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Publication/Creation

London : Percival, 1891.

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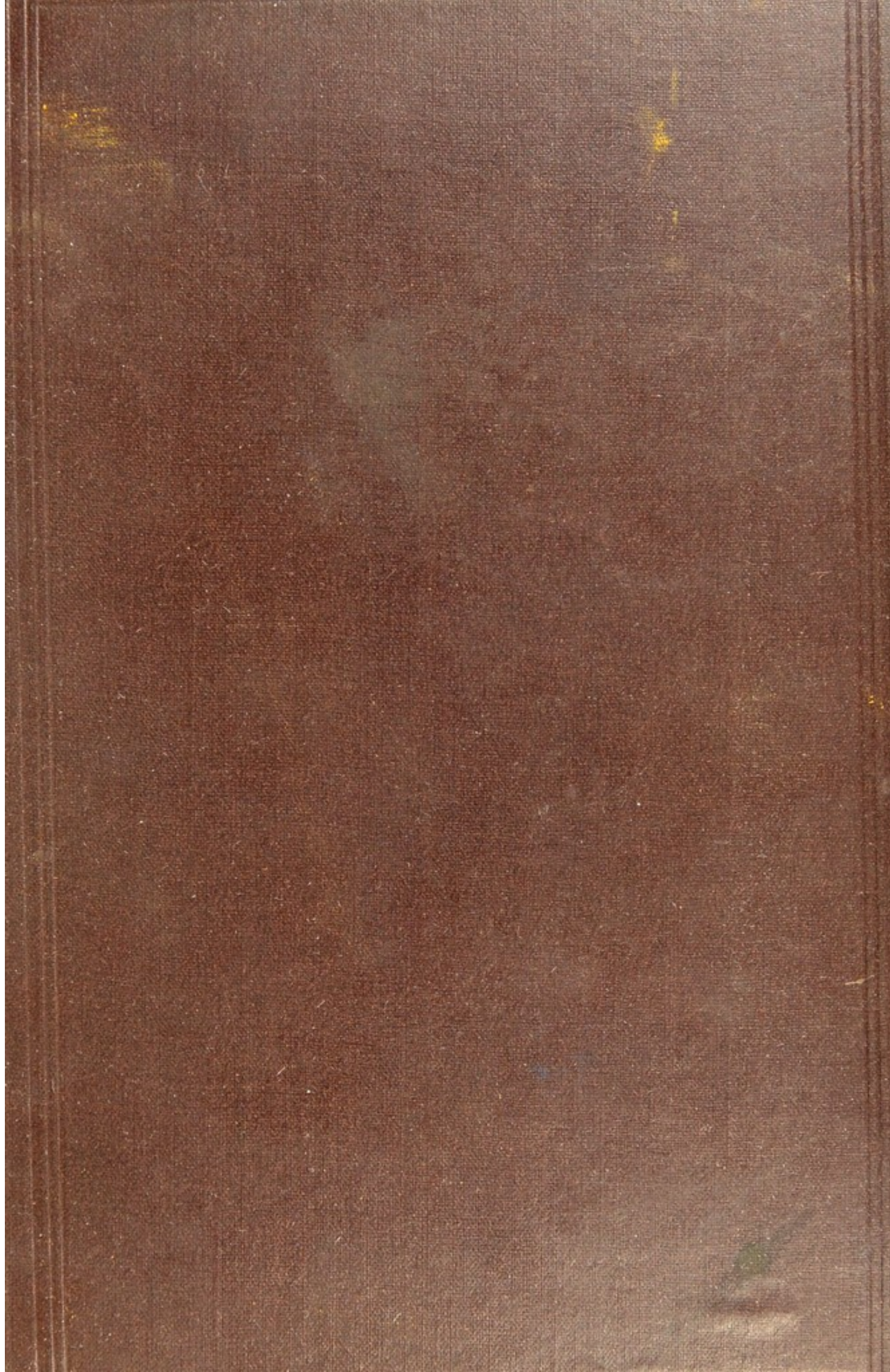
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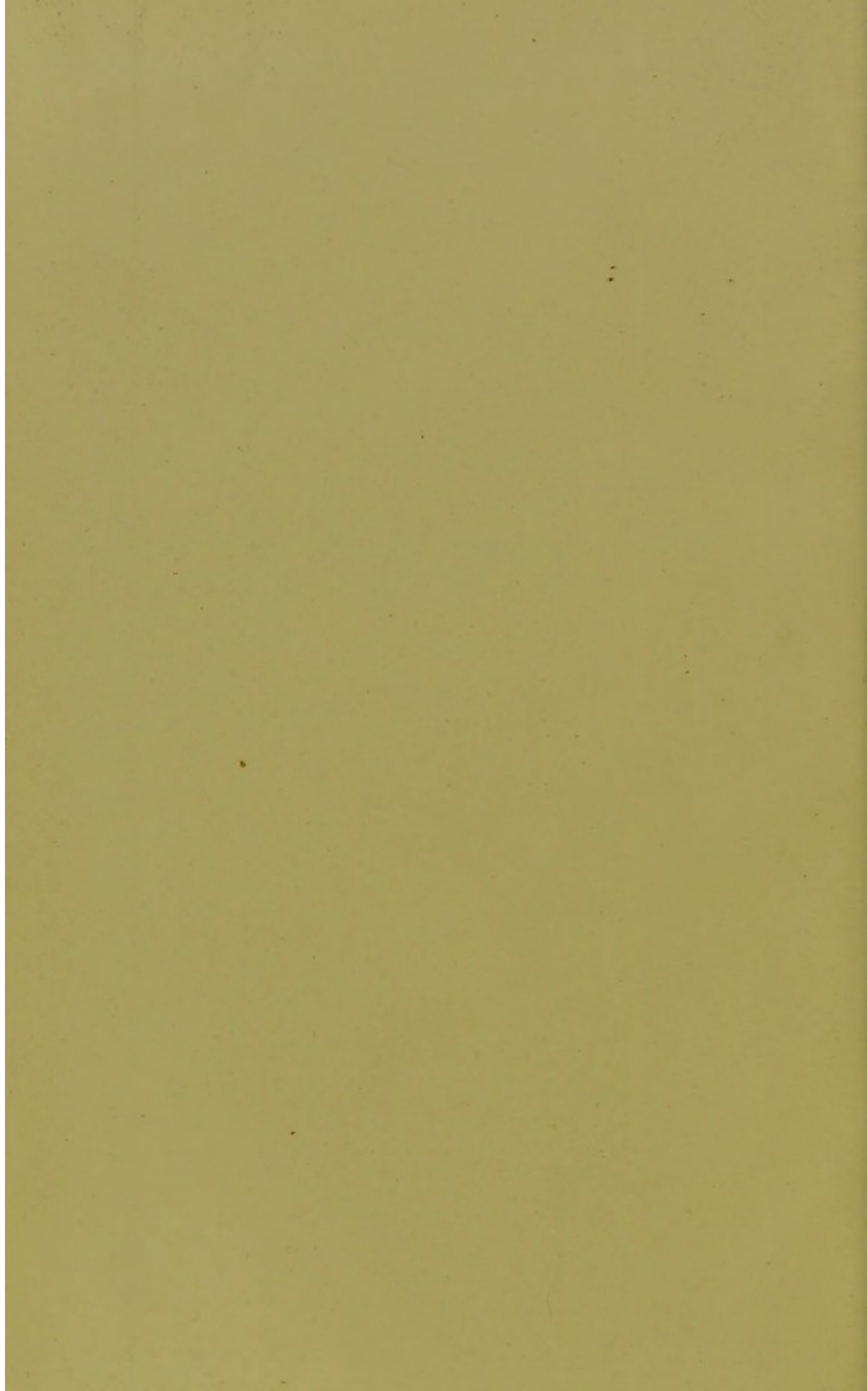




