arise as the result of contact with a previously infected surface or without any such contact.

It may appear at the site of very dissimilar lesions such as acne, impetigo, burns, vaccine pustules, or such trifling injuries as an abrasion or the sting of an insect. Its endemic season is during the months of September and October, during which the slightest wounds or sores may develop into the affection.

It is noticed in both sexes and at all ages.

It prevails from September to February, after which scarcely any cases are observed.

The disease may be contracted by those who have only travelled through an endemic district.

The period of incubation is not yet determined but may exceed fifteen days.

It is seen most commonly on the face and limbs and on exposed surfaces, being rarely noticed on the trunk. The parts attacked are, in order of frequency, the forearm, the hands, the face, and the legs. It is sometimes found on the penis, where it can scarcely be distinguished from a soft chancre.

It lasts from three months to one year, its duration averaging from six to seven months. It is seldom that one boil only is observed. More frequently from two to forty and more are seen on the same person.

It is inoculable and auto-inoculable.

It can be contracted more than once, a first attack not conferring any immunity from the disease while the person is exposed to contagion.

The eruption is attended with, or preceded by slight itching.

A reddish elevation at first like acne, the papule soon becomes yellow at its apex and the epidermis around its base exfoliates. On raising the yellow summit, there is revealed an ulcer with perpendicular edges and a foul base secreting a sero-purulent fluid.

The ulcer gradually deepens under the crust and its edges become swollen and elevated.

The first ulcer is followed by several others in its neighbourhood which coalesce either with it or with one another, thus involving a surface varying frequently from the size of a one-franc to that of a two-franc piece, and occasionally invading the entire gluteal region of one side.

The ulcer is, at first, covered with a circular or oval crust, of a yellow, greenish brown, or blackish colour, dry and of an irregular surface, which is readily renewed. It is, however, generally bare, and it then reveals a characteristic granulating, purulent base.

This condition lasts during four or five months, during which the crust dries and the ulcer gradually ceases to extend. The base now begins to fungate, developing somewhat hard, papillomatous growths, the granulation tissue of which is highly characteristic.

After cicatrization, a thickened, violet-tinted areola continues for some time around the site of the ulcer. The cicatrix slowly disappears after passing through various shades of violet earthy, brownish yellow, or white with a brownish circle. Later it becomes smooth and white, but it never completely disappears, especially when, the crust having been early removed, there has been abundant suppuration.

The ulcer is painless throughout its entire course. Its edges are inappreciably injected; and the lymphatics in its neighbourhood are not inflamed.

The above is a description of the disease in its typical form; but it presents the following varieties:—

The *erodent* variety with deep and wide ulcers, followed by depressed and irregular scars.

The *papillomatous*, characterised by an exuberant growth of granulation tissue.

The *papulo-crustaceous*, in which the papule remains dry and encrusted.

The *abortive papulo-tuberculous*, in which the papules remain stationary, without ulcerating, and become covered with a thin layer of desquamating epithelial scales. This variety may be cured in three months, without forming crusts.

The *coherent or confluent*, in which a certain region is invaded by a large number of closely set ulcers.

There is a great resemblance between this disease and Yaws, from which however it differs in these points—Delhi boil is an ulcer which usually only begins to fungate four or five months after its first appearance. The tubercles of Yaws fungate and protrude above the level of the skin from the beginning. Delhi boil is easily auto-inoculable—Yaws is not. Delhi boil is frequently contracted more than once, a first attack not conferring any immunity from the disease, while the person is exposed to contagion. Yaws is rarely contracted a second time. Delhi boil may be contracted by those who have travelled through an endemic district. The same is not the case with Yaws, which requires contact with an affected surface or with the virus to produce it. Delhi boil is met with at all ages. Yaws is specially frequent during childhood.

#### OTHER DISEASES RESEMBLING YAWS.

Yaws has been included by some with radesyge, sibbens or sivvens, mal de chicot, falcadina, male di scherlievo, &c., in a class of diseases described as syphiloids. The following are the symptoms which are said to characterise the latter diseases:—

*Sibbens*.—In infants and children, the first lesions appeared in the throat and mouth as a general inflammation of the mucous membrane, followed by white eschars, which were succeeded by fleshy growths covered by a scab; in adults, after fever and pains of the whole body, a coppery red eruption appeared on the skin, followed by “clusters of pustules and scabby eruptions of the scalp, forehead, inside of the thighs, accompanied by little hard tubercles.” “In some, tumours resembling furuncles were seen in various parts, and gave rise to ulcers which perforated the integuments.” Ultimately soft, spongy, raspberry-like tumours broke forth in various parts of the body. Nodes and caries sometimes occurred. “The affections of the genitals, when not occurring primarily, owing to the contagion affecting the surface of the body, sometimes appeared consecutively. The disease was often fatal in children and infants in whom it had made progress before submitted to treatment.” (Copland’s “Practical Medicine.”)

Lancereaux asserts that sibbens “presents itself in the form of buboes, nodes, &c., curable by mercury.”

*Radesyge*.—The following description of this disease is by Professor Sorrenson, quoted by Lancereaux in his “Treatise on Syphilis”—“Pains in the head and limbs, especially during the night; herpetic eruptions on the forehead, chest, shoulders and arms; slight inflammation of the throat. The herpetic eruption becomes more extensive, and acquires a raised margin. It shows itself on the face, in patches, at first superficial, which gradually becomes deeper; subcutaneous tubercles are formed, which pass into a state of inflammation and suppuration. The inflammation of the throat increases; there is ulceration of the uvula and tonsils, which extends to the pharynx; similar ulcers appear in the region of the palate; the palate bones are attacked and destroyed. On the limbs appear ulcerations with dark red edges, sometimes covered with a thick dry crust. On the genitals, anus, and perinæum are developed condylomata and excrescences, which extend to the thighs. The disease attacks the septum of the nose, which ulcerates and becomes perforated; there is caries of the osseous system, especially of the bones of the nose, the long bones and the



frontal bones; tophus and exostoses are observed, which soon change to caries. The primary cause of the disease is unknown; all that is known is that a contagion is developed, which is communicable by means of the saliva, the perspiration and ichor, knives, spoons and clothes, as well as by contact. Mercury is the first and most important of all the remedies for it."

Steffens, quoted by Lancereaux, states that in radesyge "indurated glands are seen, generally, on various parts of the body."

*Mal de Chicot*.—The description of this disease is similar to that of sibbens. "These ulcers" (of the skin, mouth and throat) "were followed in many instances by cervical, axillary or inguinal buboes. At a more advanced stage, the body became covered with pruriginous tetter which soon disappeared." (Copland's "Practical Medicine.")

"According to Swediaur, it commenced by small pustules on the lips, the tongue, the interior of the mouth, and more rarely on the genital organs. The disease was afterwards characterised by considerable deposits (tubercles), nocturnal pains in the bones, ulcers of the mouth and throat, complicated affections of the glands, sometimes suppurating, most frequently hard and indolent. Finally the bones of the nose, the palate, the cranium, &c., became carious; the hair fell off, pains in the chest, cough, loss of appetite, &c., supervened, which announced the approach of death. Both sexes and all ages were equally liable to the disease; children suffered in great numbers." (Lancereaux "Treatise on Syphilis.")

*Male di Scherlieco*.—This affection is described in the following terms:—

"The disease usually commenced with lassitude of the limbs and pains in the bones, which increased during the night. The voice became hoarse, deglutition difficult, and the velum palati, uvula, the tongue, and pharynx red and aphthous. Soon after the aphthæ burst and discharged an ichorous matter which eroded the adjoining part. Ulcers afterwards were formed which extended into each other, creating sores of various dimensions, but always rounded, of an ashy colour, and with hard or raised and dark red edges. These ulcers were seated chiefly in the tonsils, uvula, velum palati, tongue and cheeks, and were followed by caries of the bones of the face and nose, and the discharge of foul fetid pus. The voice was more and more changed, and, at last, lost from ulceration extending to the larynx. The exostoses and nodes in rare cases vanished along with the pains, as soon as a pustular eruption was evolved in the skin. In many cases, after the pains in the bones, a pustular eruption appeared on the surface, which M. Boné states to have announced by itching, which disappeared when the eruption was fully out. The pustules were of a coppery colour, round and of various extent, and appeared most frequently on the forehead and hairy scalp, on the inner surfaces of the thighs and extremities and around the anus and genitals. In some cases an acrid ichor exuded from them which excoriated the skin; in others, the discharge dried and formed scabs. The disease often remained stationary in this state for a long time. After the scabs had fallen off, the skin retained marks of a coppery hue, which were removed with difficulty. The disease in it appeared in some cases with various sized blotches of a coppery colour, in the centres of which ulcers were formed, from which a matter was exuded which formed scabs similar to those which covered the pustules. These blotches were surrounded by a coppery areola. . . . The ulcers which eroded the scrotum were consequent upon the general infection. Buboes in the groins or enlargement of other lymphatic glands were seldom seen."—(Copland's "Practical Medicine.")

"This disease attacked the face and skin in the form of malignant pustules, which produced ulceration of the skin and caries of the bones, and destroyed the tongue, the ears and the genital organs." "In children the disease always shewed itself in the form of an erysipelatous eruption of a dull red colour, chiefly upon the buttocks, in the groins, on the inner parts of the thighs and on the abdomen."—(Lancereaux "Treatise on Syphilis.")

It is evident from the foregoing descriptions that, though there are certain points of resemblance between these diseases and Yaws, there are differences which are sufficiently considerable to distinguish them from the latter affection. The eruptions most commonly began in the mouth and throat, where aphthous spots were first produced, and were followed by circumscribed ulcers, which afterwards extended. In Yaws the ulceration of the nose and throat is a symptom which manifests itself very late in the disease, and long after the disappearance of the cutaneous eruptions. It originates in a tubercle, which is followed by a progressive lupoid ulceration, which is never circumscribed, but steadily invades the neighbouring tissues from its commencement. There are never any bullous eruptions in Yaws or any ulcers developing on coppery red inflamed patches of skin; neither is there ever any erysipelatous "eruption of a dull red colour chiefly upon the buttocks, in the groins, on the inner parts of the thighs and on the abdomen," nor, in the secondary stage, furuncular swellings which ulcerate, nor pruriginous tetter. The characteristic and only skin eruption of Yaws is always the same and, when developed, consists of scabbed lumps of granulation tissue protruding through the skin and secreting a fluid which at first is extremely acid, and there is no other eruption which can possibly be mistaken for it. There is a marked absence of adenopathies in connection with Yaws. The lymphatic glands are never specifically affected by this disease; whereas, though it is stated that "buboes in the groins or enlargements of other lymphatic glands were seldom seen" in the "*Male di Schiervo*," we have it asserted that in the "*Mal de Chicot*" there were complicated affections of the glands sometimes suppurating, most frequently hard and indolent," and Steffens says that in radesyge "indurated glands are seen generally on various parts of the body." If buboes and other gland affections were seldom noticed in the "*Male di Schiervo*," it is plain that adenopathies were sometimes present in this disease, which is further distinguished from Yaws by the differences in the eruptions both in the mouth and throat and in the skin. There is no falling off of the hair in Yaws. All ages are said to have been equally affected by the "*Mal de Chicot*." Yaws is particularly a disease of childhood. The early and great fatality of

these diseases also places them in striking contrast to Yaws, in which the early symptoms are altogether much milder, and which has a tendency to run a quick and favourable course or a long protracted one. Other points of difference are the facility with which these diseases are said to have been communicated (while, in the case of Yaws, the system can only be affected by considerable contact with the virus), and the beneficial influence of mercury when used during their earlier symptoms, this drug being specially deleterious when employed at a corresponding stage in the latter affection.

## DIAGNOSIS FROM SYPHILIS.

The description already given of Yaws has shewn the several points in which it resembles syphilis, and many have concluded that the former is merely a modified form of the latter disease. There are not a few respects, however, in which Yaws differs from syphilis, and these are set down below. It would be almost sufficient to mention two only, viz., the fungous eruption with its acid secretion and the absence of adenopathies characteristic of Yaws; but it is instructive to note the other symptoms by which the two diseases may be differentiated.

Syphilis.	Yaws.
-----------	-------

*General Differences.*

Contracted generally by adults.  
Occurs in all latitudes and among all classes.

Only rarely epidemic.

Hereditary.

Generally enters the system through the genitals by venereal contact.

Mercury beneficial in primary and secondary stages.

Iodide of Potassium markedly useful and rapid in its action in tertiary stage.

Contracted by those suffering from Yaws.

Secondary eruption not attended with itching.

Gummata of syphilis consist of three zones, an external composed of vascular granulation tissue, an intermediate fibro-nucleated structure, and a central mass of amorphous granular material with a tendency to calcification.

*Acquired.*

Indurated initial lesion with adenopathies.

Possible phagedæna of initial lesion.

Secondary eruption polymorphous, and not fungous. Discharge from them not acid.

Cutaneous eruptions sometimes pustular.

Lesions of the mucous membrane nearly always present during secondary stage.

Alopecia and alteration in appearance of hair.

Iritis, choroiditis, retinitis, and orchitis.

Specific adenopathies.

Ulcers of the tongue, anus and rectum.

Paralysis of ocular muscles.

Malignant or galloping type attended with phagedænic ulcerations and pronounced cachexia as early symptoms.

Common in childhood.

Limited to tropical countries, and to the poor in isolated localities.

Endemic and epidemic.

Not proved to be so.

Usually through other parts by non-venereal contact with secondary eruptions.

Harmful in the primary, and the early part of the secondary stage.

Much less so, and very slow in its action.

Contracted by those suffering from syphilis.

Attended with considerable itching.

Those of Yaws consist simply of vascular granulation tissue, which either disappears by interstitial absorption, or degenerates and softens from their centre toward their circumference, shewing no tendency to fibrillation or calcification.

Neither induration nor adenopathies.

No phagedæna.

Secondary eruption, characterised by fungous growths of granulation tissue which protrude above the level of the skin, and discharge an intensely acid fluid.

Never pustular.

Never present until after secondary stage, and generally years after.

Neither.

None of these.

No specific adenopathies.

None.

None.

Never occurs.

Syphilis.	Yaws.
<i>Hereditary.</i>	
1. Teeth characteristically notched. 2. Radiating cracks around the mouth and nostrils. 3. Mucous patches about the mouth, anus or genital organs. 4. Pemphigus of palms and soles. 5. Enlarged spleen. 6. Osteophytes and epiphysial enlargements. 7. Sunken bridge of the nose. 8. Lesions of iris, cornea or choroid. 9. Deafness.	} These lesions absent.

#### DIAGNOSIS BETWEEN YAWS AND SYPHILIS.

The following are other respects in which Yaws differs from Syphilis:—

There is an absence of symmetry in secondary Yaws eruptions.

Secondary syphilitic eruptions are distributed generally over the whole body. In Yaws there may be only one tubercle on the body to represent the secondary stage.

In secondary Syphilis the eruption is polymorphous. In Yaws there is only one form of eruption which is essentially characteristic of the disease, the squamous and papular lesions being only its early or undeveloped stage.

The secondary eruptions of Syphilis appear earliest on the front of the trunk. They are seldom found there in Yaws.

Syphilitic gummata are most commonly situated on the face, between the shoulder blades and over the sternum and clavicle. Framboesial gummata are very seldom seen in those localities, being almost always situated on the lower extremities, below the knee, and occasionally on the upper, below the elbow.

The course of Yaws is interrupted by exanthematous and other diseases; but with regard to Syphilis, Lancereaux, while admitting the occasional influence of such a disease as Cholera or Typhoid in arresting Syphilis, writes as follows:—"When the syphilitic manifestations exist, the development of an acute disease has not generally much influence upon their course or termination. In an individual suffering from variola and arrived at the end of a papular syphilide, I did not observe any appreciable modification in the course of the syphilitic eruption."

The following is a statement shewing the relative frequency of Syphilis according to age (Cazenave, *Traité des Syphilides*).

AGES.				CASES.	
From birth to 10 years	...	...	...	...	1
" 10 " 20 "	...	...	...	...	2
" 20 " 30 "	...	...	...	...	67
" 30 " 40 "	...	...	...	...	43
" 40 " 50 "	...	...	...	...	27
" 50 " 60 "	...	...	...	...	11
" 60 " 70 "	...	...	...	...	2

—153

As will be seen from the tables at the end of this treatise, it is from birth to the twentieth year that Yaws is most prevalent.

It is in the tertiary stages of Syphilis and Framboesia that the difficulties of diagnosis are greatest. Hence it is that one is often at a loss to decide whether the lesion under observation is due to long standing Yaws or to hereditary syphilis, which when tardily developed presents tertiary symptoms. Fournier (*La Syphilis héréditaire tardive*) describes the cutaneous lesions of inherited syphilis as "des lésions profondes, néoplasiques, importantes, graves, de l'ordre de celles qu'on observe dans les étapes avancées de la syphilis acquise. Ce sont, en un mot, des lésions tertiaires. Précisons mieux encore: ce sont des syphilides tuberculeuses ou gommeuses." Of the cutaneous gummata which are met with both in tertiary Yaws and in acquired syphilis he writes: "Élément primordial, constitutif, essentiel, ce qu'on appelle le tubercule, c'est à dire une néoformation intradermique, constituée par une prolifération surabondante d'éléments cellulaires, de jeunes cellules déposées au sein d'une gangue interstitielle amorphée. Ce sont, en un mot, de véritables gommages cutanées." "C'est une tumeur solide, résistante sous le doigt, toujours plus ou moins dure." "À sa surface, les téguments distendus présentent une coloration d'un rouge sombre."

Though morphologically similar at the commencement, the gummata of Syphilis and Yaws, as has been in part already explained, differ in the following respects: The latter neither fibrillate nor caseate. They are limited to the extremities below the knees and elbows. The integument above them does not present "une coloration d'un rouge sombre," the skin over their centres

remaining of its natural tint for months until interstitial absorption is about to take place, when it then becomes inflamed and ulcerates. It sometimes happens, however, that absorption occurs without any discolouration or ulceration of the integument above the framboesial gumma.

The concomitant diagnostic symptoms are those affections of the organs of sense which have been shewn by Hutchinson to be so frequently found in inherited syphilis and those alterations in the shin and nose which Butler humorously refers to in *Hudibras*. We never find, in Yaws, interstitial keratitis, a sunken nose bridge, sudden bilateral deafness, notched teeth, sabre-shaped tibiae, philosophic foreheads, periostitic gummata of the cranial bones, &c. Unfortunately for diagnostic purposes, it is very seldom indeed that the eyes, ears and teeth are affected by syphilis in the African races. In them these organs generally remain intact amid the ruins which syphilis works in their skin and bones. With regard to the sunken bridge of the nose and the sabre-shaped tibiae, these are naturally somewhat characteristic of the African. The cranium of the African child hardly ever shews those deformities which are so often met with among Europeans. One is, therefore, under a great disadvantage in distinguishing between the two diseases under such circumstances, as the lesions are often limited to those which are common to the tertiary stages of both affections, viz.: cutaneous ulcerations, hypertrophic dermatitis, periostitis, osteitis, osteo-periostitis, synovitis, and teno-synovitis; and iodide of potassium and mercury, whose beneficial effects in syphilis serve to diagnose that disease in doubtful cases, are as useful in the treatment of Yaws as in that of the former affection.

#### DIAGNOSIS BETWEEN YAWS AND SCROFULA.

The lymphatic system is specially and specifically affected in Scrofula and not in Yaws.

While the materials of which scrofulous growths consist are the products of a special inflammatory process, the granulation tumours of Yaws are neoplasms in the truest sense of the term.

The inflammatory zones around scrofulous lesions are absent in those of Yaws.

The usual signs of inflammation are present in Scrofula and absent in the secondary symptoms of Yaws.

The giant cells of Scrofula have not been found in Yaws.

Yaws tubercles disappear by interstitial absorption, which is not the end of the cell-growth of Scrofula.

Caseation occurs in Scrofula but not in Yaws.

Scrofula is found in all countries. Yaws is limited to certain parts of the tropics.

The statements of observers differ considerably with regard to the extent to which Scrofula prevails in the tropics. I agree with those who consider it a comparatively rare disease in tropical countries. It appears to be greatly due to want of light, ventilation, and food, three factors which tend to produce it in cold and temperate regions, but which are absent, generally speaking, in warm climates where the inhabitants can procure food with little labour and spend the greater part of their lives in the open air. Kingsley, writing of Port of Spain, the capital of Trinidad, says: "Next, the stranger will remark, here, as at Grenada, that everyone he passes looks strong, healthy, and well fed. One meets few or none of those figures and faces, small, scrofulous, squinny and haggard, which disgrace the so-called civilization of a British city. Nowhere in Port of Spain will you see such human beings as in certain streets of London, Liverpool or Glasgow. Everyone plainly can live and thrive, if they choose."

The following are the remarks of Treves, with regard to the ages at which scrofula occurs most frequently:—

"With regard to age, scrofula is most common between the ages of three and fifteen. Before the age of one year struma is quite uncommon, and if it does occur before that age, it is usually severe in its character. An outbreak of the disease is not uncommon between twenty and thirty, or again a little later after thirty, especially in females: and scrofula may also appear quite late in life and that also in some instances for the first time (senile struma). Sex appears to have no influence in the production of scrofula, the only facts worth noting being that gland disease appears to be more common in the female, and joint affection in the male."

#### DIAGNOSIS BETWEEN YAWS AND LUPUS.

The following characteristics of *Lupus Vulgaris*, summarised from one of Hutchinson's post graduate lectures, will serve to distinguish the lesions of this disease from those of Yaws.

There is a congested zone around the ulcerative patches of Lupus.

There is hæmorrhage from the surface of the patches after the removal of the crusts when these exist.

The crust over a Lupus growth is not a single common covering, but is produced by the coalescence of the crusts of the various smaller growths which constitute the mass, so that, on its removal, it is found to send processes between the latter. The "apple jelly" growth is common in Lupus.

Lupus is always serpiginous.

It seldom attacks infants or young children.

It does not spread to the bones or the joints.

It is restricted to the skins and mucous membrane.

To these differences may be added the following:—

The granulations of Lupus are much softer than those of Yaws.

Its crusts are yellowish brown, while those of Yaws are straw or amber coloured.

The secretion from Yaws ulcers is generally copious and offensive, while the reverse obtains in the case of Lupus.

Ulceration both of the skin and of the mucous membrane in Yaws proceeds rapidly.

The ulcers of Lupus extend very slowly.

Yaws is curable by Mercury and Iodine, which are powerless against Lupus.

That Yaws often leads to Lupus, I am convinced, the lesions of the former when of long standing facilitating the entrance into the tissues of the exciting cause of the latter.

While Lupus is found in all countries, Yaws is limited to certain parts of the tropics only.

#### HEREDITY\*.

##### *Is Yaws hereditary.*

It is difficult to decide whether a disease like Yaws is hereditary. There are several cases recorded in which the patient does not appear to have come in contact with an infected person previous to the development of the disease; but this cannot be proved beyond doubt. I have known of cases in which infants at the breast have developed the disease in isolated places at and near which there were no persons suffering from Yaws. This would suggest heredity. The mother had previously had Yaws, which was considered cured; but this may not have been quite the case, and there may have been some unnoticed contact with individuals afflicted with the disease who had visited these places from long distances.

Paulet's experiment to prove the hereditary transmission of pian is told by himself as follows:—

"I shut up in a room to which no one else had access, twelve children born of diseased parents; their nurses were not affected with pian, their own health was particularly good, and yet in three, four, and seven months, these children had pian, and, some time after, in an interval of from two to six months, the nurses also became affected." "This fact" says Lancereaux "proves not only the contagiousity but also the hereditary transmission of pian." The value of the experiment of course depends on the measures taken to ensure the complete isolation of the subjects and whether these measures were successful.

Yaws is certainly a disease which very frequently attacks children; and this lends some support to the theory of its being hereditary. But in its early years the child is in closest contact not only with its mother, but also with the many other persons, children as well as adults, who may take care of it while the mother is otherwise engaged and by whom it may be infected. There is again, the possibility of the child's contracting the disease through the mother's milk, though this is not probable, from the fact that attempts at conveying the contagion by inoculating with the blood have not been successful. To those who do not believe in the possibility of contracting Yaws a second time, the fact that the nurses became affected with the disease, in Paulet's experiment, would be sufficient proof that they had not previously suffered from Yaws, and that the children were not affected by their milk.

Against an experiment of this kind, however great its value and conclusive as it would be if carried out without any possibility of error, can be placed the numerous instances in which children are born healthy and have continued so for years after, though both their parents were infected with Yaws a year at least before their birth and were still so at the time, and the fact that no cases are recorded in which a child has been born with the infection. These circumstances do not accord with those of syphilis, which is undoubtedly hereditary and with which children are frequently affected at their birth.

Touching the subject of heredity, Labat (op. cit.) Part IV., p. 131, writes "The Caribs are very subject to l'Épian. It must be confessed that this disease is peculiar to America and that it is indigenous there; all who are born there, blacks or Caribs, of whatsoever sex they may be, are attacked by it almost at birth, though their fathers, their mothers and their nurses may be quite healthy or at least may appear so."

If Yaws were hereditary, its extirpation by segregation or any other process in one generation or more would be impossible.

This has actually occurred, however, in some places in which the disease has entirely disappeared. Another argument against the hereditary nature of Yaws is the fact that it develops almost simultaneously among the members of a family irrespective of age.

#### CAN YAWS BE CONTRACTED A SECOND TIME?

The question, whether Yaws can be contracted a second time, is almost always answered in the negative, few instances being recorded to the contrary. It is quite possible to suppose that in cases in which the body has been profoundly affected, there is less likelihood of a second attack than after a mild case in which no tertiary symptoms have been developed. The immunity might be supposed proportionate to the intensity of the virus, and the extent to which it has invaded the system. There is also the possibility of the influence of the virus becoming so lessened or lost with time, as in the case of cow-pox or variola, as to permit of a second infection. The fact, however, that cases of a second attack are so very rare may be explained by the early age at which the disease is usually contracted. It is, on the other hand, comparatively rare during adult age, and the immunity from second attacks of grown-up persons who have been previously

\* The statistics at the end of the treatise shew the extent to which the disease may be considered hereditary. The larger percentage of cases in a family in which both parents were affected can be explained by the greater facility of contagion.

infected is possibly not greater than that of those who have never suffered from the disease. One instance in which Yaws has been contracted a second time is sufficient proof that it can be so contracted. The rarity of the instances only shews that it is a possible event which seldom occurs; but such instances are far from being as rare as they are thought to be.

Hirsch writes as follows: "Wherever Yaws has been observed hitherto, it is especially during childhood (from the 3rd to the 12th year) that it has occurred. But the often expressed opinion that having survived the disease in youth abrogates the predisposition to it for the rest of life, does not hold good absolutely at all events. Bajon and Thomson had already stated that this removal of susceptibility to subsequent attacks was much the same as in small-pox; that is to say, it was the rule, but there were exceptions. Ferrier also speaks of the same person taking it more than once, and Charlotis says, 'I can confidently vouch for the fact that frambœsia may attack the same person more than once; and the truth of that may be proved not only by enquiring into the history of cases, but also by inoculation.'"

Several cases of subsequent attacks have come under my observation of which I have mentioned two at the end of this treatise. It is customary for those who will not allow the possibility of a second attack of Yaws to attribute all second appearances of the disease to a return of the original attack, which they consider to have been uncured. This may be an explanation of such tertiary frambœsial lesions as may appear after secondary or other previously existing tertiary symptoms, but cannot possibly account for the development of characteristic Yaws tubercles (secondary lesions) over the body, years after a first attack.

#### YAWS IN THE LOWER ANIMALS.

Fowls are subject to a disease the eruption attending which is similar, both macro- and microscopically, to that of human Yaws. When thus afflicted, the animal becomes anæmic and loses flesh; and unless carefully attended to, is very liable to succumb to the affection.

Though the tubercles may break out over any part of the body, they are most plentiful and conspicuous about the head and beak, the eyes being almost or entirely closed by the scaly eruption. Cattle, also, may be similarly affected, the disease being apparently limited to bulls and cows, for I have never observed it in sheep and goats.

It has not been proved, either by my own experiments or by those of other observers, that human Yaws can be conveyed to the lower animals or that of the latter to man; but there is no difference between the two eruptions, even as regards the discharge from them, which is acid in both. It may be that the same micro-organism which originally produced the disease both in man and the lower animals has in course of time assumed different forms, and has become accustomed to surroundings without which it cannot exist. It is possible that, by cultivation, this organism, in the case of the lower animals (whether bacterial or protozoic), may gradually be made to thrive in human tissue and *vice versa*.

Apart from the increased facility for therapeutical and other scientific investigations which proof of the identity of the disease in man and the lower animals would afford, the interest of experiments with the Yaws virus of man on the lower animals and *vice versa* lies chiefly in the possibility of obtaining, for inoculation purposes, an attenuated human virus or a virus from the lower animals which would prove against Yaws as prophylactically efficacious as vaccine lymph against variola.

#### ÆTIOLOGY. \*

*Climate.*—The localities in which Yaws prevails most extensively are damp, hilly and isolated districts in the tropics. Some of the places in which I have known the disease to exist most extensively and in the severest forms are otherwise very healthy as compared with others where it is entirely absent. That condition of climate known as "malarious" does not appear to be an essential element in the production of the disease; though it may be an indirect cause of it by its debilitating influence. Affections similar to Yaws, such as sibbens, mal de chicot, &c., have prevailed for a time in cold climates; but they are not identical with Yaws, and are rather local epidemics of syphilis. Yaws has been observed to spread more rapidly after continued rains. Allowing it a microbic origin, moisture may have a revivifying influence on its germs, which may subsequently rise with the dust during dry weather. Fowls are generally attacked with Yaws about March; and the popular theory in the West Indies is that the disease is due to their eating the cashew nut. There is no doubt that the consumption of a pungent substance is liable to produce irritation of the skin and sometimes causes in fowls an eruption like that of Yaws in appearance. By causing hyperæmia of the skin it may aggravate the Yaws eruption, or, by the ulcers which it may produce, facilitate the entrance of the virus into the system; but it cannot, by itself, originate Yaws. March is the commencement of the hot weather and the end of the rainy season. The prevalence of Yaws about that time may be explained, as suggested above, by the influence of heat following a long period of rain.

*Nationality.*—No race is exempt from the disease, though the Africans are the most commonly affected and, next to them, those of mixed African blood. Its comparative rarity among Europeans is due rather to their avoidance of contagion than to racial immunity. It is capable of attacking East Indians and Caribs with as much severity as Africans; while, under favourable circumstances, the latter remain free from the affection.

\* The prominence given to personal contact as the chief source of contagion in Yaws, has diverted attention from other media through which the disease may be communicated, such as air, soil and water. The idea of contagion from these sources seems to be borne out by the fact that infants, who are too helpless and tender to be left on the bare ground, generally escape the disease, which is commonest among children who are old enough to crawl or run about in mud and dust.

*Age.\**—Childhood is the period of life at which Yaws is usually contracted. This is doubtless due to scantiness or entire absence of clothing at that time, to the frequent contact between children and those who nurse them, as well as to the familiar intercourse between the infected and uninfected at play. The tenderness of the skin, in the case of children, and the prevalence among them of cutaneous eruptions, such as itch, may also explain their greater liability to the infection.

*Sex.†*—The disease occurring generally in childhood, both sexes being, at that time of life, under similar conditions, are then equally affected by it. As regards adults inasmuch as injuries to the skin facilitate contagion, men would be far more susceptible to the affection than women, in places in which outdoor work is performed by the former only; but, in the localities in which Yaws prevails, women are engaged almost, if not quite, as much as men in field and other rough labour, and their tendency to contract the disease is increased by their closer contact with their children.

*Constitution.*—A constitution affected by such diseases as scrofula, tubercle, syphilis, &c., is specially liable to a severe and chronic form of the affection, both from their debilitating effects and from the ulcerations which they induce.

*Diseases.*—All diseases attended with abrasions and ulcerations of the skin such as scabies, variola, cowpox, &c., increase the tendency to contract Yaws.

*Wounds and Diseases and Injuries of the Skin.*—All wounds and diseases and injuries of the skin, such as ulcers, burns, scalds, &c., afford entrance to the virus.

*Diet.*—The diet of the people most commonly affected with Yaws may contribute to render the system less capable of resisting the contagion. It consists almost entirely of vegetables, such as plantain (*musa paradisiaca*), yam (*dioscorea sativa* and *alata*), tanya (*caladium sagittifolium*), sweet potato (*batatas edulis*), Indian corn (*zea mais*), cassava (*iatropha manihot* and *janipha*), to which is added a small quantity of salted fish, which is often not far from being putrid. Fresh meat is seldom eaten, and "greens," such as cabbage, lettuce, onion, French beans, &c., are never thought of by the majority of the inhabitants of the Yaws-infested districts. Fat (by which I mean the fat of fresh meat) is almost entirely absent from their food. They frequently indulge in shell fish and others noted for their irritating action on the skin. Other points in connection with their diet are an excessive indulgence in pepper (*capsicum*) and a very limited use of salt.

Referring to the Caribs, in his work, "Histoire Naturelle et Morale des Antilles de l'Amerique (1658), p. 504, Rocheford writes:—

"The bad food, consisting of crabs and other insects" (*sic*) "on which they generally live, is the cause of their being almost all subject to a serious complaint which they call Pyans in their language, as the French are to the small-pox. When those who are attacked with this foul malady eat the real turtle, the lamantin (manatee or sea-cow), or the tortoise, which is another kind of turtle, they break out at once in pimples, because the flesh of these animals drives out the disease. They often have also large gatherings, boils and carbuncles on various parts of their bodies. To cure these complaints, which are chiefly due to the bad food they eat," . . . and also at p. 410, "It is amusing that these poor people are so simple that, though they have many fine salt ponds amongst them, they nevertheless would not dare to use salt in their food, considering it extremely injurious to health and to the preservation of life. So they never eat it by any chance, neither do they season meat with it. And when they see our people eating it, they say to them in a pitying tone, which is really pitiful, 'Compère, you are killing yourself.' But, in place of salt they use pepper to an extraordinary extent in their meals.

"Neither do they eat pork or turtle, though these animals abound in their country."

Labat, writing of the same people in his work, "Nouveau Voyage aux isles de l'Amerique" (1694), Part IV., p. 121, says, "This is the land of eels. The Caribs let them live in peace, because they do not eat them. They brought me nine or ten of the finest in the world. We put them to roast and boil; but we were forced to season our sauces with sea water, for our hosts do not use salt, and we had forgotten to bring some with us."

The absence or insufficiency of salt in their diet has already been referred to as one of the possible explanations of the greater susceptibility of the Africans to Yaws. The habitual consumption of salted shell fish, and others more or less poisonous, as well as the excessive use of pepper may, by causing hyperæmia and consequent irritation leading to ulceration of the skin, tend to facilitate the entrance of the virus into the system and cause the eruption to develop in an aggravated form. In what manner an unvaried vegetable diet increases the liability to the disease, it is not possible to explain satisfactorily; but there are vegetables and vegetables, and fibrous roots grown constantly on the same patch of ground may eventually lose a considerable portion of their nutritious and healthful properties. One of the tropical vegetables, the plantain,‡ is highly

\* The statistics at the end of this treatise shew that Yaws is by no means frequently contracted during the first year of life, as asserted by some. They prove, on the contrary, that infants are very seldom affected with the disease in comparison with children and adults.

† In a district containing 1,004 persons, of whom 435 were males and 569 females, I found that 61·30 per cent. of the males and 51·31 per cent. of the females had contracted Yaws.

‡ The following analyses shew that the plantain is more nutritious than the Irish potato:—

PLANTAIN.		POTATO.	
Nitrogenous matter	4·820	Nitrogenous matter	2·1
Sugar, pectin, &c.	19·657	Starch, &c.	18·8
Fatty matter	0·632	Sugar	3·2
Cellulose	0·200	Fat	0·2
Saline matter	0·791	Saline matter	0·7
Water	73·900	Water	75·0

nutritious, but this is not the one generally consumed by the inhabitants of districts where Yaws prevails. The tanya is more generally preferred, possibly as being more easily cultivated. The power of diseased grain in producing disorders of the skin is well known, and it is possible that vegetables grown on a naturally poor or exhausted soil may acquire qualities which, though not readily appreciable, may yet act injuriously on the system. The Irish have had their button scurvy, and it would be interesting to learn to what extent the disease was due to the particular diet of the people in the districts attacked.

The injurious effects of salted food are not due to the salt contained in it, which is, on the contrary, healthy, but to the fact that such food is inferior to fresh, from insufficiency of fibrine and albumen, of which one-fourth and six-sevenths respectively are estimated as lost in the brine, and that, whether in pickle or dry, it has been deprived of many of its nutritious properties, and is digested with difficulty. It must be noted, also, that salted fish and meat in the tropics are generally well soaked, and as much of the salt as possible extracted from them before they are eaten.

*Alcohol.*—Alcohol exerts an aggravating influence on the disease. I have known cases which were progressing favourably, suddenly so affected by excessive indulgence in spirits that the tubercles, which were previously shrinking and drying, developed afresh and began to discharge a specially offensive fluid.

Labat (op. cit.) Part IV., p. 131, writes as follows with regard to the cause of Yaws:—

“It is said that this disease proceeds from the corruption of the air and food as well as from excessive sexual connection. It is a sort of pest which is easily communicated, and is wonderfully destructive; and it is very rarely that those affected with it get cured completely.

“It is not for me to decide what is the most probable cause of this disease, whether sexual intercourse or the corruption of the air, I leave that to the physicians. I think that either the one or the other can produce it, and that when both causes are combined in the same person, the disease is more severe, more dangerous, and more difficult to cure, or rather to alleviate.

“There are places on the mainland of America, such as Surinam and Berbice, where one formerly caught it almost on landing, and without knowing, so as to speak, whether there were women in the place. It was surely, in those cases, the corruption of the air that caused the disease. It is said that since the Dutch, who are the masters of the country, have drained the swamps and made a channel for the stagnant waters which infected the air, the disease is not so common.”

Neither diet, however, nor the other conditions above mentioned can suffice to explain the origin and existence of Yaws. There are localities in which, under the same conditions, men attain a high standard of physical development, and in which the disease is unknown; and there are districts where Yaws prevailed formerly and where, merely by the absence of contagion and without any change in the food and surroundings of the people, it has completely disappeared. In that portion of Dominica, which has been assigned to the Caribs and is occupied by them only, Yaws is virtually extinct, though neither as regards their diet nor in other respects are they more favourably situated than the Africans in the adjacent districts, among whom the affection is exceedingly prevalent. The present exemption of the Caribs from the disease, has evidently been gradually effected by the simple process of persistent segregation.

But, though improper and insufficient food may not explain the prevalence of Yaws in any locality, a particular diet long persisted in may have assisted in producing the original cases from which the contagion spread, and may not only render the system more susceptible of becoming infected by the disease in places where the virus has been already introduced, but may also cause the affection to assume a more severe and chronic form.

The remarks of Bidder on the influence of diet in tuberculosis are worthy of consideration in connection with Yaws. He believes that starchy foods and those in which there is a large proportion of potash are prejudicial, while albuminous foods and those rich in soda are beneficial in tuberculous diseases. He is of opinion that animal, is preferable to vegetable food in such cases, and attributes to their excessive use of vegetables the greater susceptibility to tuberculosis of the inhabitants of Western as compared with those of Eastern Germany, who partake freely of salted flesh. There is a striking resemblance between the skin affections of Yaws and tuberculosis as well as between their deeper lesions, and it is very probable that diseases which are so much alike in their pathology would be similarly influenced by the same diet.

## CONTAGION\*.

### *Modes of Contagion.*

Yaws is communicable by direct contact such as kissing, sucking, sexual intercourse, or by any act by which the body is made to touch an affected part. Experience shews that the surface in contact must be abraded to permit the entrance of the virus. Attempts have been made by children to contract Yaws, so as to avoid being sent to school, by repeatedly rubbing their bodies against the diseased parts of the skin of infected persons, but without success. Again, experiments performed by placing the discharge from the Yaws tubercle and the tubercle itself on an unabrased surface have not succeeded in transmitting the contagion. Husband and wife, mother and child, frequently communicate the disease to one another. The genitals in the former instance, the breast, the mouth, and neck, in the latter, are the most

\* Yaws is not easily inoculated through the healthy skin. It is very difficult to produce the disease by using the discharge from a Yaws tubercle as we use vaccine lymph. My experience leads me to believe that the Yaws virus requires a diseased part, such as an ulcer, to find its way through the skin into the system.



usual sites at which the virus is admitted. Whatever produces an abrasion of the skin opens a channel for its admission into the system. A wound, a burn, an excoriation, a fissure, an ulcer, the cavity left after extracting a chigoe, the sores caused by scabies, all these afford passage to it. The most common of these means of infection is the itch. When the latter attacks a community it offers the greatest possible facilities for the reception of the Yaws virus; and as the itch spreads rapidly in a negro village the Yaws is thus quickly disseminated.

Vaccination\* is another means by which the virus may be transmitted. When syphilis is thus contracted, the contagion is supposed to have been conveyed in the blood accidentally mixed with the vaccine lymph. But the blood in Yaws has not been proved to be infectious. Cases sometimes occur in which, after vaccination, Yaws tubercles develop around the sites of the vaccine pustules. It is doubtful whether the Yaws virus, in such instances, was introduced with the lymph, or was subsequently contracted through the sores caused by the operation. In some cases of this kind, there is no history of exposure to Yaws infection after vaccination, and this would lead one to suppose that the disease had been conveyed with the lymph; but it is always difficult to prove the entire absence of all sources of contagion, and, especially so, in the usually overcrowded houses of the poor. With vaccination as a means of communicating the disease, it is evident that Yaws might soon become epidemic in a community in which it is endemic, unless precautions were taken either to isolate the vaccinated entirely or to protect the wounded part against subsequent contagion. These measures would, of course, not be effective, if the Yaws virus is transmissible in the vaccine lymph.

Flies are supposed to convey the contagion on their legs. They cannot inoculate an un-abraded surface; but it is probable that they do convey the virus in this manner, and can infect the system through an open sore.

Wearing the boots or clothes of a person affected with Yaws may also impart the disease. This necessarily requires that the Yaws matter be conveyed on the article worn and the existence of an abraded surface for its reception into the system.

#### PART IV.

1. Pathology and Morbid Anatomy.
2. Cases illustrating the clinical history of Yaws.
3. Treatment.
4. Prophylaxis.
5. Tabulated Statistics.
6. A Yaws district.

#### PATHOLOGY AND MORBID ANATOMY.

##### THE YAWS PAPULE.

Before proceeding to enter into the details of the general pathology of *Framboesia*, it is well to consider the minute structure of the elementary form of its cutaneous lesions, viz., the papule.

Anderson (p. 117), concerning the papule of Eczema, thus sums up the results of the investigation of Biesiadecki and Rindfleisch. "That papule is formed thus: The blood vessels of papillæ of a limited area—often those which surround a hair follicle—become congested; this is followed by an exudation of fluid and later on by the formation of cells; the connective tissue corpuscles of the papillæ are also increased, in size and number, and become very succulent. The papillæ are enlarged both in a vertical and in a transverse direction. The epidermis is stretched over them but not much altered, numerous spindle shaped cells, derived from the connective tissue corpuscles, being found in the mucous or even into the horny layer of the epidermis, while many have one extremity in the papillæ, and the other in the mucous layer. In the latter they often form a dense network, within the meshes of which the slightly swollen and granular epithelial cells lie embedded. This circumscribed infiltration of the mucous layer of the epidermis and of the papillæ constitutes the eczematous papule."

This is an exact description of the initial papule from which the Yaws tubercle ultimately develops. The account given of the formation of pustules corresponds also with what is observed in the further progress of the Yaws papule. "In the development of pustules the same changes are observed in the early stage as in the case of vesicles; but the papillæ are seen to be studded with numbers of young cells which extend to the deepest part of the mucous layer so that at the apices of the papillæ, no line of demarcation between the true skin and the epidermis can be made out. These young cells approach the surface and are set free as embryonic cells and pus corpuscles before there is time for their development into epithelial cells. If Eczema becomes chronic, it is due to the persistence and intensity of the congestion of the papillary layer and to excessive cell infiltration of the corium which may extend to the subcutaneous cellular tissue, and surround, and even obliterate the blood vessels, their situation being marked by streaks of pigment, so that a veritable elephantiasis of the affected part may result. The papillæ become degenerated, and being much enlarged are distinctly visible to the eye, and often look like granulations."

The initial cutaneous lesion of Yaws is, in fact, a true papule, differing from the pseudo-papulous eruptions of lichen, strophulus and prurigo which, according to Gustav Simon, are not due to hypertrophy of the papillæ, but to the distension of the skin by serum effused into its substance through nervous influences.

\* In a district containing 1,004 persons, 600 were unvaccinated; and of the latter, 290 or nearly 50 per cent. were found to have had Yaws. Of the remaining 404 vaccinated, two years previously, 228 had had Yaws before vaccination, and of the 176 vaccinated who had never had Yaws before, only 8 contracted it after vaccination—viz., 3, two years after 2, one year after 2, two months after and 1 three months after. These figures seem to shew that the vaccination two years previously had but little to do with the spread of Yaws in that district.

## GENERAL CONDITION OF THE SKIN.

Hirsch concludes from the investigations of Paulet, Ferrier, Charlouis and Pontoppidan that Yaws is a "chronic dermatitis proceeding from the papillary layer and extending deeper into the corium in successive stages of the malady."

The researches of Charlouis and Pontoppidan are thus summarised by him. "Charlouis has found at the beginning of the skin affection dilatation and tortuosity of the surface vessels and afterwards of the deeper, together with escape of colourless blood corpuscles and extensive accumulation of these in the tissues; and he is convinced that the progressive enlargement of the papillæ of the skin and the changes in the deeper parts associated therewith have kept pace with the changes in the vascular system. He has found also that, as the disease progresses, the hair follicles as well as the sebaceous and sweat glands and the muscles of the skin are implicated in sympathy. After repeated microscopic examinations of the morbid tissues, he is unable to arrive at the actual cause of these pathological changes. Pontoppidan found on cutting out a nodule and examining it under the microscope, after it had been hardened in alcohol, that the crust consisted of a conglomerate of dried-up epidermis and pus corpuscles, beneath which was a stratum of granulation cells (as in granulomatous growths) the papillary stratum being entire, although somewhat flattened the rete mucosum on the other hand, wasted and occupied by round cells, while the corium was free from adventitious elements. He could never discover fungi, such as *Tricophyton* or *Microsporon*, either in the slough or in the layers beneath."