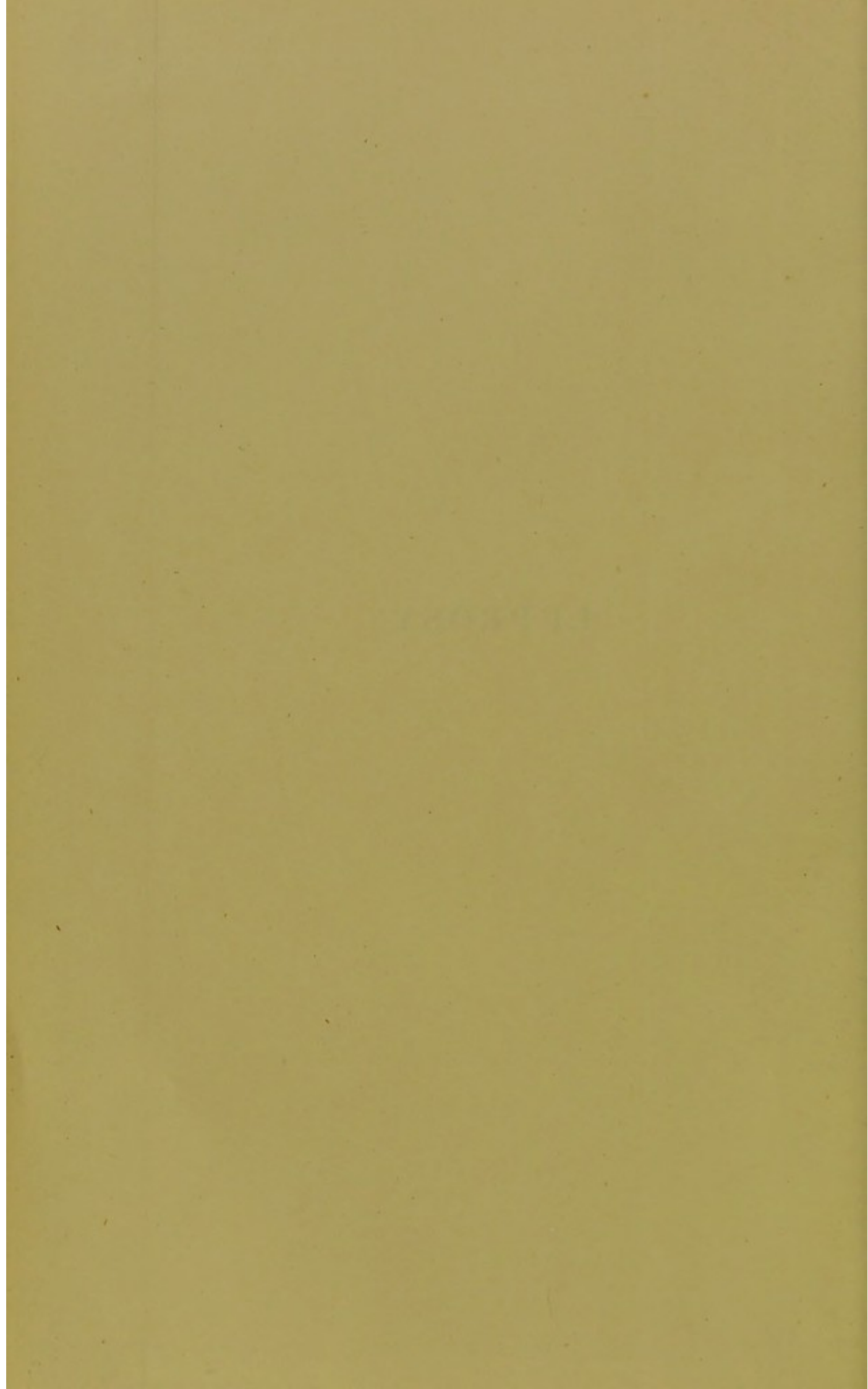


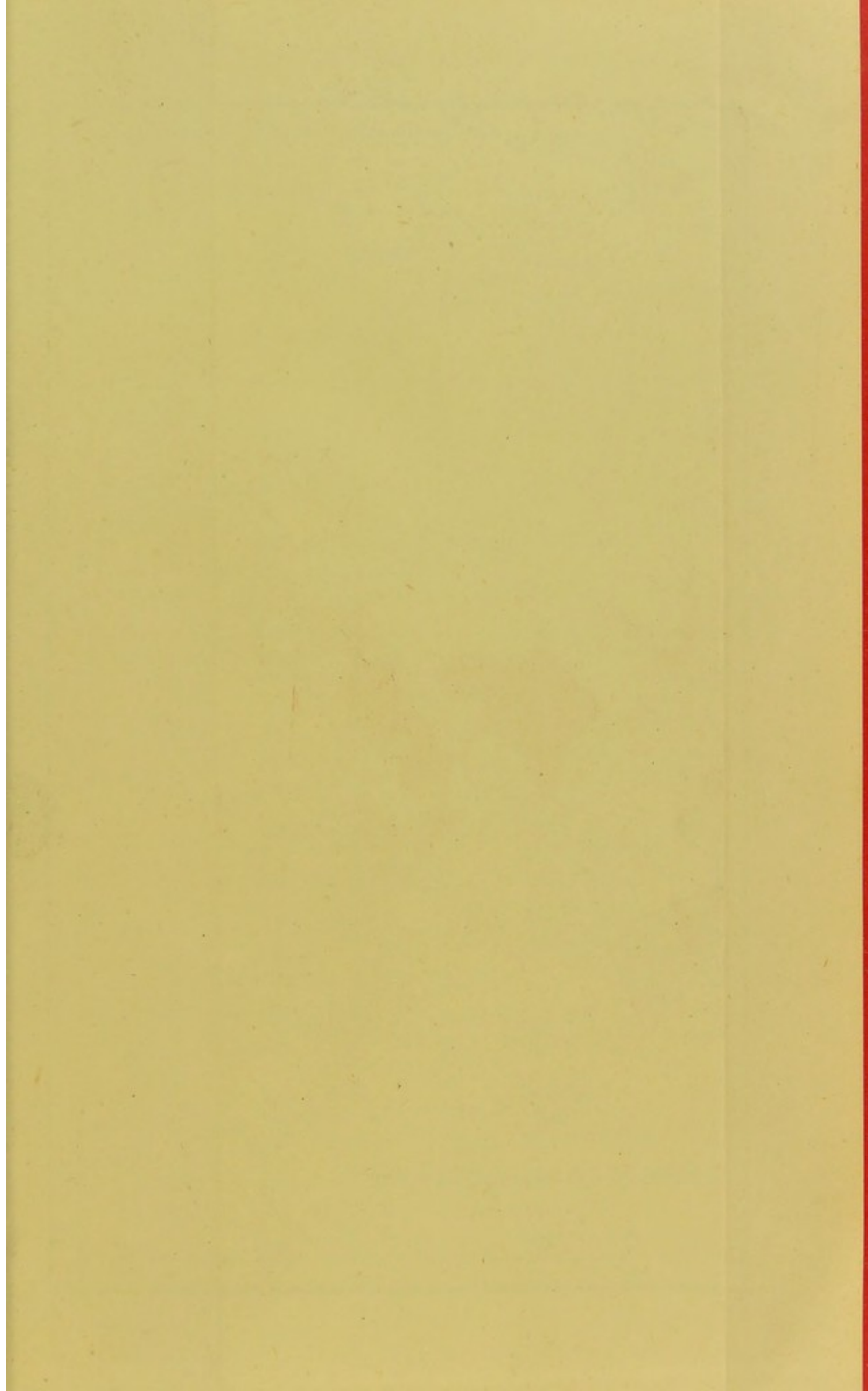
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LEPROSY



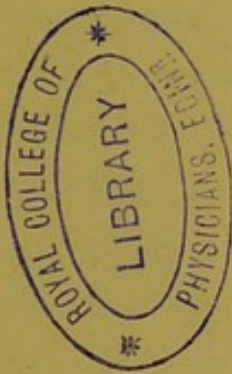




LEPROSY

BY

GEORGE THIN, M.D.



London

PERCIVAL AND CO.

1891

THE HISTORY

OF THE

REIGN OF

1714

P R E F A C E

IN 1874, Dr. Hansen reported to the Medical Society of Christiania that 'he had often, indeed generally, found when seeking for them in the leprous tubercles, small rod-shaped bodies in the cells of the swellings.' This was the first announcement of the discovery of the bacillus of leprosy, which in less than ten years from that date had been found to be invariably present in leprous tissues in all countries where the disease occurs. The discovery of a specific organism naturally raised afresh the question as to the contagiousness of the malady with which it is associated; leprosy, which had at one time been treated as a most contagious disease, having come to be considered in modern times, by many medical men, as not contagious at all. With the recognition of this special organism, the supposition that leprosy might be contagious was naturally strengthened; but although of late years the belief in its communicability has been steadily growing stronger, we are yet far from having attained unanimity on the point.