The conclusions of these two observers appear to be contradictory to one another, and that of Pontoppidan to Hirsch's. Pontoppidan refers the seat of the granulation tissue to the rete mucosum and states that "the corium was free from adventitious elements," while Charlouis asserts that he has found an extensive accumulation of colourless blood corpuscles in the tissues, and that the papillary layer and "the hair follicles as well as the sebaceous and sweat glands and the muscles of the skin are implicated in sympathy."

My own observations agree with those of Charlouis and with the changes observed by others in diseases which bear striking clinical resemblances to Yaws. Of such diseases, the one whose histological anatomy has been most extensively studied is the affection which is known as Delhi boil or Oriental sore, and of which Leloir and Vidal (*Traité Descriptif des Maladies de la Peau*, Paris, 1889) have given pathological particulars which may be briefly stated as follows:

The histological lesions (of Bouton de Biskra) are situated in the epidermis, the derma, and sometimes in the subcutaneous tissues.

These lesions are remarkably analogous with those found in tuberculous skin affections in general and in *Lupus Vulgaris* in particular.

The pathological anatomy of the disease is included in the following definition of tubercle as an elementary lesion of the skin. "It is a neoplasm, situated in the derma, of an inflammatory nature, and not disappearing spontaneously, tending consequently to destroy partially or entirely the tissues in which it is developed and containing a pathogenic micro-organism."

*The Epidermis.*—As in *Lupus*, so in this disease, the changes in the epidermis vary in different cases. In some the epidermis is destroyed by minute purulent deposits in its substance which form ethymatous pustules, or by cleavage of the stratum granulosum by purulent phycetenulæ.

In the older and papillomatous cases, the horny layer is thickened at certain points and the reverse in others. A certain number of its cells are distinctly tinted by carmine, thus shewing a tendency to desquamation. The granular layer is slightly thickened. The Malpighian bodies, thickened in certain parts, give off branches which ramify in the derma as in papillomatous *Lupus*.

*The Derma.*—The derma is infiltrated with embryonic cells, which are grouped at certain points so as to form islets or nodules, presenting, under a medium power, the general appearance of skin infiltrated by *Lupus Vulgaris*. This is especially noticeable about the vessels around which they cluster in the form of a sleeve and about the glomeruli of the sudoriparous glands.

These cells are also infiltrated along the course of the lymphatic spaces. The points of densest infiltration are the surface of the derma and the centre of the boil, the cells becoming less numerous as the periphery is approached. The infiltrating cells extend between the connective tissue fibres and invade the surrounding tissues which appear healthy to the naked eye. They also penetrate, in certain cases, into the subcutaneous tissue.

Giant cells are observed in only one case by Leloir and Vidal; but Riehl mentions having found them in large numbers in this affection. Nor have the former found the hyaline masses mentioned by Riehl as enclosing a special micrococcus.

The sebaceous follicles and part of the sudoriparous glands at the centre of the boil are destroyed.

The walls of the blood vessels are infiltrated with embryonic cells; their middle coats are thickened and their calibre reduced as a result of the proliferation of the cells of their endothelium.

The nerves are healthy.

Everything points to a microbic origin of the affection. Various observers have mentioned different micro-organisms which have been noticed by them, as the probable causes of the disease; but none of these can be definitely regarded in that light. Leloir and Vidal point to the great resemblance between the microbe described by Duclaux and Heydenreich in connection with this disease and the micrococcus studied by one of them in the affection named by him "*périfolliculite conglomerée en placards*." The microbe of Duclaux is found in the blood and not in the matter secreted by the boil; and consists of cocci of from  $0.20 \mu$  to  $1 \mu$  in groups of two round granules with well-defined borders. A similar microbe has been found by Leloir and Vidal in the water of Biskra.

The eruption in Yaws may therefore be considered to begin by infiltration of the papillæ of the derma with the embryonic elements of the cellular tissue. This may be circumscribed and limited to a few papillæ, or diffused and involving several papillæ, as well as the neighbouring

sebaceous and sudoriparous glands, and the hair follicles. The moderately active development of the neoplasm results in tubercles, and its excessive growth leads to their extension and coalescence. When their development is arrested, the eruption is limited to its vesicular, papular or squamous form.

The origin of this excessive formation of cells, at certain points of the derma, must be due to a conveyance of the Yaws virus through the blood, there being no change in the lymphatic system which would lead to the supposition that it was the channel of contagion. The lymphatic glands and vessels are never affected by the Yaws virus so as to produce suppuration or induration. If at any time there should be enlargement of the lymphatics, this is entirely sympathetic and explainable by the irritation of the eruption, as it would be by any sore or wound, and is frequently due to the itch which accompanies the affection. On the other hand, an examination of the vessels of the derma, at the commencement of the eruption, shews that they are distended and that the white blood corpuscles are escaping freely through their walls.

The tissue of the neoplastic growth, when fully developed, consists of granulation cells which infiltrate the derma to a varying depth according to the course of the disease, penetrating, in cases of deep-seated ulceration, through all the soft tissues down to the bone. The fusiform bodies and connective tissue fibres intermixed with them do not appear to be new formations, but those of the corium, amongst which the neoplasm has developed. Normally it is circumscribed in spherical masses. It is only in the very cachectic in which it infiltrates the tissues in the sense in which that term is used in connection with the cell growths of scrofula. The end of Yaws granulation tissue is liquefaction, there being neither the caseation nor fibrillation which occurs in scrofula or syphilis.

Yaws has been included among syphilis, tubercle, leprosy, lupus and glanders, as diseases characterised by granulomatous growths which spread by their own infectiveness. Yaws resembles syphilis most in its course and symptoms; but it holds a separate place from the above-mentioned diseases as regards the nature and disposition of its characteristic growths. These, as we have said, consist simply of granulation cells with a tendency normally to affect the derma only and disappear by liquefaction and interstitial absorption. They do not spread centrifugally, nor subcutaneously, nor do they penetrate deeply into the tissues, under ordinary circumstances, but, on the contrary, are circumscribed and protrude above the level of the skin, after forcing their way through it. These characteristics, as well as the absence of specific adenopathies, will suffice to distinguish it from the other affections with which it has been connected.

Those observers who have declared Yaws to be a local disease of the skin, a dermatitis, cannot have sufficiently considered its origin and the nature of its later manifestations. A disease which begins by infection of a minute part of the skin, remains latent for from three weeks to sometimes two months, then develops either a local lesion, a fortnight after which the secondary eruption appears, or a general secondary eruption, without any appreciable local lesion, and is followed years after by such deep-seated tertiary lesions of the mucous membranes and other tissues, can scarcely be looked upon as a local inflammation of the skin. It is most decidedly a constitutional disease in the sense in which syphilis is described as such, when it has developed secondary symptoms.

When the granulation cells last over their normal time, they are absorbed and replaced, under favourable circumstances, by permanent tissue; there has been no opportunity for the development amongst them of blood vessels, by means of which they can be nourished and perpetuated. When they exceed the average period, they attain a certain amount of vascularity which, without permitting any organization or even fibrillation, allows their continuance. When the system is generally enfeebled, the tissue which should replace the intruding cells, is not only not formed, but the new growth invades still further the previously existing tissues and then disintegrates; and in this manner, ulceration is produced. Sometimes the tissue which replaced the granulation cells is itself too imperfectly developed to last, and its disintegration leads to fresh lesions.

The origin of this exuberant and persistent formation of granulation tissue which characterises the disease, appears to lie in an infectiveness acquired by ordinary granulation cells. The tissue of a Yaws tubercle differs in nothing from the "proud flesh" seen in badly healing wounds or the excessive growth of tissue in certain ulcers. That such an infectiveness can be acquired is illustrated by the reproductiveness of certain benign tumours, and the development of granulation tissue in the neighbourhood of a long standing ulcer.

#### THE YAWS TUBERCLE.

The process by which a tubercle becomes fully developed consists in the protrusion of the neoplastic cells through the upper layers of the papillary fibres and through the cells of the epidermis. Each tubercle thus formed consists of several papillæ, the number of the latter varying with the dimensions of the former. Under a low power, its surface is seen to be very irregular and to consist of numerous dome-shaped masses resting on a common base, and to this arrangement is due the cauliflower appearance which it presents to the naked eye. Here and there, in the spaces between these rounded masses, may be seen the remaining portions of the epidermis which has entirely or almost entirely disappeared over the elevated points. It is by the repeated desquamation of these remnants of the horny layer of the epidermis, which are as constantly renewed, combined with the continuous exudation from the granulation cells that the pale yellow or amber coloured crusts are formed over the tubercles. The maceration of the epithelial cells in the exuding fluid produces the creamy substance which is generally revealed on removing the crust of a normal tubercle. The colour of the crust, though yellow in all races, varies in shade with the percentage

of blood corpuscles in the discharge from the tubercle, with the amount of pigment in the remaining epidermis and with the dirt which may be admixed with it.

Microscopically, the creamy substance consists of epithelial cells, blood corpuscles, small granular cells and shreds of fibrous tissue in a homogeneous fluid, these when dried, constituting, together with such substances as are found in dust, the materials of which the crusts of the tubercles are composed.

Preparatory to its disappearance the tubercle undergoes a mucous degeneration, involving the liquefaction and absorption of the granulation cells of which it is composed. By this process, there is a gradual subsidence of the cellular growth, which eventually disappears. The condition of the tissues at the site of the tubercle, after its absorption, varies with the duration of the latter and the pathological changes which it has induced. In the case of a tubercle which has been absorbed within the first three months of its growth, the alteration in the tissues is scarcely appreciable to the naked eye, and its site is indicated by a pale macula which subsequently becomes hyperpigmented in the African, and by a slight frilling which is sometimes only noticeable under a magnifier. When it persists beyond that period the dermatitis which it induces is followed by ulceration; and a scar then results which is similar, generally speaking, to that of variola. The commonest kinds of cicatrix are either uniformly honey-combed or consist of a central rectangular patch of scar tissue, from which narrow bands of the same tissue radiate to the circumference. This central scar tissue and its radiating bands are lighter than the surrounding skin, while their interspaces are hyperpigmented.

The gummata of the tertiary period of yaws consist of granulation cells developed originally in the subcutaneous tissue or the corium. On removing the skin over a yaws gumma, a reddish yellow mass is exposed, which is soft, is readily torn and bleeds copiously on section. The skin above it is normal in structure. Yaws gummata end either in absorption or ulceration. In the former case, there is mucous degeneration of the cells followed by absorption; in the latter, the pressure of the neoplastic growth towards the surface excites ulceration of the cutaneous tissues and the exposed gumma itself disappears by necrosis.

The lesions of the deeper tissues, which attend the tertiary period of yaws, consist of a progressive, destructive inflammation and an infiltration into their substance of the characteristic neoplastic growth. Hutchinson's observations with regard to the condition of the tissues in the tertiary period of syphilis, viz., that the later manifestations are "due rather to the ill constitution of the affected structures than to any free virus still circulating in the blood" is equally applicable to Yaws. Like Syphilis, Yaws is not contagious in its tertiary period, while in those in whom the disease has arrived at its last stage and who have been apparently cured of it, a slight injury often leads to dermatitis and destructive inflammation of the deeper tissues.

Recrudescence in Yaws is probably due to the fact that, in a Yaws patient in whom the disease has not been entirely eradicated, circumscribed patches of the specific granulation tissue remain in or beneath the derma, at the sites of the secondary tubercles, and possibly also in places in which their presence has not been revealed by any lesion. Here they lie dormant as potential foci of infection; and, while the surrounding tissues are sufficiently sound to resist invasion, they continue latent, but, with any pathological change induced by either injury or disease, this resisting power being enfeebled, the unsuspected growth slowly advances and forces its way to the surface.

#### THE ACIDITY OF THE SECRETION OF THE YAWS TUBERCLE.

The acidity of the secretion from the Yaws tubercle is probably the result of a hypersecretion of both the sebaceous and the sudoriparous glands, and possibly also, of a butyric fermentation of the products of these glands. It may furthermore be explained by the acid nature of the intercellular fluid.

#### THE CONDITION OF THE LYMPHATIC GLANDS IN YAWS, COMPARED WITH THEIR CONDITION IN NEOPLASTIC AND ALLIED DISEASES.

With the exception of those sympathetic enlargements of the lymphatic glands which often accompany skin eruptions, there are no alterations in the structure or function of these organs which can be considered as a special result of the action of the Yaws poison. The glands most commonly enlarged are the femoral, and, next to them, the submaxillary and anterior cervical, the former, as a result of an ulcer of the corresponding leg or foot, the latter, in consequence of ulcerating tubercles of the lower part of the face. This enlargement of the femoral glands often co-exists with an ulcer, even previous to the infection of the latter by the Yaws virus; and, with regard to the submaxillary and anterior cervical glands, they hardly ever undergo hypertrophy in connection with non-ulcerating tubercles. The axillary glands are sometimes, and the inguinal, hardly ever, affected. The former may become so in sympathy with an ulcerating tubercle of the arm; the latter, when a similar condition exists about the pudenda. The glands, under those circumstances, present the appearance of being uniformly enlarged, and form a comparatively soft, unyielding, painless mass, without any tendency to inflammation, induration or suppuration. Neither is there any inflammation of the skin above them. Enlarged glands are observable in Yaws during the secondary stage only, and assume their normal dimensions as soon as the exciting ulceration has disappeared. They are never found during the tertiary stage, the only exception to this rule being that elephantoid condition of the derma of the foot, which is sometimes connected with destructive inflammation of its deeper tissues and is attended by periodical extension

of the inflammation and a concomitant fever during which the femoral glands become hypertrophied.

It is interesting both for etiological and for diagnostic reasons to compare the state of the lymphatics in Yaws with their condition in such diseases as Syphilis, Leprosy, Glanders, Cancer, Scrofula, &c. What is the condition of the lymphatic glands during the secondary and tertiary stages of syphilis? Lancereaux (vol. I. pp. 180, 181, 182) writes as follows: "Like the period of local eruption, the period of general eruption has its peculiar adenopathies; but whilst in the first of these periods the change remains limited to the ganglionic sphere which corresponds to the chancre, in the second it is usually generalised at several points of the body." He then mentions the inguinal, posterior cervical, mastoid, submaxillary, &c., as those glands which are most commonly implicated during the secondary period. He proceeds further to state "at the same time that these glandular modifications exist, the lymphatic vessels are sometimes the seat of a peculiar change (adhesive lymphangitis). They give to the touch the sensation of small, hard, movable cords, enlarged here and there in the vicinity of the valves. Bazin (p. 16), who was one of the first to point out this fact, insists with Sigmund upon the presence of these lymphites at the upper and inner parts of the thighs and arms, seeing that in an obscure case, their presence may become a valuable element of diagnosis." He describes these conditions as being of "slow course and long duration." He considers that "there is most frequently no relation between the adenopathy and the eruption," and that where such relation exists, "the adenopathy assumes an inflammatory type." "Frequently in fact," he says, "subcutaneous adenopathies are the only evidences of the period of secondary affections."

Referring to the tertiary period, he writes (pp. 207 and 379), "Glandular lesions are not wanting here any more than in the preceding period; but, instead of the superficial glands, it is the deep-seated, and especially the visceral, glands which yield to the attacks of syphilis."

The presence of such affections of the lymphatic system is sufficient to distinguish between syphilis and Yaws, the changes in the glands in the latter affection being limited to those short-lived, non-indurated enlargements which have been described in connection with the ulcerative lesions of its secondary stage.

With regard to the condition of the lymphatics in leprosy, Hillis (pp. 69 and 70) states, "A great deal has been written on the lymphatics in leprosy and a variety of opinions prevail. Carter writes, 'The lymphatic vessels and glands were not affected in any special way as far as examined. In one case complicated with syphilis, the opaque cortex of the enlarged inguinal glands contained large granular cells or masses which bore a close resemblance to those found in the thickened leprous skin.' Kaposi states, 'There is nothing very characteristic about the lymphatic glands.' Danielsen and Boeck are of opinion that the enlargement is a sort of 'glandular hypertrophy'; but Hansen found specific leprous elements in the external glands as well as in those situated in the porta hepatis and hilus of the spleen; and in answer to the question, 'Have the elements in the glands the same properties as those in the skin?' he answers, 'It might be so inferred from their entire anatomical correspondence.'" He further quotes from Dr. Hoggan's pamphlet, "The Lymphatics in Leprosy" (p. 7), "Finally, I feel bound to state that, although leprosy causes changes in the appearance of the lymphatics, these changes are merely secondary, and the lymphatics themselves have no share in the causation of the disease." Hillis refers also to the case of mixed tuberculated lepra examined by a committee appointed by the Clinical Society of London, October 10th, 1879, when "fibroid induration of the glands" was found, and in connection with which "Dr. Powell stated that he had not noticed the 'aggregation of cells' described by Hansen."

Hillis, giving his own experience on the subject of tuberculated lepra (p. 17), writes, "The lymphatic glands early sympathize with the surrounding disorganization, and enlarge. I have not seen a well-marked case of this form of leprosy without enlargement of the femoral glands, which are like symmetrical tumours in the groin, so large are they. As the disease advances, they become more prominent, the enlargement occurring below Poupart's ligament when the disease is on the feet and legs: in the neck they enlarge from irritation of the tubercles on the face, and in the axilla from those on the upper extremities. They get smaller on the subsidence of the irritation caused by each fresh eruption, but never entirely disappear. They are alluded to by lepers as their 'sentinels' or 'barometer,' for, when they enlarge and become painful, they are aware a fresh exacerbation is about to take place or a fresh outbreak of ulcerations is at hand." And he states also (p. 69), "The lymphatic glands in tuberculated lepra are found enlarged in the earliest stages of the disease, before sufficient irritation is present to affect this enlargement; irritation from neighbouring tubercles, it is commonly known, is a frequent cause later on in the affection."

The appearance of the enlarged femoral glands in leprosy is exactly that of the same in Yaws, with this difference, that, while in the former disease they are symmetrical and larger, in the latter they affect that thigh only which corresponds with the leg or foot on which the infected wound or ulcer is situated. Again, while in leprosy there are repeated acts of enlargement of the femoral glands with every fresh eruption of tubercles, this is never the case in Yaws, the glands, as already explained, in that affection generally returning to their natural size *pari passu* with the healing of the exciting ulcer and never passing into the tertiary stage.

In non-tuberculated lepra the femoral glands enlarge when there is ulceration of the lower limbs.

The adenopathies of scrofula are characterized by chronic inflammation and suppuration both of the glands and neighbouring tissues. They are induced by affections of adenoid structures. They survive the lesions which produced them. They are seldom found in the groin or axilla, being generally limited to the maxillary and anterior cervical regions where they arise in

sympathy with lesions of the scalp, mouth and pharynx. It may be observed here that those cervical glandular enlargements which occur in sympathy with affections of the throat in scrofula and syphilis, are never met with in even the severest frambesial lesions of that part.

#### ELEPHANTOID DERMATITIS OF YAWS.

The dermatitis induced by Yaws produces a chronic thickening of the skin, which is different from that of true elephantiasis. The lymphatic lesions characteristic of the latter are absent in the former. In some instances it resembles that condition known as exfoliating dermatitis, there being present exfoliation of the horny layer and thinning or complete disappearance of the stratum granulosum, while the cutis itself is thickly studded with immature cells, which are most numerous in the neighbourhood of the dilated blood vessels.

#### HYPERPIGMENTATION IN YAWS.

The dark spots which develop at the sites of the Yaws tubercles are not characteristic of the disease; they follow many forms of inflammation of the skin of the negro and mulatto. In these, the sites of blisters as well as of pemphigus, and other eruptions, are temporarily or permanently dark, according to the severity of the inflammation. The dark colour of the maculæ in Yaws does not appear to be so much due to an absolute increase of pigment over the entire surface of the spots, as to excessive pigmentation at certain points of them only. As has already been explained, the raised parts of the honeycombed maculæ are lighter than the surrounding skin; while the deeper parts are hyperpigmented. As in chronic, and in some cases of acute dermatitis, the pigment cells travelling along the vessels of the corium are deposited in the rete mucosum, when this exists; but, where this structure has been destroyed, there is an absence of pigment. The result is the arrangement described, in which certain portions of the maculæ are excessively, and others insufficiently, pigmented.

#### MICROBIC ORIGIN OF YAWS.

Its resemblance to diseases like syphilis, leprosy, lupus, &c., which are chronic and of bacterial origin, suggests that the lesions of Yaws are produced by a bacillus and not by a protozoon, which is the probable exciting cause of the exanthemata which run an acute course. Its rapid dissemination throughout the system after inoculation at one spot, and the impossibility of auto-infection, argue that the contagion is not due to a parasite acting from the surface of the skin as in the various forms of Tinea.

#### AUTO-INFECTION.

The question of auto-infection is an important one, inasmuch as it would afford a plausible explanation of the dissemination of the disease over the rest of the body from a single infected spot, as has been suggested by Leloir and Vidal in the case of Delhi boil. But my experience leads me to believe that auto-infection seldom, if ever, occurs in Yaws. All the attempts which I have made to inoculate a patient with the Yaws virus from tubercles on his own body or from more recent or more advanced cases, have failed; nor have I ever known a case in which an eruption has been caused by virus conveyed by the patient himself from one part of the body to another. There are many instances in which only one tubercle has developed and has persisted for months in careless and uncleanly patients without any subsequent extension of the skin lesions. A tubercle frequently develops on the skin near the margin of the anus, and persists, as a result of constant irritation, long after the other tubercles have disappeared; but it never produces another on the opposite spot with which it is constantly in contact. To test whether an abrasion under these circumstances would induce infection, I have excoriated the skin on the opposite side, but, even then, no tubercle was produced at the site of abrasion. It is certainly not by auto-infection that the development of Yaws tubercles under the thickened epidermis of the palms and soles of the negro can be explained.

It is possible that auto-infection may occur during the early period of the primary Yaws lesion; but persistent unilateral tubercles of the buttocks are found so frequently that one cannot but conclude that auto-infection is not a consequence of contact with the secondary Yaws tubercle. There are doubtless cases in which two tubercles are found on the buttocks exactly opposite to each other and very suggestive of auto-infection, but the probabilities in such cases are that the tubercles arose independently of one another, as they often do, at the corners of the mouth.

#### THE ANATOMICAL SITE OF THE YAWS TUBERCLES.

Yaws is not essentially connected with the hair follicles, inasmuch as its lesions are found in the palms and soles where those follicles do not exist. The scalp and axillæ are very rarely affected; and, with regard to the rest of the body, the hairy parts are not more frequently invaded than the others.

Neither is Yaws essentially connected with the glandular systems, whether sebaceous, sudoriparous or lymphatic. Yaws tubercles develop in the palms and soles where there are no

sebaceous glands, and shew no predilection for parts richly supplied with sudoriparous glands. They rarely appear in the palms in the early part of the disease; and it is only in its later stages that they develop as *tobos* in the feet. Of the cases analysed by Nicholls, in only three "were the tubercles found on the scalp, and they were not once met with in the axillæ." The following is a statement of the frequency with which the different parts were affected in the above-mentioned cases:—

" On the face and head the eruption occurred in 49 cases.			
"	trunk	"	20 "
"	genitals	"	16 "
"	perinæum	"	20 "
"	upper extremities	"	29 "
"	lower	"	70 "

Yaws is not necessarily developed originally in the epidermis. This is proved by the fact that its fungous growths may originate in the centre of deep ulcers and its tubercles develop beneath the epidermis of the palms and soles.

#### INFLUENCE OF THE NERVES IN THE PRODUCTION OF THE YAWS TUBERCLE.

The pain which is felt in the limbs generally before, and, sometimes, during the eruption of the Yaws tubercles, suggests the possibility of a nervous influence being concerned in the production of the neoplastic growth. As the nerves exert an indirect effect on nutrition by the control which they exercise over the vascular system, it is possible, as Marshall has pointed out with regard to cancer, that a loss or diminution of that control may result in the excessive cell growth which is characteristic of such diseases as Yaws.

#### CUTANEOUS LESIONS, erroneously ATTRIBUTED TO YAWS.

In a foot note to the French translation (1883) of Duhring's work on Skin Diseases, M. le Dr. Barthélemy, one of the translators, remarks as follows:—"Beaucoup de cas de prétendus pians ne sont pas autre chose que de la syphilis, de la scrofule ou de la lymphadénie cutanée (syphilitides verruqueuses, végétantes, hypertrophiques, lupus, mycosis fungoides). D'une façon générale ce sont des phlegmasies cutanées chroniques, accompagnées de productions papillomateuses hypertrophies circonscrites (ce groupe comprend même des *cancers de la peau*), pièces du musée, Nos. 136, 273 et 587). C'est une variété de l'*ulcus elevatum*."

There is no doubt that there are many pathological conditions of the skin, erroneously attributed to Yaws, which are the result of dermatitis induced by other diseases, especially syphilis and scrofula. The hypertrophic dermatitis so frequently met with among the inmates of the poorhouses of the tropics, is induced by a variety of diseases among which Yaws may be reckoned. The thickening of the skin in these cases bears a strong resemblance to that which accompanies elephantiasis, from which, however, it differs in the manner of its development. In elephantiasis, the enlargement is, at first, uniform, œdematous and periodic; in the other diseases, the hypertrophy, whether due to long-existing ulceration of the derma, periostitis or osteitis, will be found to have been originally circumscribed, non-œdematous and non-periodic.

#### THE RELATION OF YAWS TO SYPHILIS.

Is Yaws a descendant of Syphilis or the reverse?

If syphilis is of American origin, it may have been derived from Yaws which, on being imported into cold and temperate climates, underwent the modifications which would follow from its new surroundings. We know that while cold intensifies, warmth mitigates the action of the syphilitic virus, and that, in those epidemics of cold and temperate regions, such as the Sibbens, Mal de Chicot, &c., accounts of which have been already given in previous pages, though the cutaneous eruptions which attended them were considered the same in appearance as those of Yaws by persons who had had experience of both diseases, yet both these and their other symptoms were marked, in their earliest stages, by far greater severity than ever attends the corresponding periods of the latter affection. That the disease described as "Epien" by Father Labat was not, as is thought by some, "the venereal disease," though he himself asserts it to have been such, is proved by his own statement, in a subsequent part of his work, that the African children in the West Indies were as subject to it as Europeans in their childhood were to small-pox, and that they were very readily cured of it by simple, native tisanes.

Yaws is doubtless indigenous to Africa, and has existed there from time immemorial. It is probable, therefore, that it was introduced into Spain by the Moors during their occupation of that country and before the discovery of America, and that it may then have given rise to those cases of syphilis which existed in Europe previous to the Neapolitan epidemic. That this epidemic may have been partly of Western origin, through the importation of American Yaws, is quite probable, considering the influence of climate, as already observed, and the exceptional circumstances that attended its birth; but it is only within reason to presume that there must have been some cases of African Yaws, and of syphilis derived from it, among the Spanish infantry who were present at the siege of Naples. It must also be remembered, in connection with the possible development of European syphilis from American Yaws, that a disease always

attacks virgin communities with greater severity than those in which it is indigenous or has been long prevalent.

Arguments against an American, and in favour of an African, origin of syphilis, assuming it to be derived from Yaws, are the short intervals which elapsed between the discovery of America and the Neapolitan epidemic, and the statement by a historian, already quoted, that the soldiers who were brought over from the West Indies to take part in the siege, arrived after the development of that epidemic. The short interval referred to would be insufficient to allow of any modification, by repeated transmission, of the imported American disease, a modification for which, in the case of Yaws brought over from Africa, there were both time and opportunity. But, considering the effects of climate, the circumstances of a siege, and the fact that it was a virgin community that was attacked, it is possible that the Yaws imported by the Spanish soldiers from the West Indies may have been modified, on its earliest transmission, by the above influences, and that both America and Africa had each its share in producing the syphilis which existed in Europe, the latter, before, and both, during the Italian campaign.

#### CASE I.

##### ILLUSTRATING INITIAL LOCAL LESION OF YAWS AND DERMATITIS OF THE SOLE.

E. R., Negress, aged 28.

*Present Disease.*—Dermatitis of the sole.

*Previous History.*—Was suckling a child some months old when she got the Yaws. Had no sore or wound anywhere; but the child had Yaws about the mouth and infected her below the nipple, just where it meets the areola. The child was about six months old when the Yaws appeared on the mother's breast as a small papule, the summit of which filled with a white fluid about a week after its appearance. It then ulcerated and formed a small sore which lasted about two months. After the sore healed two tubercles appeared over the left sterno-mastoid, coalesced and spread to the size of  $3\frac{1}{2}$  in. by 1. They scabbed over as usual. At the same time two others appeared on the chin and spread to about an inch square. These lasted nine months; and the scabs fell off and left maculæ which are now darker than the adjacent skin. Took guaiacum, sarsaparilla and sassafras in tisane for three months.

When the papule came out on her breast, she had neither pain nor fever; but when the tubercles appeared on her neck and chin, she began to feel pains in all her limbs and in her loins, back and neck. The pains were so severe that she could not walk or raise her arms. She could not move, and had to keep lying in bed. She used to have ague every day, about 4 p.m.; but did not perspire after it. The pains and ague began when the tubercles appeared, and lasted until they dried. The pain used to abate in the day, and was more severe at night. The toes and fingers felt quite numbed and burning and pricking and painful.

At present she complains of pain in the metacarpo-phalangeal joint of the left index finger which is swollen. This joint began to swell when the Yaws appeared, and has continued painful since. She also feels pains in the left arm and in both knees, and climbs a hill with much difficulty. Her feet get rather puffy after walking.

About six months after the tubercles disappeared she felt a burning sensation in the soles of her feet. Numerous blisters then appeared on them, from the size of a fourpenny-bit to that of a shilling. She opened the blisters, which discharged a white fluid like flour and water. She then pared the hard epidermis which was thus revealed until she reached the derma, which was quite healthy. The epidermis grew again over the parts, but the sites of the blisters have remained tender and burning, and are painful when she walks.

The epidermis is now riddled with holes about an eighth of an inch in diameter, the sites of small blisters which have formed and burst. These small blisters have now ceased to appear. When they came out, they used to itch very much. Now the whole sole itches. The small blisters came out also on the toes after they ceased to appear on the sole. The blisters no longer come out on the toes; but, since their last appearance, the toe nails have shrivelled. A blister formed some time ago on the tip of the middle finger, which burst and dried. Since then, the skin over it has become hard, yellow and painful, and the nail of that finger is dry and shrivelled.

#### CASE II.

##### ILLUSTRATING INITIAL LESION OF YAWS.

W. S., Negro, aged 35.

*Present Disease.*—Dermatitis of the sole.

*Previous History.*—About the end of August, 1881, he arrived in Dominica from Barbados, where he had spent three weeks. Previous to going to Barbados he had been cohabiting eleven years with a woman in Dominica, who contracted Yaws about April, 1881. The Yaws eruption in the woman assumed the squamous form at first, and afterwards a tubercle appeared on one of her feet. At the beginning of June she was taken by him to the hospital, where she remained until his return from Barbados, at the end of August, when she went to stay with him.



About the beginning of July a squamous eruption had come out on him about the upper part of his left thigh. After staying three weeks with the woman (on his return from Barbados) he noticed a small pimple on the edge of the prepuce. On the top of this pimple a small watery vesicle formed, and the pimple ulcerated and formed an ulcer about the size of a florin. The ulcer was red and clean and was quickly cured by carbolic oil. Before the ulcer healed Yaws tubercles broke out on his cheeks in the form of clusters of small vesicles with a single yellow scab over each cluster. Other tubercles afterwards appeared on his body, these consisting of the ordinary granulation tissue covered with yellow scabs.

About three months ago (April, 1890), the soles of his feet began to ache. They then began to crack and peel. They now cause him much pain in walking. The epidermis over them presents the appearance of having been nibbled at various points.

### CASE III.

#### ILLUSTRATING LONG STANDING YAWS.

L. M., Mulatto, aged 16.

*Present Disease.*—Two patches of granulation tissue covered by yellow crusts on left leg.

*Precious History.*—Had Yaws when about 14 years old. Had then a rash on his left instep which became poisoned by Yaws virus. This produced tubercles on his legs below the knees only. He remained about five months in hospital. When he left there was no rash on him. About two months after, fresh tubercles broke out on both legs below the knees only. He was given calomel by his mother in a tisane of guaiacum and sarsaparilla twice a day for a fortnight, until he was salivated. The calomel was being given him when a hurricane came on, by which the house in which he lived was broken down and he was exposed to the inclemency of the weather. About a month after he began taking the calomel the right leg healed; but the tubercles on the other leg continued, enlarged and coalesced, forming two patches, one on the outer ankle and the other on the upper third of the outside of the leg. The lower one measured 4 in. by 2 in. and the upper 6 in. by 3 in.

### CASE IV.

#### ILLUSTRATING YAWS IN AN INFANT AND SUGGESTING HEREDITY.

M. L., Mulatress, aged 1.

*Present Disease.*—Yaws.

*Precious History.*—Developed Yaws when she was nine months old. Had never come in contact with any one affected with Yaws, there being no Yaws in the house or in the immediate neighbourhood. The mother (about 28 years old) had Yaws 12 years before the birth of the child, of which she was thoroughly cured by a native Yaws doctor with mercury, guaiacum and sarsaparilla. The child's Yaws lasted three months. The eruption was of the tubercular form, the first tubercle having appeared on the chest over the centre of the sternum. The spots at the old sites of the tubercles are lighter than the adjacent skin. The child was well before the Yaws appeared on it. She was suckled by the mother until a week ago. She continued well after the Yaws eruption dried about three weeks ago until within the last fortnight, when she was attacked with diarrhoea. About five days ago the feet began to swell and then the abdomen. The child looks emaciated and pale.

### CASE V.

#### ILLUSTRATING ULCERATION OF THROAT IN YAWS.

W. F., Negro, aged 18.

*Present Disease.*—Sore throat, uvula and fauces congested.

*Precious History.*—Had Yaws when he was five years old, which lasted nine months. It began as a pimple over right ankle, which vesiculated and then ulcerated. After about a week the ulcer began to look pale, fungating and ichorous, and, about three weeks from the appearance of the pimple, Yaws tubercles began to break out over him, beginning on his face and extending to his arms and legs. There were about six tubercles on his face, one on each elbow, one on each knee, and none on any other part of the body.

He had never had any illness, slight or severe, since the attack of Yaws, which soon left him. He always worked well, felt well and lived well. His work was that of an estate labourer and woodcutter. He is a well-built, well-developed, muscular young man, whom one would consider in perfect health.

About three weeks ago he began to get ague every day about 4 p.m., which lasted only a short while, about half an hour, and which was followed by very slight fever. He also felt discomfort about the throat when he swallowed. He still gets ague every day at 4 p.m. About a week after the ague began, he felt a soreness at the back of the uvula.

At present his pharynx, uvula and tonsil are inflamed, and a greenish yellow matter is seen adherent to pharynx. Examination with hand mirror reveals ulceration of the posterior surface of the uvula. He was then at once sent to the hospital.

*Subsequent History.*—About six weeks after he was sent to the hospital he appeared before me requesting me to give him a certificate to the effect that he was unable to work. He was

much thinner than when he went away. His voice was altered and quite nasal. On examining his throat I found that the whole of the soft palate had been destroyed by ulceration, and his pharynx was covered with a purulent discharge.

## CASE VI.

## ILLUSTRATING YAWS GUMMATA.

P. I. I., Negress, aged 30.

*Present Disease.*—Skin of leg ulcerated at certain parts, and at others hypertrophied and scaly, and marked with keloid-like cicatrices.

*Previous History.*—Had Yaws when sixteen years old in the form of tubercles, which were limited to both legs below the knees. Subcutaneous, fleshy nodules developed in the legs two years after the disappearance of the tubercles. The first was seen on the left tibia. It lasted three months, after which it burst at its centre and ulcerated to about the size of a shilling. The ulcer was red, but discharged serum and pus very freely. The leg never swelled. One year after the ulcer had healed small subcutaneous nodules appeared about the front of the ankle and instep. These used to last two or three months before they ulcerated. They itched severely before ulcerating. They then discharged a reddish serous fluid in large quantities. When the patient stood up the leg used to get quite purple and itch inordinately, and the serous fluid would flow from it more profusely and would be of a darker colour than when the leg was raised.

## CASE VII.

## ILLUSTRATING YAWS GUMMATA.

T. A., Negro, aged 25.

*Present Disease.*—Ulcers of the leg.

*Previous History.*—Had Yaws as a child, the eruptions having appeared as tubercles on left heel and left instep. About five years ago, a subcutaneous nodule about the size of a small cherry developed in his left calf. It remained there three weeks, after which, it burst at its centre and formed an ulcer which lasted nine months. Six months after its healing, another like it began in his right calf. It lasted four months, after which, it ulcerated to the size of four florins, and healed at the end of twelve months. After this, a large subcutaneous nodule appeared over the right tibia, opposite the junction of its middle and upper thirds, and lasted three weeks. It then burst and ulcerated, and was five months in healing. Two months after this, a similar nodule appeared on the left tibia, opposite the junction of its lower and middle thirds, and lasted three months before ulcerating. It is from the ulcers produced by the last-mentioned nodules that he is now suffering. He never had any pains in his legs, but they used to swell and burn and discharge a serous fluid when he stood up. The ulcers do not itch, except when they are healing. He took mercury, when the Yaws tubercles first broke out, and again, when the ulcer appeared on his right calf, and he was salivated by it. He also took iodide of potassium, which appeared to heal the ulcers on his calves.

## CASE VIII.

## ILLUSTRATING YAWS GUMMATA AND CONTRACTURES OF MUSCLES.

A. L., Mulatto, aged 28.

*Present Disease.*—Ulcers of the leg.

*Previous History.*—Had Yaws when he was ten years old, the eruption consisting of papules and erythematous spots covered with thin scales, followed by tubercles, the first of which appeared on his right heel. He went through the usual native treatment, in the form of tisanes and mercury, without being salivated. The disease was ushered in by pains all over the body (joints included), which became more severe as the scaly eruption broke out. His legs and arms were permanently flexed, and he could only walk on the balls of his great toes. The pains and the above-mentioned condition of his limbs lasted until he was seventeen years old, when they disappeared. Shortly after their disappearance a subcutaneous nodule was noticed on the right tibia, and remained there four years. This was followed by another on the right instep, to which leeches were applied. The leech bites produced ulcers, which kept spreading up the leg and were a long while healing.

At present red subcutaneous nodules about the size of a small cherry appear on the leg, last two or three months, and then ulcerate.

## CASE IX.

## A SECOND ATTACK OF YAWS 15 YEARS AFTER THE FIRST.

J. H., African, female, aged 30.

*Present Condition.*—Recurrent Yaws tubercles of the soles attended with chronic exfoliating dermatitis of the same parts.

With the exception of the pain caused by the condition of her feet the patient feels in her usual health.

*Previous History.*—She had Yaws when about 13 years old, which appeared as a few large tubercles and lasted about twelve months. She was infected through an ulcer on the foot. When the Yaws began to dry, she was put through a course of mercury (calomel). She had neither relapse nor reminders after that attack.

She has had six children of whom three have had Yaws, viz., the 2nd, 4th and 5th. The eldest child died from bronchitis when about three months old; the others are alive. The 4th (a girl) got Yaws when about ten months old. She was then suffering from eczema capitis through which she became infected. The tubercles appeared all over her body including her lips. The mother, who was then suckling her, became infected. Six papules appeared on the areola around her left nipple. They were first red, and then became white at their apices. They gradually enlarged and fungated, forming flat dome-shaped tubercles with thick yellow crusts, which dried and disappeared after six weeks' duration, leaving the nipple twice its normal width and much smoother than the other.

This attack occurred about three years ago. She has, since then, had two children, now two years and one year old respectively, the younger of whom she is at present suckling. The former contracted Yaws through an ulcer in the heel when two years old, the tubercles affecting the whole body, including the lips, and lasting one year. The latter has not had the disease.

About eighteen months ago, Yaws tubercles developed in the soles of the patient's feet, in the form of red fungous masses about the colour and size of a ripe cherry, which forced their way through the thickened epidermis. They were attended with dermatitis and exfoliation of the epidermis. They lasted about three weeks, when they shrivelled and disappeared. About six weeks ago fresh tubercles appeared as before. It is from these that she is now suffering.

#### CASE X.

##### A SECOND ATTACK OF YAWS 15 YEARS AFTER THE FIRST.

J. P., Mulatto, male, aged 20.

*Present Condition.*—The patient is affected with an eruption distributed in patches of various sizes over the following parts:—

PARTS.	NUMBERS AND SIZES OF PATCHES.
Outer side of left knee joint . . . . .	One size of a sixpence.
Inner side of right leg about centre . . . . .	„ „ „
Backs of the hands . . . . .	„ „ „
Lower third of ulnar aspect of the left arm . . . . .	„ „ „
Inner surface of left upper arm . . . . .	„ „ „
Lower third of posterior surface of right arm . . . . .	„ „ „
Right deltoid . . . . .	„ „ „
Right pectoralis major . . . . .	Three „ „
Hypogastrium . . . . .	One „ „
Angle of left scapula . . . . .	One size of a florin.
„ right „ . . . . .	Three „ shilling.
An inch below right scapula . . . . .	One „ „
Six inches „ „ . . . . .	One „ „
Right lumbar region . . . . .	Three „ sixpence.
Left side of neck on a level with thyroid . . . . .	One „ „
Chin . . . . .	One „ threepenny piece.
Right half of upper lip . . . . .	One „ „
Right masseter . . . . .	One „ „

These patches are much lighter than, and are slightly raised above, the adjacent skin, which is dark brown. They consist of closely set minute conical papules, only observable, on close inspection, by the naked eye, the integument between them being of the same pallid tint. Their central papules become incrustated after a time; and when the crusts fall off, the surrounding papules shrivel, desquamate and subside to the ordinary level of the skin. The central parts of the patches, where the crusts existed, become hyperpigmented, the pigmentation extending gradually over the rest of the site of the patch. The eruption neither pains nor itches. The patient has a nodule about the size of a walnut over the extensor aspect of his right arm at the junction of the upper and middle thirds. He has, also, a small ulcer, about the size of a threepenny piece, on the inner surface of his left great toe. He feels pain and weakness in his left knee after walking. He never suffers from fever, and experiences no pain when he is at rest. The patient, who is very muscular and well-proportioned, appears otherwise in excellent health.

*Previous History.*—The patient had Yaws when he was about five years old. He contracted it through a sore on the back of the right foot over the metatarso-phalangeal joints of the fourth and fifth toes. The Yaws appeared as tubercles over various parts of his body and lasted about a year. After that he remained well until nearly two years ago, when he perceived a small swelling at the site of the present nodule on his arm. The swelling gradually enlarged

to the size already mentioned. The nodule would sometimes get smaller, but always returned to its normal dimensions, which it has never exceeded. When it enlarged it became painful. (It still undergoes the same periodical changes.) Since its appearance, other smaller nodules have developed on his left leg below the knee; and, after paining him for some time, these have disappeared.

About four months ago, he broke his left great toe; and, in consequence of this, an ulcer formed on it, the remains of which have been mentioned as still existing. About two months after the appearance of the ulcer, the eruption presented itself first on the backs of his hands, and then over the rest of his body.

*Remarks.*—There is no doubt about the frambœsial origin of the patches, these being identical with those which precede or accompany genuine Yaws tubercles in undoubted recent cases of first infection. The nodules are frambœsial gummata, the tertiary manifestations of the first attack.

## CASE XI.

### ILLUSTRATING SQUAMO-PAPULOUS ERUPTION.

A. S., African, aged 10.

*Present Condition.*—Her face, neck, back, chest, arms (extensor surfaces), buttock and legs (chiefly extensor surfaces below knees) are marked with white patches. Her abdomen, hands and feet are quite free from them. On her face they are chiefly seen on her forehead, ears, sides of the nose, angles of the mouth and on the chin. The patches are neither raised above nor depressed below the level of the skin. They are of all sizes, varying from that of a pea to that of a florin, and of all shapes, circular, oval, rectilinear, with regular or irregular margins. Their surfaces are dotted with closely set pale papules, which are so minute as only to be noticed on close inspection with the naked eye. There is no appearance of desquamation over the more recent patches, but over those of longer standing the papules are less defined or are not noticeable, and the epithelium has become dry and fissured. The apices of some of the older papules at the margins of the patches chiefly appear brown, as perhaps the result of scratching. Under a magnifier, the papules appear like hypertrophied papillæ from the summit of each of which a hair protrudes. The epithelium, even in the more recent patches, is in varying stages of desquamation and the skin generally appears coarser than normal. Some of the hairs on the affected spots are entirely white, while others are so at their lower halves.

There are two Yaws tubercles over the lower end of the tibia, immediately above the junction of the leg and foot, slightly to the left of the middle line. These are pale condyloma-like growths raised about an eighth of an inch above the skin, secreting a scanty creamy fluid (which is only observable on removing the scabs) and covered with thick, rugged, pale yellow crusts which are slightly depressed at their centres. The tubercles are about the size of a four-penny piece each and they are coalescent. They do not itch.

The patient has no fever and with the exception of slight pains in the shoulders and limbs feels in her usual health. There are no signs about her of scrofula or any other constitutional disease. The patches do not ache and only itch slightly at times.

*Previous History.*—The patient is one of a family of three children, two of whom have only recently recovered from Yaws. About three months ago, a small pimple appeared at the site of the two Yaws tubercles on her left leg. It caused considerable itching, in consequence of which she scratched it and a shallow sore with a red base developed at the spot to the size of a fourpenny piece. The ulcer thus formed was accompanied by enlarged femoral glands on the same leg. About six weeks after the appearance of the ulcer, the dark brown crust which had developed over it fell off, leaving a very faint scar. (About this time she began to feel the present pains in her shoulders and arms.) A week after this, another pimple appeared a quarter of an inch to the left of the site of the sore. This caused considerable itching, which led to scratching and to the production of one of the present Yaws tubercles on the site of the pimple. Another week later the other tubercle developed on the site of the old sore, which had also become itchy.

It was about the time when the scab fell off the sore on her leg and when she felt the pains in her shoulders and arms, that the white patches appeared on her skin. They were first noticed on her face, from which they gradually extended downwards.

## CASE XII.

### CASE ILLUSTRATING CONTAGIOUS NATURE OF YAWS AND THE IMPROBABILITY OF ITS BEING HEREDITARY.

N. J., a Carib woman, aged about 35.

*Present Condition.*—Yaws-gummata on extensor surfaces of arms and legs, as high up as elbows and knees only, attended with articular and neuralgic pains. They begin as small red papules that itch considerably, and after a time develop into nodules the size of a sixpence which either become absorbed or develop a pustule over them. When the pustule bursts, a small hole is seen in the centre of the subjacent nodule, from which a serous fluid escapes. The nodule may or may not proceed to ulceration. In any case it scabs over, and finally contracts and disappears.

*Previous History.*—This woman, who is of pure Carib blood, was living, when about four years old, in a Carib village where there were no cases of Yaws and where there had been none within the memory of anyone in the place. It happened that a cousin of her's of mixed Carib and African blood, who had contracted Yaws in a distant African village, came to live with his African wife and two children in the Carib village. N. J., who had a sore on her great toe, and used to spend a great part of the day at this cousin's house, contracted Yaws shortly after his arrival, and so did both of his children. No one else in the village caught the disease. She has had seven children, the eldest of whom is sixteen; and none of them have ever had Yaws. She was treated with mercury to salivation and tisanes of a bitter bark (here called quina) and guaiacum. The bark and guaiacum were boiled in a quart of water until the latter was reduced to half a pint.

The present tertiary symptoms indicate that the disease has been in her system from the time of its contraction, and yet none of her children have inherited it, not even the infant which she is now suckling and which was born during the development of the present lesions.

### CASE XIII.

#### CASE ILLUSTRATING YAWS GUMMATA AND DEFORMITY AFTER LONG-STANDING AND RE-CURRENT DISEASE.

G. D., Mulatto, aged 25.

*Present Condition.*—Scar left by ulcer a little in front of left internal malleolus measuring about two inches by one. Just beyond its margin are three papules with brown scales. From his waist down to his ankles his skin is covered with a squamous eruption, which is thickest over the anterior aspects of the legs below the knees. The eruption begins with itching; and, after scratching, vesicles are formed which coalesce, burst and scab over. On removing the scabs, no ulcers are seen, but red condylomatous patches are revealed the largest of which is about the size of a threepenny piece. The epithelium for about one-fourth of an inch, on an average, around these patches has fallen off, and beyond this a narrow zone formed by a fringe of dried epithelium detached from the subjacent skin. On the left leg, by about half an inch above the ulcer before mentioned, is the scar of an old ulcer of about half an inch in diameter. This latter ulcer was developed from a gumma. Over the inner surface of the head of right tibia is the scar left by a Yaws tubercle half an inch in diameter. The two scars are very different. The one produced by the ulcerated gumma is superficial, smooth and shiny; the one left by the Yaws tubercle resembles a vaccination scar. It has a white, square patch of cicatricial tissue, in its centre, about a quarter of an inch in size, from which very fine bands of the same tissue radiate towards the margin, which is irregularly crenated. It is hyperpigmented between the radiating bands only. His left fore-arm which is atrophied bears an irregular, glistening, superficial scar over the upper third of its flexor surface and another which covers the entire lower third of its posterior aspect. The latter scar extends as far as the middle of the back of the hand. The extensor and flexor surfaces of the thumb are covered with scars. That over the extensor surface is glistening and superficial; but the other is dull and consists of thick, white cicatricial tissue. The muscles of the thenar eminence have wasted away. The left hand is permanently flexed (as completely as possible) at the wrist. The four fingers of the same hand are hyper-extended at the metacarpo-phalangeal joints, so that the hand presents the appearance of a bird's claw. The metacarpo-phalangeal joint of the left thumb is immovable, the thumb itself being wasted and club-shaped. The distal and medial phalanges of the left ring finger have wasted in length and thickness. The distal is permanently bent at right angles to the medial and the medial at right angles to the proximal. Each is only two-thirds of its original length and only one third of its former thickness. The end of the finger is rounded like a stump, and is about the thickness of an ordinary lead pencil. Two yellow pieces of nail remain attached to the posterior surface of the finger over the medio-distal phalangeal joint. The right arm and hand are sound with the exception of the right thumb, which is covered on its entire flexor aspect with a glistening superficial scar, and is permanently fixed at the proximo-medial, phalangeal joint. The right side of the face bears a scar two and a half by one and a half inches, which extends from the angle of the mouth and a little below it, up to a line connecting the lower part of the lobule of the ear with the inner cauthus of the eye. The right corner of the mouth is distorted by the same cicatrix which, by its contraction, has uncovered the greater part of the two bicuspsids of that side. An ulcer exists over the left half of the chin, measuring three-fourths of an inch in diameter. It is shallow for about one-fourth of an inch in depth and contains a slough. Its margin is thick and sodden, and its base consists of granulation tissue, which readily bleeds and discharges a thick, white matter. An enlarged submaxillary gland, oval in shape and about one-fourth of an inch in length, is seen about the level of the hyoid bone.

The patient eats well; but he sleeps badly. He never has fever and never feels pain. The lower half of his body and both his lower limbs itch exceedingly. He is fairly well nourished and only slightly anæmic. His tongue is clean; his bowels are regular; and his appetite is good. His urine scalds him sometimes. He can walk for hours over an altitude of 2,400 feet.

*Previous history.*—He had a small sore a little in front of his left internal malleolus when he was about thirteen years old. He was then living with some people who were suffering from Yaws. This sore became infected with the Yaws virus, and, as a consequence of this, it began to develop pale granulation tissue which rose considerably above the surface of the surrounding skin and discharged a thick, white, tenacious fluid. A short time after, a Yaws fungus appeared on the back of the neck. It soon dried. The sore on the leg scabbed over with the usual Yaws crust, and shrivelled and disappeared after nine months. He had pains in the legs all the time between the

infection of the sore and the disappearance of the Yaws fungus on the back of the neck. After this he remained well for three years. A gumma then appeared half an inch above the site of the old ulcer which had been infected with Yaws. It inflamed, burst, and formed an ulcer which scabbed over after six months and dried, producing the scar already described. After this a typical Yaws fungus developed on the skin over the internal tuberosity of the right tibia. It remained about two months before it dried and disappeared, leaving the scar before mentioned. When this fungus had disappeared a gumma developed on the inner surface of the left ring finger over its second phalanx, and another over the exterior aspect of the metacarpo-phalangeal joint of the right thumb. These inflamed, burst and formed ulcers, which ate deeply into the fingers and gradually reduced them to their present condition. Another gumma then presented itself about the centre of the back of the left hand. It inflamed, burst and formed an ulcer about one inch in diameter, which quickly healed. As soon as it healed, another appeared at a short distance above it and produced an ulcer which also soon healed. This gumma was followed, in its turn and immediately above it, by another which ulcerated and thus by successive gummata the present scar was produced which extends from the centre of the back of the left hand to the junction of the middle and lower thirds of the extensor surface of the left lower arm. The scar over the left thumb was produced in the same way as, and simultaneously with the last.

When the gummata ceased forming at these parts, they appeared on the upper third of the flexor surface of the left arm, and, by ulceration, produced the scar already mentioned as existing at that part.

After the ulcers on the left forearm had healed a gumma appeared about the centre of his right cheek. It inflamed, burst and formed an ulcer which extended and produced the scar before described. This ulcer lasted about four months. About a month ago a gumma appeared on the left half of the chin and produced the ulcer now existing at that spot. The enlarged submaxillary gland appeared about a week ago. It is situated beneath the true skin and is slightly movable under it in every direction. The skin can be pinched up over it. It is oval in shape, about one-fourth of an inch in length and an eighth of an inch in width and thickness.

The patient has never suffered from either fever or pain since the time when the ulcer near the internal malleolus of his left leg became infected with the Yaws virus, the pains which he then felt in his legs having ceased when the fungus at the back of his neck disappeared. He attributes the persistence and severity of the symptoms in his case to his having exposed himself imprudently to damp and cold while under the influence of the mercury which he had taken during the early stages of the disease.

It is very rarely indeed that Yaws gummata develop on the face. They have always been limited in other cases within my knowledge to the limbs below the knees and elbows. The ulcerations which destroy the throat and nose most probably have their origin in similar masses of granulation tissue formed originally in the submucous tissue.

#### CASE XIV.

##### CASE ILLUSTRATING YAWS GUMMATA.

*Present Disease.*—Ulcers of the forearm. On the inner side of the right forearm, near the elbow, there is a group of ulcers occupying a space of 7 inches by 4 inches. These ulcers are covered with dark brown scabs.

*Previous History.*—Had Yaws as a child. About three years ago a large subcutaneous nodule appeared over the upper end of the ulna. It remained two years, at the end of which time it disappeared without ulcerating. About a week after its disappearance small red subcutaneous nodules were noticed over the present sites of the ulcers. Each lasts about four or six weeks, then ulcerates and scabs over, and is followed by another, which goes through the same process. They itch very much before they ulcerate, and after that they only burn.

#### TREATMENT.

The belief in the syphilitic nature of Yaws naturally influenced its treatment, and we find that the remedies employed in this affection were the same as those used in dealing with syphilis. It is interesting to note the measures adopted in the earliest days of the disease by those who were considered the most expert in its treatment, and to compare the present practice with that originated by the savages among whom the contagion first appeared.

Labat (op. cit.) thus describes the treatment in use in his days among the Caribs of the West Indies:—

“Ambrose Paré, in his ‘Treatise on Surgery,’ relates that in his time two young men of Paris, having travelled in Italy, brought back the disease which was then known as the ‘pelade,’ because it caused the hair to fall off.

“In any case the disease was so new in France, that, far from getting rid of it, there was not a physician or surgeon to be found who wished or was able to undertake to cure those young men. Their parents were therefore obliged to apply to the French ambassador in Madrid to ask permission of the King of Spain to allow the two patients to be sent on board of one of his galleons, in order that they might be placed for treatment under the care of some Indians.

“They were accordingly sent, and the President, to whom they were highly recommended, put them in the house of an old Indian woman, who undertook to cure them.” This author

relates that she never gave them anything more than a tisane prepared with guaiacum and seguine. She did not use the bark of the guaiacum, as is done at present, but the heart of young trees, which she cut in small pieces and boiled in water a considerable time with the seguine. It was this decoction which she made them drink as soon as they were out of bed, after which she took them to the woods or to her cornfield, where she made them work until the perspiration poured from them as profusely as could be expected. When she saw them in this state she would make them rest in the sun, and would give them dry meat to eat, *i.e.*, meat roasted and smoked, and no other drink but the tisane of guayacum. So they spent the day working, perspiring and drinking tisane. She made them drink it also before going to bed, and made them keep themselves very warm at night. She cured them in this way in a comparatively short time, and sent them back as satisfied with her as she was with them for the trinkets which they gave her.

"Our Caribs, to this day, still follow the same method, more or less, for treating those who are suffering from this disease (*l'épian*). They make them perspire and drink large quantities of the same tisane. They say they put other herbs in it which they will not make known, and that they rub the patients with a sort of ointment which, without exciting salivation, like mercury, produces the same effect without so much danger and suffering.

"I think I have mentioned that African children born in America are so subject to the epian that it might be said that this disease is as natural to them as the small-pox in France. When they get it in childhood, they are cured of it as readily as if it was the itch; but, when they are older, *i.e.*, from fifteen to sixteen, there is greater danger, especially when they have not been prudent as regards the opposite sex, and then it becomes necessary to put them through a course of the medicines used in Europe.

"I do not understand whether it is due to people's faith in the actual necessity for using medicines or whether it is owing to the avarice of our surgeons, who would be very angry at not having their services and their drugs utilized, but it seems to me that the sick might be treated in the same way as our Caribs are treated; for this costs little and cures as effectively as it is possible to do so.

"An officer from the Mississippi, called *le Sieur de Manteuille*, a creole of Canada, has assured me that the savages on the banks of this great river are very subject to the epian, because, besides inhabiting localities which are considerably unhealthy, they are very licentious and very addicted to the society of the opposite sex. The remedy which they use to cure themselves is altogether strange, and would certainly kill any one but a savage. After two or three very violent purges, they lie naked on the sand at some spot where there is no possibility of there being any shade, and remain thus exposed to the sun from its rising to its setting, so that its heat might draw all the poison and consume all the bad humours which they have in their bodies. They declare themselves cured after that.

"The negroes are constantly subject to many diseases, most of which are caused by hard work, want of nourishment, and often by their intemperance and indiscretion—the colic attacks them pretty frequently; they are subject to diseases of the stomach (*maux d'estomac*) which degenerate into dropsy; their intemperance with regard to spirits and the bad food they eat give them diarrhoea and dysentery; but the disease to which they are most subject is the Yaws and the other affections which spring from the same cause. Our surgeons, who are ignorant and ill-provided with medicines, have caused the death of an incredible number of them (*en ont fait crever un nombre incroyable*): others who escaped from their hands have borne through all their lives traces of the effects of the mercury which had been inopportunately administered to them, or have remained covered with ulcers and nodes.

"A skilful surgeon, named *Masson*, who had established himself at Guadeloupe, and who, combined with a perfect knowledge of his art much piety and uprightness of character, has made some wonderful cures, both at Guadeloupe as well as at Martinique, with a tisane of which he has given me the prescription, which I think it my duty to make public, because it is excellent not only for all venereal diseases, but further for thoroughly purifying the bulk of the blood, for restoring the normal equilibrium of the humours, and for cleansing the body of all the impurities which it may have contracted. Many persons have used it in France with wonderful success. We call it the Guadeloupe tisane, from the residence of the person who originated it; the following are its composition and the directions for using it.

"To a pint of water, Parisian measure, add an ounce of sarsaparilla, an ounce of walnut-shell, half-an-ounce of 'Seguine de Levant,' or an ounce of that of the Islands: split the sarsaparilla and the seguine down the middle and then cut them up in small pieces, and pound the walnut-shell into a powder.

"Take also an ounce of antimony, crush it into a powder and place it in a small bag made of a piece of good strong cloth folded in two. Tie it well, so that nothing can escape from it.

"Put the water, the sarsaparilla, the seguine and the walnut-shells in an earthenware pot that is new and well-glazed; suspend the bag containing the antimony in the centre of the pot so that it shall not touch the bottom or the sides.

"Boil the water gently, allowing it to simmer on a good charcoal fire without smoke, till it is reduced by one-third. After that, remove the bag of antimony and strain the liquid through a cloth, without squeezing the ingredients, and put the tisane in a glass bottle.

"After that, the seguine, sarsaparilla and walnut-shells which remained in the cloth through which the tisane was strained, must be replaced in the same pot with the same quantity of water, and the bag of antimony suspended in it, as before.

"The water must be allowed to boil till it is reduced by a third, then strained as before, and put into a glass bottle to be used as I will indicate further on—

"This second tisane is much less concentrated and much weaker than the first. For that reason, it is called "petite tisane." The sarsaparilla, the seguine, and the walnut-shell can only do for once; the bag of antimony will do for five times. After that it must be renewed.

"Before giving him the tisane, the patient must be prepared for it by bleeding, and by an ordinary purge the following day. On the third day he is allowed to rest. On the fourth he is bled again. On the fifth he is purged. On the sixth he begins taking the tisane and continues doing so during fifteen or twenty days in succession, or, at the most, thirty days. The affection must be very obstinate not to yield at the end of that time.

"The quantity to be taken is about three-quarters of a pint daily in three doses. The first glass is given at six in the morning, the meal being taken at ten. The second glass is drunk at two in the afternoon, supper being at six. At ten at night the third glass is taken.

"The food during that time should consist of meat roasted on the spit or grilled, without salt, without soup, without stew, salad, fruit, fish, cheese or anything else. The drink must be only the 'petite tisane' both at meals and during the day when thirst is felt.

"The patient must abstain from tobacco in every form, and he must be kept warm.

"Though this regime may appear rather irksome, it is far more agreeable to make use of this treatment, which is attended with no risk, than many others which produce unpleasant results, and are far more expensive. It is gentle in its action, which is scarcely felt. Its only perceptible action is the profuse perspiration which it provokes, and which drives to the surface everything that is deleterious, and so to speak renovates the whole body."

Rocheford (op. cit.) describes the treatment of Yaws in use among the Caribs, as follows:—

"To cure these complaints, which are chiefly due to the bad food they eat, they have the bark of a tree called *chipiú*, as bitter as *suje*, which they soak in water, and having scraped into this infusion the bottom of a certain large shell, called *lambys*, they swallow this medicine.—They also squeeze sometimes the freshly raised bark of some *miby* trees or other vines that creep along the ground or attach themselves to trees, and drink the juice when thus expressed. But they prefer to use this medicine only when the trees are in full sap.

"Besides these medicines, with which they purge the bad humours from within, they also apply externally certain ointments and liniments which have the special property of cleansing all the pustules which generally remain on the bodies of those who are troubled with Yaws. They prepare these medicines with the ashes of burnt reeds, which they mix with the water collected from the leaves of the *balisier*. They use also, for the same purpose, the juice of the fruit of the *junipa*; and they apply to the tubercles the crushed pulp of the same fruit, because it has the property of attracting all the matter from the sores and of closing the edges of the ulcers.

"They also make use of artificial baths, and excite perspiration by means of a sort of stove in which they enclose the patient, who is entirely cured by this remedy. The Soriquois also make their sick perspire."

Raymond Breton (op. cit.) thus refers to the Caribs' practice in dealing with cases of Yaws.

"This (Yaws) is an indigenous disease which prevails as commonly in the Islands as the great pox (*grosse vérole*) in France, and of which savages cure themselves without trouble and risk, not only on account of the temperature of the air which is very equable, but also because of the powerful remedies which grow in the torrid zones and which have not lost any of the qualities of the fresh plant, as is the case with those brought here from those islands after a voyage of 1,800 leagues. They use the juice of the bark of the *chipiú*, with which they rub themselves, and the juice of the *genipa* mixed with the ashes of burnt reeds to blacken their bodies with; they take the juice of some creepers, like that of the bark of the *mibi*, with scrapings of the bottom of the *lambi*; when the large pustules burst, they apply pieces of cotton wool to them, so as to close the edges of the ulcers, and to prevent deformity."

Raymond Breton (op. cit.) gives the following account of the remedies above-mentioned:—

"*Chipiú*.—A tree, the juice of which is so bitter that it has given its name to all bitter things, and if the savages touch its bark, they impart so much bitterness to everything they touch, that it is impossible to use it. They pound the bark, extract the juice, and rub themselves with it when they have 'les pians,' i.e., the great pox (*grosse vérole*), which makes me believe that it has some virtue against this unsightly disease.

"*Genipa*.—It is easy to work, and they make the rafters of their huts with it. The wood ants eat it and destroy it in time, but the rain harms it still more, if it falls on it. The savages extract the juice from the fruit when it is soft and ripe, and their wives paint them with it. They sometimes use this black dye when they are tired of wearing the red one. It is only time that can efface the colour.

"*Manlíra*.—Guaiacum.—The Caribs do not use it for 'les pians' or the great pox (*grosse vérole*).

"*Manbula*.—Reed.—The savages dry the reeds and burn them; then they rub the ashes on and blacken those who have 'les pians.'"

"*Mibi*.—Creeper.

<sup>o</sup> *Genipa* or *Junipa*.—This is one of the trees to which Humboldt refers, as follows, in his description of the entrance to the Cueva del Guacharo—"The rock that overhangs the cave is covered with trees of enormous size. The Mammee and the Genipa, with huge, polished leaves, lift their branches perpendicularly on high; and the Courbaril and the Erythrina spread theirs horizontally and form a thick, leafy vault."



"*Lambis* or *lambys* is the present name of a large spiral shell, which is now used to blow as a signal of the approach of a fishing boat, &c."

I have not been able to trace the *chipiú*. Father Labat refers to the 'bois amer' in almost the same terms as Raymond Breton does to the *chipiú*; and I conclude that they are both the *simarubá*. Neither have I succeeded in finding here the plant known as *junipa* or *genipa*. The black dye now used by the Caribs for painting calabashes is prepared by scraping the bark of the *kumanti* (known in creole patois as 'zyé crabbe'), soaking it in water, squeezing it so as to extract the glutinous fluid it contains, and mixing soot with it. A glossy black is thus produced.

There is some discrepancy as regards the use of the guaiacum in Yaws, between the statement of Father Labat, who asserts that the heart of the young plant was boiled by the Caribs and made into a tisane, and that of Raymond Breton, who expressly states that the guaiacum was not employed by them in the treatment of the disease. Possibly it came into use as a remedy for Yaws after the date to which the latter author refers.

An analysis of the Carib treatment of Yaws as above described shews that it consisted internally of sudorifics, diuretics, alteratives, bitter tonics and alkalies, and externally of alkaline astringent applications. The diet was limited to dry meat, liquids being avoided as much as possible, except in the form of the decoctions prescribed. Salt, condiment, spirits and tobacco were also forbidden.

Bontius (op. cit.) states that the remedies employed in the treatment of Yaws were mercury, antimony, sarsaparilla, guaiacum, china root, &c.

M. Dazille, Médecin du Roi à St. Domingue, writes as follows in his work, "Observations générales sur les maladies des climats chauds." (1785):—

"En sortant des Arcahayes à l'embouchure du Cul de Sac, et au milieu d'une terre sans culture appelée la saline, parce qu'elle contient en effet beaucoup de sel marin, on trouve à quelque distance du bord de la mer deux sources dont les eaux jaillissent verticalement du sein d'une terre calcaire et remplissent deux excavations . . . d'où elles s'échappent et vont se perdre dans la mer.

"L'odeur de ces eaux est infecte et se fait sentir à plus d'un quart de lieu; elles tiennent de la nature des eaux croupissantes et des dissolutions de foie de soufre.

"Mes expériences, d'accord avec l'usage, prouvent que ces eaux ne contiennent aucun principe dangereux, mais elles répugnent tellement au plus grand nombre des malades qu'il leur est impossible d'en avaler. Il est pourtant de notoriété publique qu'elles dessèchent les vieux ulcères, guérissent radicalement le pian, les dartres et autres maladies de la peau, lorsqu'on peut surmonter cette répugnance et se déterminer à en user tant en boisson qu'en bains et en douches."

This extract serves to show the efficacy of sulphur, both internally and externally, in the treatment of Yaws, in the opinion of a distinguished physician at the end of the last century.

The remedies above mentioned appear to have remained in use far into the present century. The treatment recommended in the Cyclopædia of Practical Medicine is as follows:—

"During eruption.—Mild diaphoretic, such as precipitated sulphur, contrayerva in powder or infusion, decoction of china root or infusion of sassafras, and vapour or warm baths.

"When eruptions dry.—Compound decoction of sarsaparilla and other vegetable tonics, such as contrayerva, sassafras and guaiacum.

"Towards decline.—If the disease does not go off kindly, mild mercurials as alteratives, and not to occasion ptyalism. Minute doses of a solution of the oxymuriate of mercury have been generally preferred, together with Decoet: Sarze Co.

"When erosions of cartilages of nose and palate, foul ulcers, bone ache, &c.—A generous diet and plentiful use of sarsaparilla, both in decoction and powder."

With regard to applications to the ulcers, the writer proceeds as follows:—

"Simply unctuous dressings and warm fomentations are rarely serviceable. Washing them with cold water and certain vegetable applications will often have a good effect." He recommends the leaf of the snake wyth (*cissus sicyoides*) or that of the iatropha curcas (English physic nut) as a dressing for small ulcers, and for large ones, the leaves of the latter tree pounded and mixed with sugar or the pulp of roasted Seville oranges and sugar as an antiseptic poultice. Chronic ulcers he recommends being dressed with ung. hyd. nit. or an ointment consisting of carbonate of iron, citric acid and lard.

"Under all the usual circumstances of Yaws and in every stage except the primary febrile one, it is necessary that the patient's strength should be supported by a generous diet, including a full allowance of animal food, with a due proportion of wine or diluted spirits."

The writer also lays special stress on the need of cleanliness, easy exercise in the open air, such as weeding their provision grounds or following sheep and cattle in the case of labourers, and "usage conducive to mental content and cheerfulness."

Copland, in his "Diet. of Practical Medicine (1858)," describes Yaws as a variety or modification of syphilis, under the terms syphilis, or lues Æthiopica or Africana, and recommends for it the treatment used for the latter disease.

Lancereaux (1866) holds the same opinion as Copland.

Tilbury Fox (1873), depending for his information on Dr. Imray, of Dominica, and Dr. Bowerbank, of Jamaica, writes as follows:—

"Dr. Imray says the treatment of Yaws is as simple as it is usually effective in every instance, if commenced at an early period of the disease, and if only persisted in with strict regard to cleanliness and attention to diet.

"In the early stage it is customary first to wash the patient, then to encourage the full development of the eruption by the exhibition of sulphur and supertartrate of potash for six or eight days. In the next place, mercury is to be administered in conjunction with decoction of

sarsa or sassafras or mezereum, in the form of tisanes, to which great virtues are attributed. The mercury is dropped directly signs of its action on the gums shew themselves. Tonics should be conjoined with mercurials in the case of weak persons. Occasional aperients are also needed. The diet should be good and unstimulating. As regards local applications, Dr. Inray advises a carbolic acid solution, or weak nitrate of mercury ointment. The natives apply the boiled and beaten-up leaves of the physic nut, *iatropha curcas*, the juice of the sour orange, the *janipha manihot*, or the flowers of sulphur dusted over the part.

"Dr. Bowerbank tells me that mercury is the active ingredient in all the Yaws specifics—and their name is legion—issued in Jamaica, that iodide of potassium is also efficacious, and especially if the disease attack the mucous membranes."

Dr. Horton (*Diseases of Tropical Climates*, 1879) makes the following recommendations with regard to treatment:—

"This disease runs a definite course in the system, and the treatment must be guided by the symptom presented; perfect cleanliness should be enjoined; the diet should be generous, and composed principally of animal food. Tonics and alteratives should be given at the commencement of the disease. I have always found the arsenical preparations to have the best effects; the mineral acids, as well as the extract of sarsaparilla and antimonials, are valuable remedies. The use of mercury has been proposed; if used early it cuts short the disease, but increases the constitutional effect, also the pains in the joints and bones, and the weakness is apt to return. Iodide of potassium and the alkalies are excellent when the ulcers are indisposed to heal. The iodide of potassium might be given in combination with the liquor arsenicalis.

"The local treatment consists in the application of various remedies; in Western Africa the natives wash the ulcer with soft cloth until it bleeds and then strong caustic is applied, either sulphate of copper or nitrate of silver; it gives some pain, but destroys the obstinate excrescences. An arsenical paste, consisting of ten grains of arsenious acid, two scruples of sulphuret of mercury, and ten grains of powdered animal charcoal, has been recommended by some physicians; but it should be cautiously used, and a small quantity at a time applied. Topical application of creosote has been used with good result, the strength is  $\frac{3i}{j}$  to  $\frac{3i}{j}$  of lard or simple cerate. Gentle exercise, nourishing and generous diet, warm clothing, and perfect cleanliness should be recommended."

Dr. Bowerbank expresses the following opinions as regards treatment:—

"There is no doubt that in a case of normal Yaws, occurring in an otherwise healthy person, the disease tends to a spontaneous cure.

"In its primary stage the needed treatment is of the simplest description; the patient should be kept within doors in a well-aired room, suitably clothed, have light nourishing food, a daily warm bath and some simple vegetable tea, as of sarsaparilla, lime-leaves, or lemon-grass. Exposure to wet and cold must be avoided, until the eruption is fairly developed, so as not to run the risk of its being repelled or driven in. When the Yaws tubercles, or excrescences are large and full, the skin must be kept clean by daily washing; and no undue friction or handling of the excrescences must be used. When they are flabby and unhealthy, a more nourishing and stimulating diet is required; and the internal use of sulphur, camphor and guaiacum is beneficial. Mercury is often used to hasten the dispersion of Yaws; but it is always to be very carefully given; and a much safer and quite as effectual a remedy is the iodide of potassium. This may be given in any stage. If at any time tonics are required, nothing is better than small doses of quinine with sulphuric or nitric acid, with quassia or *simaruba*."

Dr. Nicholls, of Dominica (1879), writes as follows:—

"In many instances, Yaws will end in recovery without medicinal treatment, if the patient be placed under proper sanitary and hygienic conditions. There can be no doubt, however, that the disease may be arrested or its duration abridged by the administration of certain drugs which experience has shewn to have a curative effect." He then proceeds to point out the hopelessness of expecting any benefit from direct treatment when the patient is in a cachectic condition, and the need, in such cases, of "tonic medicines, good and nutritious diet, and the strict observance of the laws of hygiene," before attempting to cure the disease. With reference to mercury, he states: "There exists no doubt, in my mind, that some cases of Yaws can be cured by mercury, but I am equally confident that in many instances its effect is positively injurious."

He refers to the difficulty of determining when the eruption was fully thrown out (which was the proper time, according to the old writers, for the administration of mercury), and the diminution of the red blood corpuscles induced by the continued use of the drug, a result which would only aggravate the anæmia of the latter stages of the disease. He adds, "It may be beneficial when the red tuberculated growth—the true frambæscial excrescence—exists in strong plethoric individuals; but even in such instances, I would prefer trying other remedies before having recourse to mercury."

The writer of the article "Yaws," in the ninth edition of the "Encyclopædia Britannica" (1880), states as regards treatment: "The malady in a person of good constitution runs its course and gets well in a few weeks. Whatever tends to check the eruption, such as exposure to chill, is to be avoided. A week's course of cream of tartar and sulphur (confection of sulphur) at the beginning of the illness is often resorted to, so as to bring the eruption well out. The patient should remain indoors in a well-aired room and take daily warm baths and diluent drinks. If the excrescences are flabby and unhealthy, it is an indication for generous diet. Mercurial treatment is no longer in vogue. As external applications, weak lotions of zinc or carbolic acid may be used, and, if the excrescences are irritable, a water solution of opium.

Tedious and unhealthy Yaws should be dressed with a wash of sulphate of zinc or copper; the same may be applied to a Yaw ulcer."

We have now arrived at a stage in the history of the treatment of Yaws in which mercury is considered by many a doubtful or unnecessary remedy; and we find that in standard works after this date, different opinions are expressed as regards the employment of the drug. In the "Epitome of Skin Diseases," by T. Colcott Fox (1883), the views of Dr. Nicholls on the subject are re-stated.

In Quain's Dictionary of Medicine, 1883, Erasmus Wilson writes: "The treatment of Yaws, according to the best authorities, consists in cleanliness, generous diet, the local use of carbolic acid lotions and diluted nitrate of mercury ointment; and the employment of constitutional remedies, of which the most useful are mercury with sarsaparilla or a decoction of the woods, iodide of potassium and tonics."

In Holmes' System of Surgery (1883), the following is the treatment recommended:—"Locally, mild stimulating ointments; internally, tonics, nutritious food and occasional alteratives; aperients appear to be indicated. Mercurials have been used in former times, but are now generally believed to be worse than useless."

Hirsch (1883) states:—"The use of mercury in Yaws has been found to be absolutely injurious."

McCall Anderson (1887) merely repeats Dr. Imray's recommendations as to treatment, viz.:—"Mercury with decoction of sarsa or sassafras or mezerium till salivation." "Iodide of potassium is also efficacious." With such contradictory statements before him, the practitioner who has had no previous experience of Yaws will certainly be at a loss to decide which view he should adopt as regards mercury, whether that expressed by Erasmus Wilson, that it is the most useful of constitutional remedies, or that of the writer in the Encyclopædia, that mercurial treatment is no longer in vogue, or that of the authority in Holmes' "System of Surgery," that mercurials are now generally believed to be worse than useless.

Before proceeding to express my opinion as to the most suitable treatment for Yaws, I will recapitulate the methods which have been hitherto adopted in dealing with this disease. We find a consensus of opinion as regards the following points:—(1) Cleanliness. (2) Nourishing food. (3) Exercise. (4) Healthy action of the skin: and with respect to drugs: (1) Diaphoretics. (2) Alteratives. (3) Tonics. Diaphoretics have been employed by both the civilised and uncivilised, in the form of active exercise, exposure to the sun, vapour baths, hot-water baths, stoves, &c., and such drugs as sulphur, antimony, sarsaparilla, sassafras, mezereon, guaiacum, and camphor. The tonics used have been vegetable tonics and the mineral acids; and the alteratives, antimony, mercury, iodine, arsenic, sulphur, and those of the vegetable kingdom, such as sarsaparilla, guaiacum, &c.

In considering the above treatment, one is struck with the fact that iron is not mentioned as necessary in a disease whose chief characteristic is the anæmia which attends it. Another point deserving of notice and to be alluded to further on, is the absence of alkalies which formed part of the drugs employed by the Caribs. Horton alone mentions alkalies in combination with iodide of potassium. He alone recommends arsenic with any emphasis, stating that he had always found the arsenical preparations to have the best effects. The only other reference to arsenic is that of Dr. Nicholls, who writes as follows:—"In chronic cases, which are unaffected by the various agents I have mentioned, arsenic may be given with advantage . . . . Arsenic seems to be especially valuable when the squamous and the papular stages persist for a long time."

I purpose discussing the treatment of Yaws under the headings of the different stages into which I have divided the disease.

#### INCUBATION STAGE.

There being no positive proof of disease at this stage no remedy is sought or administered.

#### PRIMARY STAGE.

When the existence of this period is revealed by the presence of a papule at the seat of contagion or by the ulceration of the papule, the patient must be at once isolated. The skin should be cleansed by a tepid bath and the free use of carbolic soap; a purge of castor oil, just sufficient to clear the bowels, is to be administered, and the action of the skin kept up by flannel or other warm clothing. Iron is to be given three times a day in tonic doses, and, if the patient shews any signs of cachexia, cod liver oil should be added to these. The best form in which to administer the iron is some neutral preparation, such as the tartrate, which may be given before meals, the oil being taken after food. The most suitable diet is one consisting of grilled fresh meat or fresh fish and vegetables without condiments, taking care to give sufficient to nourish the patient without disturbing his digestive organs. The sore should be bathed with corrosive sublimate lotion, dusted with equal parts of finely powdered iodoform and sulphur, and well protected by a layer of cotton wool.

When the seat of contagion is a previously existing sore or wound and the presence of the poison in the body is manifested by pale, fungating and ichorous granulations, every effort must be made to heal this sore, for, as already explained, an ulcer prevents the development of the

general eruption by which the infection is eliminated from the system. The internal and external treatment and the diet must be the same as above indicated, the granulations being daily touched very lightly with caustic potash to hasten cicatrization.

The further treatment consists in hot air baths, which should be administered every night immediately before bedtime, and should not produce excessive perspiration. The bath may be used in the usual way by making the naked patient sit with a flannel round him on a wooden stool under which a spirit lamp is burning.

The above treatment naturally refers to adults and children of a certain age. In the case of very young children the tartrate of iron or syrupis ferri phosphatis *co.*, may be used, and for infants the best diet is, of course, cow's, goat's or ass's milk, prepared with water and sugar to assimilate it, as much as possible, to human milk. An infected child, it need hardly be explained, must not be allowed to be suckled by an uninfected person; and, though there may be no danger to a nurse who has had Yaws or who is actually affected with it, her milk may be injurious to the child. For, notwithstanding the fact that we have no proof of the transmissibility of the disease by the milk, when taken at the breast, this may yet be the case, and, under any circumstances, that fluid must be impoverished, considering the effects of the disease on the constitution. With regard to a nurse who has previously had Yaws, her feet, nose, and throat ought to be carefully examined, to detect any traces of the disease; and it should not be forgotten that, even without those external signs, the disease may be still latent in the system. In order, therefore, that the infant may receive suitable nourishment, to enable it to throw off the disease within the shortest possible time, it is wisest to bring it up by hand and feed it on milk and such prepared foods as are known to be adapted to its digestive powers.

Warm baths and flannel clothing can be substituted for vapour baths in the case of a patient whose age may make the latter inadvisable.

Though exercise is useful at this stage, by increasing the action of the skin, and fresh air, in itself, cannot but be very healthful, it is advisable to keep the patient within doors during the hottest part of the day, so as to avoid exposure to the sun, which is at that time far too ardent in the tropics not to act injuriously on an individual weakened by disease, and protect him from those changes of temperature which may interfere with the full development of the secondary eruption. All outdoor exercise should, therefore, be taken early in the morning or in the afternoon, a little before sunset, the patient returning within doors as soon as his work is done to have his body well rubbed down and his damp clothes changed for dry ones. He must not be allowed to work or go out in the rain, and the place in which he lives should be free from draughts.

It is not often that the disease is recognisable at this stage, when it assumes the form of a papule or sore, but it is very commonly noticed when it has entered the system through a wound or ulcer and the characteristic changes have taken place in them. On the first appearance of these changes the patient should be isolated and the measures above recommended adopted. When a papule develops on the lip, neck, shoulders, or breast (the usual sites in such a case of the primary lesion) of a woman who is nursing a child suffering from Yaws, or of a child who is being nursed by an infected mother, or when the same appears on the lips or genitals (or in the neighbourhood thereof) of a person cohabiting with another who is affected with the disease, and such a papule proceeds to ulcerate, there are sufficient grounds for assuming the probability of infection and for consequently isolating the person in whom such a lesion presents itself.

#### THE SECONDARY STAGE.

It has been already explained, in treating of the clinical history of the disease, that the premonitory symptoms of this period vary considerably in their intensity, being almost always in infancy and childhood, and often in adult age, so slight as scarcely to be noticeable, and, in other cases, so severe as to cause great suffering. Under the latter circumstances, considerable pyrexia is present, and the patient is affected with articular pains which are as acute as those of the severer forms of rheumatism.

In the milder cases, the treatment of the previous period may be continued until the secondary eruption appears; but, when the symptoms are severe, salicylate of soda and quinine are the drugs to be employed, in doses of from ten to fifteen grains, until both the fever and the pains have disappeared. The hot air baths may also be given two or three times a day, and the patient should be kept warm in bed to promote perspiration. Warm, diluent drinks should also be administered for the same purpose; and the most appropriate diet, while there is fever, is one consisting of easily digested, nutritious food, such as milk, eggs, bovril and farinaceous foods.

The fever and pains cease when the rash appears; and, on their cessation, the treatment hitherto adopted must be altered.

The remedies now to be used will vary with the nature of the eruption. When it passes through its usual stages of vesicle, papule and tubercle, the course to be adopted is as follows:— During the vesicular and papular stages the action of the skin must be promoted by keeping the patient warm in bed and by administering carbonate of ammonium in frequent doses of two grains, with one drachm of *mistura guaiaci* to adults and proportionately to children. These drugs will be found to produce free perspiration and thus facilitate the development of the rash. If the dose of the carbonate is found insufficient to excite diaphoresis it must be increased or given more frequently, and, on the other hand, lessened or given with longer intervals, if the stomach is deranged by it. When the tubercles have appeared, the same treatment must be continued until they have

fully developed. The carbonate of ammonium possesses qualities which make it of as special utility in this disease as it is reported to be in scarlet fever and measles. It has stimulant, antiseptic and diaphoretic properties, and it is readily diffused. Its alkalinity, however, is the virtue which causes it to be particularly useful in Yaws. It has been already pointed out that the secretion from the Yaws tubercles, until they begin to wither, is highly acid. This suggested to me the employment of a counteracting alkali, and carbonate of ammonium was selected on account of its stimulant diaphoretic and antiseptic properties, by virtue of which I found it to act beneficially, as well as by its neutralizing the acid secretion of the tubercles and thereby preventing their extension, coalescence and ulceration.

After the tubercles have developed fully, the secretion from them must be kept neutral by continuing the administration of the carbonate of ammonium, which may then be given less frequently and in larger doses for that purpose. Five grains may be taken, three, or if necessary, four times a day, in combination with from five to ten minims of liquid extract of cinchona, or from one to two ounces of the decoction of cinchona. The astringent property of bark makes it preferable to quinine, as a tonic, in the relaxed conditions of the tissues which generally obtain in those among whom Yaws prevails; but, should the fever which accompanied the premonitory symptoms persist during the eruption and not yield to cinchona only, it must be arrested by appropriate doses of quinine (about fifteen grains) which should be continued for three or four days after the disappearance of the fever. The carbonate of ammonium and the cinchona are best given an hour before meals; and, during its administration, no acid of any kind should be allowed either as a drink or with the food, vinegar and acid fruits being strictly forbidden.

The anæmia which accompanies the disease in all its stages is to be remedied by a non-acid preparation of iron, the neutral ferrum tartaratum being well suited to the purpose both for adults and children. In the case of infants and very young children, syrupus ferri phosphatis compositus, commonly known as chemical food, or Parrish's syrup may be substituted, in appropriate doses, and lime water added to their milk. When an adult patient is suffering from great debility, it may be found necessary to use Easton's syrup instead. In all instances, and especially in those in which there are signs of tubercle or scrofula, cod liver oil will be given with advantage.

When the eruption is arrested in its development, and has assumed a permanently squamous or papular or vesicular form, the same remedies are indicated during a period corresponding to that usually required for the maturation of the tubercles. Should any of the latter appear among the general eruption, their condition will serve as a guide for the duration of the treatment.

When the tubercles that were last to appear have matured, the most appropriate treatment consists of warm sulphur baths and calomel fumigation. In localities in which there are sulphur springs, these may be utilized both for drinking and bathing. Failing these, warm baths in which potassa sulphurata has been dissolved, about an ounce to 8 gallons, may be administered every night, followed by fumigation with calomel. Before commencing the baths, the crusts of the tubercles must be removed by warm baths and the frequent application of equal parts of liquor potassæ and olive oil. As soon as the patient has been removed from the bath, he must be made to sit naked on a wooden stool under which is placed one of the lamps constructed for calomel fumigation, and both his body and the stool must be enveloped in a long loose gown or cloak which is to be tied at one end round his neck and, at the other, is to rest on the floor, so as effectually to prevent the escape of the calomel fumes. The best lamp for the purpose is one in which the receptacle for the calomel is surrounded by a trough to contain water. Or the calomel may be placed on a hot piece of brick placed in boiling water. Thirty grains of calomel may be used at fumigation, which should last fifteen minutes, an equal time being allowed for the previous sulphur bath. The water to be evaporated at each sitting with the calomel should be about an ounce. The gown or cloak should be constantly worn day and night while the fumigating process lasts, and only removed for the purposes of the bath. During that time, as indeed during the whole of the eruptive period of the disease, the only baths allowed should be those above indicated, and nothing should be taken as food or drink which is in any way acid. All purges must be avoided, and every means adopted to prevent the patient catching cold. The duration of the treatment will vary with the constitution of the patient and the nature of the attack. In any case it must be continued until the flow of saliva is slightly increased, there is a metallic taste in the mouth, and the gums are redder than usual and somewhat tender.

The above directions are intended for the cases of adults. They must, of course, be modified for children and infants and for those who have been rendered anæmic or generally cachectic by disease or other causes. In the former instances, the quantity of calomel used at a sitting must be proportioned according to age; and in the latter, special caution must be exercised in its administration. It is more prudent, in the case of the cachectic, to use smaller quantities of calomel over a longer period. In the case of infants, inunction may be found preferable to fumigation.

The tartrate of iron and cod liver oil must be continued during the calomel fumigation, as well as the cinchona and carbonate of ammonia; and the diet, after the disappearance of the fever, must be limited to grilled fresh fish or fresh meat, stale bread, and dry vegetables, such as plantain, all other articles, such as fats, acids, pepper, spices, &c., being avoided. Alcohol, tobacco and sexual connection must also be forbidden.

The tubercles have generally dried by the end of the calomel course; and the time has then arrived for the administration of iodide of potassium. This must be administered to adults in five grain doses and upwards three times a day, an hour before meals, for six weeks, instead of the carbonate of ammonia; the tartrate of iron and cod liver oil being given, as before, after

meals. A drachm of sulphate of magnesia and a drachm of sulphate of soda must be administered to adults every morning or every other morning, or more frequently, to ensure free, but not excessive evacuation. The iodide of potassium is best taken in sarsaparilla and cinchona, two drachms of the fluid extract of the sarsaparilla and fifteen minims of the liquid extract of cinchona to each dose of the former.

For infants and children, the doses of iodide, sarsaparilla and cinchona, must be adapted to their ages, and some suitable saline aperient selected, such as carbonate or citrate of magnesia, or, better still, the almost tasteless phosphate of soda, which may be given in milk. In their cases, also, the tartrate of iron and cod liver oil must be administered after meals.

During the administration of the iodide, both children and adults are to be allowed the free use of the compound decoction of sarsaparilla; a pint to be used daily by the former and a corresponding quantity by the latter. The diet may be more varied, vegetables being allowed, but nothing which may disturb the digestive organs or cause hyperæmia of the skin should be permitted either as food or drink. All kinds of fish that cause hyperæmia of the skin, especially shell-fish, must be avoided, as well as all pickled or salted food, acids, peppers, spices, alcohol, &c. The skin must be kept cool, without exposing the patient to catch cold, and tepid baths with soap to be used twice a week to keep the skin clean and healthy. Excessive perspiration must be avoided, and great care used to prevent any injury to the skin or its infection by disease. Everything, in fact, must be done to keep the skin clean, healthy and duly active, and everything avoided which may excite unhealthy action. For that reason, the patient should be kept under careful observation during the six weeks of the course of iodide of potassium, and for another six weeks after, during which he is to be brought into as good condition as possible by nourishing food within the limits prescribed, and by iron and other tonics.

If the eruption persist after this course, which happens very rarely in the case of tubercles, and more frequently in the squamous, vesicular or papular forms, liquor arsenii et hydrargyri iodidi\* must be employed for adults in doses from five to ten minims, three times a day, after meals, until the skin becomes healthy. Its effects, however, must be carefully noticed, so as to avoid any excessive action of either of the constituent drugs, and it must be suspended and resumed according to circumstances. It should be administered after meals, the iodide of potassium being given with the cinchona and sarsaparilla, in five grain doses or more, three times a day, before meals. The same precautions as to diet, as above indicated, must now also be observed.

It is very rarely indeed that the disease in children resists the treatment by sulphur baths, calomel fumigation, iodine and tonics. Should this occur, hydrargyrum cum creta may be administered in doses of from one to two grains, night and morning, guarded by a little compound chalk powder, and the iodide of iron used at the same time with cod liver oil.

With regard to both adults and children, however, it is preferable to repeat the sulphur baths and calomel fumigation rather than administer any form of mercury per *orem*. The latter method should only be adopted as a last resource.

To the tubercles which form about the anus, and become irritable and painful with friction, an ointment of calomel, iodoform and tannin in vaseline may be applied, or the more rapidly effective unguentum hydrargyri.

When the tubercles ulcerate, the ulcers must be washed with a lotion of bichloride of mercury, dusted with finely powdered iodoform and sulphur in equal parts and covered with cotton wool, twice a day. They should also be bathed twice a day with warm water to remove the pus and adherent powders. When they are indolent, iodoform and resin ointment (one drachm to the ounce) form a useful application. Where any crusts exist, they must be removed in the manner already indicated; or, if necessary, by poultices, before applying the dressing.

The treatment of the lesions of the palm and sole will be discussed when dealing with those of the tertiary period.

The fumigation treatment indicated above for the secondary stage of Yaws is one which can only be adopted under certain circumstances, and cannot be practised either among the out-patients of a hospital or in such badly-appointed institutions as those in which Yaws patients are generally segregated. However desirable, therefore, it may be, it is found necessary in practice to limit it to those cases in which the cutaneous lesions will not yield to mercury when internally administered, and to have recourse generally to the least debilitating of the mercurial salts, viz., the perchloride of mercury. The combination in which it may be most efficiently prescribed is as follows: for adults, the sixteenth of a grain of perchloride of mercury, fifteen minims of the perchloride of iron and three minims of liquor strychniæ to be taken three times a day. For patients between twelve and twenty, one-eighth of a grain of the perchloride of mercury, ten minims of the perchloride of iron and two minims of liquor strychniæ. For those between twelve and six, one-sixteenth of the perchloride of mercury, five minims of the perchloride of iron and one minim of liquor strychniæ. Children under six, in the tropics, in my experience, stand one-sixteenth of a grain of perchloride of mercury quite as well as older children and better than many adults. For infants, inunction may be preferable; but one thirty-second of a grain of the perchloride of mercury and half a minim of liquor strychniæ in twenty drops of syrupus ferri phosphatis are generally taken without unpleasant consequences.

The patient must, of course, be watched during the administration of the perchloride of mercury to detect the earliest signs of salivation. As soon as the throat is sore or the gums tender, or, sometimes, before this, as occurs in certain patients when nausea prevents food being taken, the mercury must be suspended until these symptoms disappear. On resuming it, the same dose will be easily tolerated for a longer time.

\* To improve the condition of the skin as much as possible, the patient should, in all cases, be put through a course of arsenic during the last six weeks of treatment. The arsenic and cod liver oil may be administered after, and the iron and other tonics before meals.

## TERTIARY PERIOD.

It is seldom that a case occurring in a healthy individual, under judicious treatment, develops tertiary symptoms.

The lesions of this period must be remedied by mercury and iodide of potassium, assisted by guaiacum and sarsaparilla, the patient's strength being kept up by bark, iron and cod liver oil. It is a mistake to suppose that iodide of potassium can cure tertiary symptoms. It may alleviate them or check them for awhile, as it may those of the secondary period, but they will constantly return until removed entirely by mercury.

As the disease has now invaded the deep tissues, mercury must be used per orem, to reach them through the blood. It may be administered according to the following prescription of Dr. Berkeley Hill:—R hydrarg. bichlor., gr. 3; pot. iod., gr. 96; tr. cinchon. co., 4 ounces; sesquicarbonate of ammonia, gr. 60. Water sufficient to make up 8 ounces. Of this, two teaspoonfuls should be taken half an hour before meals, three times a day. The dose of the bichloride, according to Aitken, *re* syphilis, may be increased to two-thirds of the grain daily; but he states that, except in such a solution as the above, its action is uncertain. The strength of the bichloride must be gradually increased weekly, until the patient can tolerate the latter quantity per diem, and must be either continued until the disappearance of the disease, if there are no indications to the contrary, or suspended on the appearance of sore throat or tenderness of the gums, or excessive salivation, until these symptoms have subsided.

The quantity of iodide of potassium will, of course, be increased in proportion to that of the bichloride used in the mixture; but it may be found necessary, after the third week, to raise it to fifteen grains or more, according to circumstances, remembering that there is a limit to the dose which the system can absorb and utilize, and that the deeper the lesions, the larger the quantity of iodine required. A drachm of the salt per day, divided into three doses, is as much as any case should require.

The combined iodine and mercury treatment should last six weeks, and should be followed by a six weeks' course of iodide of potassium alone.

There are cases, however, which cannot tolerate the internal administration of mercury. These must be treated by calomel fumigation only, as already described, followed by iodide of potassium.

When there are ulcerations of the skin, and the drug can be taken, a combination of the internal and external methods may be used, the quantities being proportioned accordingly. Ten grains of calomel daily are sufficient for fumigating, when this process only is used; and five grains when combined with the internal administration of the bichloride, which should not then exceed a third of a grain daily.

Local fumigation is useful in cases of long-standing ulceration. As these are, with scarcely an exception, always limited to the limbs, it may be easily carried out by means of the lamp already described. The closed end of a sack may be cut open and a hoop bound to it. The limb is passed through the other end, which is bound firmly against the skin. By this means the leg or arm can be placed over the lamp for fifteen minutes and thus fumigated.

A lotion of tartrate of iron should be used for bathing the ulcers which, when deep, should be carefully syringed out with the fluid; finely powdered iodoform should then be dusted over them and a thick pad of absorbent cotton wool firmly applied, taking care to introduce the iodoform and the wool into any existing recesses. This should be done twice daily.

When an ulcer is fungating, it should be cauterised with a solution of caustic potash in an equal quantity of water, taking care to limit its action. This, however, should not be done until after the patient's condition has been improved by treatment; otherwise, it may lead to more extensive ulceration. The applications to the ulcer until then must be those above indicated.

The solution of caustic potash will be equally useful in those case of fungous granulations, which have been described as occurring about the sole, generally at the heel; but its use must be reserved until the patient's general health has improved.

The ozæna of this period is best treated by calomel fumigation, the patient being made to inhale five grains of the drug, if an adult, and proportionately, if a child, nightly, after syringing out the nose carefully with a weak lotion of liquor potassæ in warm water. During the day an ointment consisting of thirty grains of iodoform and an equal quantity of tannic acid in an ounce of vaseline, should be applied three times a day with a feather.

Ulceration of the throat and posterior nares should be similarly treated. In these cases, the posterior nares should be carefully cleansed by means of a post-nasal syringe, and the throat thoroughly swabbed with the liquor potassæ lotion, before applying the calomel fumigation. The iodoform and tannin ointment may be used with a large camel's hair brush on a long bent handle, small quantities being carefully employed, to prevent any injurious effect which might follow the absorption of an undue quantity of iodoform by the stomach.

To the large masses of fungous granulation which may block the throat, the liquor ferri perchloridi fortior should be carefully applied, three times a day, in the case of an adult, and, in that of a child, a lotion of equal parts of the tartrate of iron and water. Other efficacious applications in these cases are tincture of iodine mixed with glycerine, and aromatic sulphuric acid with glycerine of tannic acid, in equal parts.

For otorrhœa and fungous granulations in the ear, the iodoform and tannin ointment may be used, after syringing, the granulation being carefully and gradually destroyed with a stick of sulphate of copper.

In the dermatitis of the sole and palm, and superficial serpiginous ulcers of the arms, and legs, the best application is the unguentum hydrargyri nitratis rubbed in night and morning, either alone, if the patient can bear it, or diluted with simple ointment. When there are deep-seated subcutaneous granulations in the palm or sole, which cause pain in walking (a condition known as "crab" or "tobo"), the thickened epidermis over them must either be pared off, or removed by strong potash lotions or continued warm poultices. The granulation should then be destroyed by repeated applications of a stick of sulphate of copper or potassa cum calce or chromic acid.

The contractions of the limbs which occur at this period should be treated with warm baths, local calomel fumigation, massage and a prolonged course of perchloride of mercury and iodide of potassium.

All the above conditions require not only the local applications mentioned, but also and especially the mercury and iodine courses prescribed. In the case of the dermatitis and deep-seated subcutaneous granulations in the sole and palm, if the former is superficial and neither of them is accompanied by pains about the bones and joints, or any other symptom indicating the latency of the disease in the system, the local remedies prescribed may be sufficient; but, if such symptoms be present, or, if these conditions recur after such application, the mercury and iodine courses are necessary. In the case of gummata, all the granulation tissue should be destroyed by cauterization, to prevent their recurrence at other neighbouring parts.

During the three months in which the mercury and iodine are being administered, the tartrate of iron and cod liver oil must be given after meals, and the compound decoction of sarsaparilla, as a drink, to the extent of a pint daily.

The diet must be that recommended for the latter part of the secondary period, all the restrictions and limitations there indicated being carefully observed.

#### REMARKS ON THE DIFFERENT DRUGS USED IN THE TREATMENT OF YAWS.

*Mercury.*—That there should be differences of opinion as to the use of mercury in the treatment of Yaws, is not surprising, considering that there are many who doubt its necessity in syphilis, a disease constantly under the observation of the most scientific members of the profession, who possess every means of testing the efficacy of the drug. What has been discovered with regard to the latter disease holds good in respect of the former, viz., that it has a tendency in a healthy subject, under favourable hygienic circumstances, to disappear without medicinal treatment. As this fact has led many to believe in the uselessness of mercury in syphilis, so it has led many also to declare it as being either "no longer in vogue" or "worse than useless" in Yaws. This scepticism will soon, however, be discovered to be ill-founded in the case of Yaws, as it has often been in that of syphilis, by those who attempt its cure without mercury; for, though, as has been explained, the disease may pass away entirely without medicinal treatment, there are others in which the same or severer symptoms supervene shortly or after many years, twenty or more perhaps, and others again in which the disease never even abates without the use of mercury. Both secondary and tertiary symptoms in Yaws may be arrested by iodide of potassium, but they are certain to return, however long the interval, unless the system has been previously sufficiently influenced by mercury. A shorter course of the drug is necessary in Yaws than in syphilis, as will be seen by comparing the term during which it is advised to be employed in the former disease, with the duration of a mercurial course in the latter, superficial lesions requiring a less prolonged use of it than those which are deep-seated.

*Iodide of Potassium.*—This drug is useful in Yaws after mercury. Employed alone, it can only retard the symptoms which will not fail to recur, even though it be after a long interval. It appears to be necessary to eliminate both the mercury and the virus from the system, the term during which it should be administered being in proportion to the depth of the lesions. Iodide of potassium should never be prescribed with chlorate of potash, as a poisonous iodate may thus be produced.

*Arsenic and Antimony.*—As these drugs act on the epidermis only, they can only be employed in the squamous and papular forms of the secondary eruption, the tubercles being too deep-seated to be affected by them. The use of antimony is not advisable. Arsenic is equally efficacious as regards its action on skin diseases, while diaphoresis can be produced as profusely by less dangerous remedies.

*Guaiaicum and Sarsaparilla.*—The opinion of Mr. Pearson on these medicines is as follows, with regard to their use in syphilis: After stating that he has seen no benefit from guaiaicum except as a slight sudorific inferior to antimony or volatile alkali; and that after persisting in a course of it during four or five weeks he had not gained any material advantage, he proceeds to say: "When the dolores osteocopi were not connected with some morbid alteration of the structure of a part, this medicine was of little avail. When the strength and vigour had been reduced by a successful mercurial course, with confinement to the house, and where a thickened state of the ligaments or of the periosteum remains, or where there are foul indolent ulcers, these sores will often heal, and the enlarged membranes will subside, during the administration of this decoction.

"The decoction of guaiaicum will often suspend the progress of certain secondary symptoms of lues venerea for a short time, such as ulcers of the tonsils, venereal eruptions, and even nodes; but I never saw one single instance in which the powers of this medicine eradicated the venereal virus. It has been recommended by many people to combine guaiaicum with mercury, with the intention of improving the specific powers, and of counteracting the injurious effects of that mineral;



the advantages to be derived from this compound mode of treatment are by no means well established, for guaiacum is certainly no antidote to syphilis.

And with regard to sarsaparilla he expresses himself thus: "While I reject it as a specific I would by no means disparage it as a medicine possessing no valuable qualities. In those cases, where the malignant powers of the virus have proved materially prejudicial to the health, so that the patient cannot enter upon the use of mercury with propriety, the decoction and powder of sarsaparilla will often retard the destructive agency of the venereal poison, and repair the breaches made in the constitution; it may be sometimes given with advantage during a course of mercurial frictions, when it does not occasion a determination to the bowels; and it will almost invariably remove many of the most troublesome sequelæ of a course of mercury."

Mr. Lee, in Holmes' System of Surgery, writes: "Nor are the salutary properties of the sarsaparilla root useful in those diseases only that are either immediately or remotely connected with syphilis; its beneficial effects are often demonstrated in the treatment of foul, untractable, spreading sores in more than one form of scrofula."

The above authoritative opinions will serve to guide those who may desire to use these drugs in the treatment of Yaws.

*Cinchona*.—Mr. Lee (op. cit.) writes of bark:—"In all diseases characterised by want of power, bark may be advantageously employed; and it may often be most beneficially used in cases of syphilitic eruptions, where, either from some constitutional peculiarity, or from the long continuance of the disease, or from the debilitating effects of the remedies employed, a want of power is manifested in a patient's system. It may conveniently be given during a mercurial course, or after the mercury has been discontinued. The beneficial effects of bark are, however, most manifest in cases where destructive ulceration or sloughing occurs."

Quinine is necessary in the treatment of Yaws when marked fever is one of the premonitory symptoms of the secondary period.

*Salicylate of Soda*.—The use of this drug in Yaws was suggested to me by its efficacy in rheumatism. It is very beneficial in allaying the severe pains which sometimes precede the development of the secondary eruption.

*Carbonate of Ammonia*.—This drug is useful as a diaphoretic, and on account of its alkalinity as already explained.

*Iron*.—The anæmia which always attends the disease at its inception or during its progress must be remedied by iron, the tartrate being preferable as a neutral preparation. I have seen many cases, in which the eruption persisted in spite of prolonged treatment, rapidly improved and cured when iron was added to the other drugs employed.

*Cod Liver Oil*.—In all tubercular and scrofulous patients afflicted with Yaws, cod liver oil is essential. It will be found beneficial also in every other case, especially in those in which the system has been previously weakened by any cause.

#### COURSE OF TREATMENT PRESCRIBED FOR YAWS BY A SKILFUL "YAWS DOCTOR" OF DOMINICA.

The treatment of Yaws is divided by this "doctor" into five stages, which may be named—

- |                                |                             |
|--------------------------------|-----------------------------|
| (a) The "cold tisane" stage.   | (d) The guaiacum stage.     |
| (b) The "strong tisane" stage. | (e) The special diet stage. |
| (c) The mercury stage.         |                             |

(a) *The cold tisane*.—This is prepared from the roots of the native sarsaparilla, the "Fleuri noel," the "Chaque chaque," the "Tolulu" and the "Pacques," and guaiacum chips. A certain quantity of each, three times the size of an ordinary thumb, is put in a vessel, into which a sufficient quantity of boiling water is poured to cover all the ingredients completely. These are allowed to soak in the water for an hour, when the latter is poured off into another vessel, and cold water is added to it to bring it up to the quantity required to be drunk during the day. This tisane is thus prepared and drunk to the extent of about two quarts daily, until the eruption has developed fully. When the latter has disappeared, the patient is still kept under observation, and the tisane is continued, because, according to the "Yaws doctor," the Yaws tubercles reappear generally three times after intervals of a few days. A week after the last appearance of the eruption, the patient begins the next course.

(b) *The strong tisane*.—This consists of a concentrated decoction of the roots of the native Sarsaparilla, the "Pou de Bois," the "Seguine," the "Olivier," the "Raisin bord de la mer," and the "Poirier" and guaiacum chips. A portion of each about three times the size of an ordinary thumb is boiled in a gallon of water until the latter is reduced to half a gallon. Three teacupfuls of this tisane are taken daily, one in the morning, another at midday, and another at night, until the eruption has completely disappeared. The patient is then put through the following course.

(c) *The mercury* (perchloride) is put in a quart of rum, which is allowed to stand a week in the sun. Of this rum a teaspoonful is then taken three times a day, morning, noon and night, until it is finished. This is now followed by the guaiacum course.

(d) *The guaiacum* (resin) is put in a pint of rum which is allowed to stand a week in the sun, and of this a tablespoonful is taken three times a day. When this course is completed, a special diet is begun, the details of which are as follows:—

(e) *The special diet*.—Salt fish (the salted cod imported into the West Indies from North America) soaked in water until all the salt is extracted, olive oil, the root of the Manihot utilisima, grated, washed and dried and known as "farine," the plantain (*Musa paradisiaca*), the

banana (*Musa sapientium*), and the yam (*Dioscorea sativa*), with an occasional allowance of fresh beef, constitute the diet, which must be observed for forty days after the guaiacum course. During this time, as well as throughout the different stages of the disease, the patient must abstain from wine, beer, spirits, tobacco, vinegar, capsicum, black pepper, onions, &c., in fact, from all acid and pungent things. All exciting and debilitating influences must be avoided, sexual intercourse being strictly prohibited.

While the "cold tisane" is being taken, the patient is purged every fortnight, with Epsom salts or jalap. Bathing in cold water and exercise in the open air are also allowed during that time; but hard work, excessive exercise, and prolonged exposure to damp and heat are forbidden as being injurious, during the disease and for some time after.

During the mercury and guaiacum courses, the patient remains indoors and is not allowed to bathe.

When the guaiacum course is over, sea baths are taken daily all through the forty days of special diet.

The native Sarsaparilla is a plant whose roots resemble those of the officinal Sarsaparilla. Its succulent and fibrous stem varies from two to four feet in height, according to its age, and is about four inches in diameter. From its summit its dagger-shaped leaves radiate horizontally in many layers. They measure twenty inches in length, three-fourths of an inch in width at the base, and an inch and a quarter at the middle, whence they gradually taper to a fine point. The edges are finely serrated; and the tip is armed with a strong, sharp, brown spine.

The roots of the *Agave Americana* (the dagger plant), which also resemble those of the Sarsaparilla, are likewise used in the preparation of some of the Yaws tisanes.

The plant called "Seguine," which is referred to above, is a creeper with gigantic glossy, heart-shaped leaves, which are dark green on the upper, and light green on the under surface, and which, when fully developed, measure two feet four inches in length and one foot four inches in their greatest width. It is known in Dominica as "the snuff bush" or "Seguine tabac," because its leaves are used for wrapping snuff. It is generally found climbing up trees in company with the *Monstera pertusa* and the *Philodendron lacerum*. The former is the "Mibi," which has already been referred to as one of the constituents of the Yaws tisane in use, in olden days, among the Caribs.

The following are the botanical names of some of the other ingredients of the tisane—"Olivier" (*Bucida*), "Raisin bord de la mer" (*Coccoloba Uvifera*), "Poirier" (*Bignonia Leucoxyloa*), "Chaque chaque" (*Crotalaria incana*).

## PROPHYLAXIS.

This consists in avoidance of persons affected with the disease, and of everything with which they come in contact, such as drinking or eating utensils, wearing apparel, tools, implements of husbandry, &c., and in strict personal cleanliness, whereby the formation of ulcers and other skin diseases are prevented as much as possible.

The question of prophylaxis includes that of segregation, which may be expressed as follows: Can Yaws be extirpated from any country by segregation? This, of course, can only be done if the disease is not hereditary. We may, I think, assume that it is not hereditary. In that case, the reply is, Yes: Yaws can be extirpated from a country by segregation, but by general segregation only. It is evident that the isolation of a few cases of a contagious disease, while twelve times as many or more are left at liberty, can never end in the eradication of that disease. And to be general, segregation must be compulsory. The community, therefore, which cannot afford the expense of compulsory, general segregation, is wasting money in attempting the impossible by adopting any less radical measure. But, though general segregation may, if persisted in for a considerable time, cause the disease to disappear, it by no means ensures its non-recurrence. For the disease may be disseminated again by its reappearance in those who had been segregated and who had been thought radically cured, or by importation from abroad. Something else, therefore, is wanting besides even general segregation to both eradicate and prevent the recurrence of the contagion. This something is an improvement in the sanitary surroundings of those among whom the disease originates and spreads, in the form of wholesome food and cleanliness, which can only be brought about by education and by remunerative industry. For such people education must be compulsory and free or assisted; and they must be provided with a market for the fruits of their labour. The disappearance of the disease has ever followed the improved social condition of the inhabitants of every country in which it has prevailed, even without either general or even partial segregation. That partial segregation is altogether useless, I do not mean to assert, but what appears to me plain is that it cannot possibly effect what it is intended to achieve, viz., the extirpation of the disease, and that the expense connected with it is so enormously out of proportion to any result that it may produce, that it would be wiser to devote the considerable sums of money which have been spent in some colonies in the vain attempt to eradicate it, to improving the social condition of the people. The small colonies in which it is most prevalent cannot afford to provide shelter, food and attendance for all those who are affected with Yaws during the long period required for the cure of the disease. All that can be done is to compel their attendance as out-patients on certain days at a public dispensary until they are declared cured by the Medical Officer, and to decide on a rational treatment of the affection, which should be strictly carried out. The erroneous ideas which are entertained by some as to the proper treatment of the disease have been, unfortunately, the cause of its extensive persistence in some places from which it should have been long since entirely eradicated.

## A

TABLE SHOWING PERCENTAGE OF YAWS CASES TO POPULATION IN A GROUP OF NEIGHBOURING VILLAGES.

Villages.	Population.		Number of cases of Yaws.		Percentage to population.		Total population.	Total No. of Yaws cases.	Percentage to population.
	M.	F.	M.	F.	M.	F.			
A	87	147	49	70	56.32	47.61	234	119	50.85
B	100	128	58	51	58.00	39.84	228	109	47.81
C	36	37	21	22	58.33	59.45	73	43	58.90
D	78	87	50	43	64.10	49.42	165	93	56.36
E	17	25	10	20	58.82	80.00	42	30	71.42
F	13	25	13	22	100.00	88.00	38	35	92.10
G	15	21	12	14	80.00	66.66	36	26	72.22
H	89	99	51	51	57.30	51.51	188	102	54.25
I	28	23	15	18	53.57	78.26	51	33	64.69
K	188	205	116	78	61.70	38.04	393	194	49.36
L	18	19	13	18	72.22	94.73	37	31	83.76
11	669	816	408	407	61.53	49.51	1,485	815	54.88

This table shows that 12 per cent. more males than females were attacked, that the percentage of cases in the different villages varied from 47.81 to 92.10, and that the percentage of the total number of Yaws cases to the total number of inhabitants was 54.88.

## B

TABLE SHOWING PREVALENCE OF CASES ACCORDING TO AGE.

(The cases include both those actually existing and all those which had occurred previously among the 1,004 persons.)

Ages.	Under one	1 to 5	6 to 10	11 to 15	16 to 20	21 to 25	25 to 30	31 to 35	35 to 40	41 to 45	46 to 50	Above 50	Total.	Total percentage.
Numbers according to age	18	147	171	181	107	73	52	14	48	22	81	90	1,004	
Percentage of above to total population.	1.79	14.64	17.03	18.00	10.65	6.27	5.17	1.39	4.78	2.19	8.06	8.96		
Number of Yaws cases according to age.	4	85	204	80	121	16	26	—	5	—	12	44	597	59.47
Percentage of above to total No. of cases.	0.74	15.26	36.62	14.36	21.72	2.87	4.66	—	0.89	—	2.15	0.74		

## C

TABLE SHOWING PROPORTION OF YAWS CASES AMONG CHILDREN OF WHOSE PARENTS ONLY THE MOTHER HAS HAD YAWS.

Ages.	Total number of Children and their present ages.		Total.	Number of those who have had Yaws and their ages at the time.		Total.
	M.	F.		M.	F.	
Under 1	—	—	—	—	—	—
1 to 5	3	4	7	—	—	—
6 to 10	3	4	7	5	5	10
11 to 15	6	9	15	1	1	2
16 to 20	4	5	9	—	—	—
21 to 25	1	1	2	—	—	—
26 to 30	—	2	2	—	—	—
31 to 35	—	—	—	—	—	—
36 to 40	—	—	—	—	—	—
41 to 45	—	—	—	—	—	—
46 to 50	—	—	—	—	—	—
Above 50	—	—	—	—	—	—
Total	17	25	42	6	6	12

Percentage of total number of Yaws cases to the total number of children = 28.57.  
The 42 children were divided among 11 families giving an average of 3.8.

## D

TABLE SHOWING PROPORTION OF YAWS CASES AMONG CHILDREN OF WHOSE PARENTS THE FATHER ONLY HAS HAD YAWS.

Ages.	Total number of Children and their present ages.		Total.	Number of those who have had Yaws and their ages at the time.		Total.
	M.	F.		M.	F.	
Under 1	—	1	1	—	—	—
1 to 5	9	16	25	13	2	15
6 to 10	14	16	30	23	15	38
11 to 15	12	15	27	2	3	5
16 to 20	9	6	15	3	3	6
21 to 25	4	8	12	—	—	—
26 to 30	2	2	4	—	—	—
31 to 35	—	1	1	—	—	—
36 to 40	—	—	—	—	—	—
41 to 45	—	—	—	—	—	—
46 to 50	—	—	—	—	—	—
Above 50	—	—	—	—	—	—
Total	50	65	115	41	23	64

Percentage of total number of Yaws cases to total number of children = 55.65.  
The 115 children were divided among 21 families, giving an average of 5.5 nearly.

## E

TABLE SHOWING PROPORTION OF YAWS CASES AMONG CHILDREN BOTH OF WHOSE PARENTS HAVE HAD YAWS.

Ages.	Total number of Children and their present ages.		Total.	Number of those who have had Yaws and their ages at the time.		Total.
	M.	F.		M.	F.	
Under 1	2	1	3	—	3	3
1 to 5	21	28	49	12	22	34
6 to 10	32	34	66	41	36	77
11 to 15	27	34	61	6	15	21
16 to 20	17	12	29	4	8	12
21 to 25	3	11	14	—	—	—
26 to 30	5	5	10	—	—	—
31 to 35	—	1	1	—	—	—
36 to 40	—	—	—	—	—	—
41 to 45	—	—	—	—	—	—
46 to 50	—	—	—	—	—	—
Above 50	—	—	—	—	—	—
Total	107	126	233	63	84	147

Percentage of total number of Yaws cases to total number of children = 63·09.  
The 233 children were divided among 54 families, giving an average of 4·31.

## F

TABLE SHOWING PROPORTION OF YAWS CASES AMONG CHILDREN NEITHER OF WHOSE PARENTS HAS HAD YAWS.

Ages.	Total number of Children and their present ages.		Total.	Number of those who have had Yaws and their ages at the time.		Total.
	M.	F.		M.	F.	
Under 1	—	2	2	—	—	—
1 to 5	4	5	9	7	4	11
6 to 10	10	13	23	7	13	20
11 to 15	10	10	20	6	7	13
16 to 20	5	10	15	1	1	2
21 to 25	3	3	6	1	—	1
26 to 30	3	2	5	—	—	—
31 to 35	—	1	1	—	—	—
36 to 40	—	2	2	—	—	—
41 to 45	—	—	—	—	—	—
46 to 50	—	—	—	—	—	—
Above 50	—	—	—	—	—	—
Total	35	48	83	22	25	47

Percentage of total number of Yaws cases to total number of children = 56·62.  
The 83 children were divided among 18 families, giving an average of 4·61.  
The totals of the preceding tables are 104 families, 473 children, and 270 cases of Yaws, giving an average of 4·5 children to each family and a percentage of 57·09 of Yaws cases to the number of children.

SUMMARY OF TABLES C, D, E, F.

	Had Yaws.			
	Mother only.	Father only.	Both Parents.	Neither Parent.
Number of families . . . . .	11	21	54	18
Number of children . . . . .	42	115	233	83
Average . . . . .	3.8	5.5 nearly	4.31	4.61
Number of Yaws cases . . . . .	12	64	147	47
Percentage to Number of children . . . . .	28.57	55.65	63.09	56.62
Percentage of cases under 1 year to total cases	—	—	2.00	—
Percentage of cases from 1 to 5 years to total cases	—	23.12	23.13	23.40
6 to 10 years . . . . .	83.33	59.37	52.44	42.55
11 to 15 years . . . . .	16.66	7.34	14.28	27.66
16 to 20 years . . . . .	—	9.37	8.16	4.68

Table B shows that the largest number of cases is found among those who are twenty years of age and under, and that of these the disease occurs most frequently in children of from 6 to 10 years both inclusive.

In estimating the age frequency of a disease, however, a distinction must be drawn between the absolute and the relative frequency. There is always an excess of population between birth and twenty as compared with those more advanced in years, and this would account in a measure for the larger number of cases observed within the first twenty years of life; but, if the percentages of the population, according to age, to the total population be noted for the years 6 to 10 and 11 to 15, it will be seen that though these are 17.03 and 18.00 respectively, the percentages of Yaws cases at those periods are 36.62 for the former and only 14.36 for the latter. For children whose ages are from 1 to 5 inclusive, though the percentage of the population, at that age, to the total population is 14.64, the percentage of Yaws cases for that period is only 15.26. It appears, therefore, that there is some cause apart from excess of population which determines the special frequency of Yaws at the ages of 6 to 10 inclusive and 16 to 20 inclusive, for though the population frequency of those age periods is 17.03 for the former and 10.65 for the latter, yet their disease frequency is respectively 36.62 and 21.72, being more than double relatively of that for the period 1 to 5.

With regard to infants under one year old, these statistics confirm my experience that they are very seldom indeed attacked with the disease, and refutes the surprising statement of a large number of observers that Yaws is most frequent between the ages of three to seven months.

The following figures given by Nicholls and Tulloch differ but slightly from the above as regards the frequency of the disease between the ages of 5 and 10. Nicholl's figures for that period are 30.5 and those of Tulloch 27.78.

NUMBERS OF CASES.

Ages.	Nicholls.	Tulloch.	Rat.	Total.
From birth to 10 years . . . . .	224	417	293	934
10 to 20 . . . . .	119	150	201	470
20 to 30 . . . . .	49	58	42	149
30 and above . . . . .	74	138	21	233
	466	763	557	1,786
	Percentages.			
From birth to 10 years . . . . .	48.11	54.65	52.62	52.29
10 to 20 . . . . .	25.5	19.66	36.08	26.31
20 to 30 . . . . .	10.5	7.60	7.53	8.34
30 and above . . . . .	15.9	18.08	3.78	13.04

## A YAWS DISTRICT.

The district of which the foregoing statistics have been given is part of one of the volcanic West Indian islands, and lies about latitude 15 degrees north, and longitude 61 degrees west. It consists of a narrow stretch of land by the sea, lying between the latter and a lofty chain of mountains which runs almost north and south. The numerous conical peaks which form the chain are of different altitudes, some rising to a height of over 4,000 feet. Numerous spurs project from this central ridge to the sea, and enclose short narrow valleys of varying dimensions. Though only a few miles in length, as the crow flies, it is watered by five considerable and never-failing streams, which supply an abundance of pure water.

Only a small portion of the district is under cultivation, a few acres being planted with sugar cane, cacao, lime, arrowroot and Indian corn, and a few more devoted to vegetable gardens. The rest is covered by the forest, which reaches to within a very short distance of the sea. The coast line presents an alternation of abrupt headlands beetling over the ever dashing waves of the Atlantic and tortuous ravines or narrow valleys. Here and there along the sea, a few flattened or rounded ridges may be seen, but the spurs which come down to the shore from the central chain of mountains are almost all of that pyramidal form which is characteristic of volcanic countries. Though so thickly wooded that the soil is completely concealed beneath the dark green foliage of the forest, yet the light and shade reveal the alternate ridges and furrows which landslips and precipitous torrents are ever fashioning down the mountain sides.

The land consists of pyramidal rocks, buried generally beneath yellowish red or brown loam of varying depth, but here and there projecting in bare, rugged and scorched masses. This loam, which often rests on, or alternates with, white or reddish clay, is covered with a thin layer of vegetable mould and the decomposing leaves with which the forest trees incessantly strew the ground. The soil of the lower lying valleys, especially in the neighbourhood of the rivers, is generally alluvial, the loam at such parts being mostly sandy, and only occasionally marly. The rocks consist of huge masses of conglomerate and immense slag-like boulders, hurled from a volcanic mould, and trachyte, resting on the submarine strata. Here and there marls and limestones are seen. One white cliff of tertiary calcareous marl rises about the centre of the district.

The littoral vegetation is such as is found on sandy shores in tropical countries. The *Ipomœa pes capræ*, with bilobed leaf and purple bell-shaped flower, darts along the sand. The shore grape (*coccoloba uvifera*), with its imbricated glossy sea green leaves with coral veins, cover the windbeaten cliffs as with a coat of mail. Almost to where the waves reach, the white cedar, creole "Poirier" (*Bignonia leucoxydon*), the so-called "almond tree" (*Terminalia calappa*) and the "Manchineel" (*Hippomane mancinella*) spread their branches above a thick undergrowth of shore grape and cocoplum, creole "zicaeque" (*Chrysobalanus pellocarpus*). There being no swamps by the sea, few of the plants are to be found which thrive in lagoons. The mangrove is consequently conspicuous by its absence; and it is only here and there in low-lying places that the dumb cane (*Caladium seguinum*—*Dieffenbachia*), the swamp seguine (*Montrichardia*) and the swamp fern (*Acrostichum aureum*) are met with. Along the river banks and up the sides of the ravines the balisier (*Heliconia*) spreads its broad cool leaves, and, above it, the restless "bois flot" (*Ochroma*), decked with the convolvulus flowers of the ivy-leaved *Ipomœa*, waves its silvered foliage in the breeze. Higher up on the cliffs, *Plumieria* and *Iacquinia* are seen, and the grasping, irrepressible "Scotch attorney," the tree-killing *Clusia*, with its thick, dark-green leaves and purple fruit, folds the defenceless trees in a fatal embrace. Here too the West Indian agave (dagger-plant or *languede bœuf*) sends forth its green maypole, and the defiant cactus rises among wild pines.

The "naked Indian" or Bois mulâtre (*Pentaclethra filamentosa*) stands further inland, like a tree in bronze, surrounded by various kinds of acacia and euphorbia.

In the hollows where the alluvial soil affords ampler sustenance, larger trees appear, such as the olivier (*Bucida buceras*), the galba (*Calophyllum calaba*), the angelin (*Andira inermis*); and, as one advances further towards the truly sylvan zone, the giants of the forest begin to raise their stately forms on high, such as the Moubin or hog-plum (*Spondias lutea*), the gommier (*Bursera gummifera*), the bois riviere (*Chymarris cymosa*), the figuier (*Ficus lentiginosa*), the simaruba (*Simaruba amara*), the bois canon (*Cecropia peltata*), the many-branched ceiba or silk cotton tree, or fromagier (*Eriodendron anfractuosum*), the leafy sandbox (*Hura crepitans*) and the lofty locust (*Hymenoclea courbaril*) lifting its crown of leaves high up above the neighbouring trees. A thick, tangled undergrowth surrounds their bases, and around their trunks are wound gigantic creepers that, spreading from branch to branch, bind their summits together and deck them with festoons of flowers of every shape and shade.

The people who inhabit this district are almost entirely Africans, descendants of the slaves of former days, there being few mulattoes among them. When slavery was abolished, they continued to reside for a time on the estates of their former masters, building their huts there, and paying rent for the land; but when they found that they could be easily turned off the land, they sought other places in which to establish their homes and cultivate their gardens.

They therefore settled on Crown lands in the neighbourhood of the estates, wherever their fancy led them. Thus it is that their huts are found irregularly scattered in the district, some perched high upon a peak, others deep down in some narrow gorge or on the mountain side. But, as there were feelings due to kinship or friendship which kept them together, they did not travel far from one another or from the estates to which they formerly belonged, and so the groups thus formed gradually enlarged into the present villages. They cultivate vegetable

gardens, the produce of which they partly consume themselves and occasionally sell. They also grow Indian corn and arrowroot (chiefly the latter) which they dispose of at the capital or in the neighbouring islands. Those who have inherited cacao trees from their more industrious ancestors live on the produce of these trees, without ever thinking of adding to their number, and a few plant the sugarcane and derive a very uncertain livelihood by converting it into sugar. The bulk of the people, however, exist either by cultivating the Crown land or that of neighbouring proprietors, or by working as day labourers on one of the three sugar estates in the district. Many are quite content to live on the vegetables which they grow in the gardens near to their huts, and only exert themselves occasionally to exchange their produce for the least dispensable articles of clothing. Those endowed with more vanity or a greater desire for comfort, exert themselves sufficiently to procure now and then some addition to their vegetable fare or to purchase the dress which they love to display at church or on festive occasions. But of genuine industry and economy there is hardly any. The result is that, a few excepted, they have become accustomed to their indolent habits of life, from which they have never been roused by the example of Europeans of the labouring class, and they are content to live one year after another the same life which their parents lived and which their children will live after them. Their condition, however, is not entirely due to native indolence. They live in an isolated district from which the roads to the chief town, where they might dispose of their produce, are arduous to travel and often impassable, while their surf-beaten coast makes it difficult at all times and impossible at most, to ship their fruits and vegetables. As they are not at all provident, it is only in their youth and prime that they can obtain sufficient food; but as they grow old and become unable to work those who have no children to support them lead a miserable life of semi-starvation, in dependence on the charity of neighbours who can scarcely spare anything from their own scanty stock. Infants and young children, who are as helpless as the aged, suffer equally with them. Mothers who are obliged to go to the fields to labour all day leave their infants at home to be fed on arrowroot and vegetables; and, on their return, they give them such milk as the breast will furnish after a hard day's work in the sun on insufficiently nutritious food. A sick widow or abandoned mother remains at home, to starve herself and see her children starve.

The vegetables on which the people mostly live are the plantain (*Musa paradisiaca*), the tanya (*Caladium sagittifolium*), the sweet potato (*Batatas edulis*), the yam (*Dioscorea sativa*), the bread fruit (*Artocarpus incisa*), the sweet cassava (*Manihot aipi*), the flour of the bitter cassava (*Manihot utilissima*). They occasionally indulge, as on luxuries, on the calaloo (*Busella cordifolia*), the ochro (*Hibiscus esculentus*), the pumpkin (*Cucurbita pepo*), the tomato (*Solanum Lycopersicon*), the pigeon pea (*Cajanus flavus*), the aguacate, or avigato, or avocado pear (*Persea gratissima*), the Christophine (*Sechium edule*), the Indian corn (*Zea mays*), the kooskoosh (*Colocasia esculenta*); but, unless these can be procured without much trouble, they prefer to limit themselves to the daily consumption of plain tanya, the root of which is easily dug out of the garden by the house, plain boiled, or highly seasoned with the native pepper (*capsicum*) picked off a neighbouring tree, if there be such at hand. They eat but little salt with their food; but for this deficiency they make up by an extravagant indulgence in *capsicum*. It is seldom, as I said, that the bulk of the people add anything to their vegetable fare. When they do, it is generally what is well known in the West Indies as "salt fish"—dried salted fish imported from North America. There are different kinds of this imported fish, some being large, white and thick, others, of inferior quality, small, reddish and thin. The latter are remarkable for their parchment-like dryness. Fresh fish is also eaten; but the surf prevents fishing for nearly nine months in the year. But even if it were not so, I believe there is a fatal predilection for "salt fish" among not only the lower classes, but even among those who could procure fresh fish if they desired to do so. A cow, or goat, or pig is occasionally slaughtered, or dies a less violent and sudden death, and the wealthier inhabitants regale themselves with the fresh meat or proceed to salt it for future use.

Fruit trees are not planted in the district. Here and there a mango tree is seen laden with fruit at certain seasons; and the people indulge inordinately in them for the time, lapsing into perfect indifference on the subject when the wild mango trees have ceased to bear. A sweet orange tree is a great rarity, and one hardly ever sees any of the numerous tropical fruit trees which would so readily thrive with a little attention.

Though coffee and cacao are easily grown in the country, the majority of the people do not use them, but indulge rather in a morning cup of a warm decoction of some aromatic leaf or fruit rind, such as the orange peel. Even those who own large numbers of cocoa trees never prepare chocolate for their own use, but drink instead a decoction that involves less trouble.

Drunkenness is not common amongst them. It cannot be said to be due to any abhorrence of alcohol; for when there is money to procure it, or it is given to them for nothing, they show themselves as ready to indulge in it as any other people. The alcohol they chiefly consume is new rum, made from the sugar cane, not by themselves but by the more industrious inhabitants of neighbouring islands. As, however, whatever money they have is required for food and clothing, they are compelled to be sober. But it may be said that here, as in the rest of the tropics, drunkenness is not the common vice that it is in northern countries.

The diseases from which they suffer are those which may be expected to prevail among a people who live on such a diet as has been already described. Anæmia, dyspepsia, and such affections as result from these two conditions, are the commonest ailments met with among them. They are very subject to ulcers, partly as the result of injuries to their bare feet and legs, and partly to their poverty of blood, which prevents wounds and abrasions from healing rapidly. Their skin is not uncommonly attacked by the itch acarus and the chigoe, which may produce ulcers. Chronic dermatitis is often induced about the legs by their crossing rivers after walking in the sun along the hot roads and by the irritation of the dust and prickly bushes.



Elephantiasis of the legs is not an unusual complaint amongst them. Leprosy is very rare indeed. Scrofula, in so far as it affects the glandular system, is scarcely ever seen; tuberculous ulcers of the skin are not infrequent; and as regards bone diseases, it is difficult to decide to what extent they are due to scrofula, Yaws or syphilis. In the absence of glandular disease on the one hand, and to the concomitant symptoms of syphilis on the other, the bulk of the bone affections appear to be due to Yaws. Phthisis occurs among them, but not frequently. The women suffer most commonly from amenorrhœa, dysmenorrhœa and prolapsus uteri—the latter the result of carrying heavy weights and of working too soon after confinement. Of epidemic diseases, the commonest are measles, which attacks children and adults, and is followed usually in the former by diarrhœa and dropsy, and next to measles, dysentery. Of endemic diseases, Yaws is the most prevalent; over 50 per cent. of the present population have suffered from it. The district not being swampy, malarial diseases are not very prevalent. Mild intermittents occasionally occur, but the severer forms of remittent and intermittents are contracted by those who have travelled to the swampy parts of the island.

During more than a year's residence in the district, I was only consulted once for primary syphilis; and in that time I never treated anyone for the secondary symptoms of the disease. A few cases, however, of chronic dermatitis came under my observation, which could only be explained as being tertiary symptoms of syphilis, and others of destructive ulceration of the nose and throat, which in their early stages could not be distinguished from Yaws and lupus, but subsequently revealed their true character by attacking the bone.

The mortality among children is very high. Fifty per cent. of the total deaths in ten years was among children under ten years of age. This is doubtless due to the infants and young children being left to be fed on arrowroot while their mothers are labouring in the fields, and to the improper and too exclusively vegetable diet of the older children. The great mortality among the children is not due to syphilis. From statistics which I have drawn up on the subject, I find that there are very few deaths of children at the ages when syphilis is most fatal among them. That vaccination has not had any effect in introducing Yaws into the system, and thus adding to the mortality, is shown by the fact that of one hundred and seventy-six persons who had never had Yaws and who were vaccinated more than two years previously only eight contracted Yaws after it—two three months after, another two months after, and the rest a year or more after.

The inhabitants of the district live very much in the open air during the day, but at night they sleep in overcrowded rooms. Though they have an abundance of fresh running water, pool water or rain collected in puncheons is drunk in some places to avoid a short walk to a neighbouring stream. The nature of their food has been already described. The long interval between the evening and morning meals is very conducive to dyspepsia. They eat nothing between their dinner at 6 p.m. and their mid-day meal, except a cup of tea and a small piece of vegetable. They labour all the morning in the fields; and, when they return home at midday, they consume large quantities of vegetables, the whole of which their stomachs cannot digest, and indulge freely in capsicum, which, by exciting the flow of saliva, facilitates the ingestion of their dry meal. Only a very few of them use cesspools; throughout the district generally excreta are discharged indiscriminately at unpleasantly short distances from the houses.

The district is very damp, both on account of the heavy rains and the spray which is constantly driven across the country by the Atlantic winds, which generally blow with considerable force from the east and north-east.

Subjoined is a statement of the rainfall and temperature during an average year:—

Month.	Rainfall.	Temperature.	
		Min.	Max.
January . . . . .	27·20	67	80
February . . . . .	9·98	69	79
March . . . . .	4·84	74	82
April . . . . .	12·32	72	83
May . . . . .	8·90	72	84
June . . . . .	4·38	73	83
July . . . . .	8·63	72	83
August . . . . .	9·73	72	84
September . . . . .	6·72	71	84
October . . . . .	16·02	69	83
November . . . . .	10·26	68	84
December . . . . .	8·75	68	81
Average . . . . .	10·64	70·6	82·5
	Monthly.	76·5	

The greatest rainfall in any one day during the same year was 6·5 inches, and the greatest number of days in any quarter of the year without rain was 44.