One of the chief objects of this book is to systematise, for the convenience of the medical profession, the knowledge that has been acquired up to the present time relating to the bacillus lepræ, its relations to the pathological changes peculiar to leprosy, and its important bearings on the etiology of the disease. At the same time, an attempt is made to place clearly before the reader the amount and nature of the

evidence which can be adduced to show that leprosy is contagious. In order to further render the work useful as an epitome of the most important and suggestive information which has been accumulated regarding this disease, the author has prepared a summary of its history and geographical distribution. Making no claim himself to special archæological or geographical knowledge, he has in this part, as in other parts of the book drawn freely on previously published works, and has received assistance and information from several accomplished scholars. His thanks in this connection are especially due to Professors Robertson Smith and Macalister of Cambridge, and to Dr. Koelle. He also takes this opportunity of thanking those medical men in China and other parts of the East who so very kindly placed their special knowledge at his disposal.

Such an account has been given of the symptoms, pathology, and diagnosis of leprosy, as is likely to be useful to those members of the profession who wish for fuller information than can be found in ordinary text-books of medicine, but who have not the opportunity of studying the larger special works which the author has consulted in the preparation of this part of the book. As might be expected, the best portraits of leprosy as a disease have been drawn by the physicians of leper asylums, who have had the opportunity of observing its long course over a period of years in the same patients; and the author has endeavoured to embody in his treatise, as concisely as the subject would admit, the information which is to be obtained by a reference to certain standard works by physicians of this class.

At the head of the list stands, and probably always will stand, the important classical work by Danielssen and Boeck, published in Paris in 1848. This book gives an erudite

account of the history of leprosy in ancient and modern times, and draws a graphic picture of the malady—its richness of clinical observation, wealth of detail, and objectivity, rendering the work indispensable to every one who desires to make a complete study of leprosy. It is as much a standard work now as it was when it was published forty-three years ago, notwithstanding the great progress that has been made in medicine during that time. Writers on leprosy have continued, since its publication, to use it freely; and in the preparation of this treatise we have ourselves used it unsparingly, and have transferred several of its pages to our own in the chapters which deal with the history and course of the malady.

In 1881, Dr. Hillis, now of Dublin, but at the time in Demerara, published his *Leprosy in British Guiana*—a work which contains a very complete account of the symptoms of the disease, as observed by him in British Guiana, but for the most part applicable to leprosy in any country. Dr. Hillis gives in detail reports of a number of cases which were under his care, as examples of the material which he utilised in describing the course of the malady, and the book contains a number of excellent coloured Plates. The work has the merit of being a well-arranged record of the observations of an experienced physician, thoroughly acquainted with the disease of which he treats, and alive to the bearings of his own observations on various modern theories regarding the pathology and treatment of leprosy and the management of lepers. Our pages bear testimony to the use we have made of Dr. Hillis's work. At the date of its publication, the full bearing of Hansen's discovery had hardly been apparent. The first important work that was published after the discovery of the bacillus was the large volume by M. Leloir, the distinguished

Professor of Dermatology at Lille. M. Leloir had made journeys to the Riviera and to Norway, expressly for the purpose of studying leprosy; and the pages of his book bear ample evidence of the diligence and appreciation with which he collected materials for description and analysis from many quarters. He has recorded in it a number of cases which he has personally observed, and the researches which he has made in connection with the bacillus, and the pathology of the disease; and he has also utilised to the fullest extent the works of Danielssen and Boeck, Hillis, and others of his predecessors. It is freely illustrated with woodcuts, coloured plates, and photographs, and constitutes—large and comprehensive as it is—a very complete treatise on leprosy. We have pleasure in bearing testimony to the advantages which we have derived from this work, and in recognising our indebtedness to the talented author, both in connection with his book and with private communications which we have received from him.

We have also utilised information contained in a small, but instructive book by Dr. Munro, published in 1879. This work contains an excellent account of the history of leprosy, and contributes many weighty facts which bear on its contagious nature.

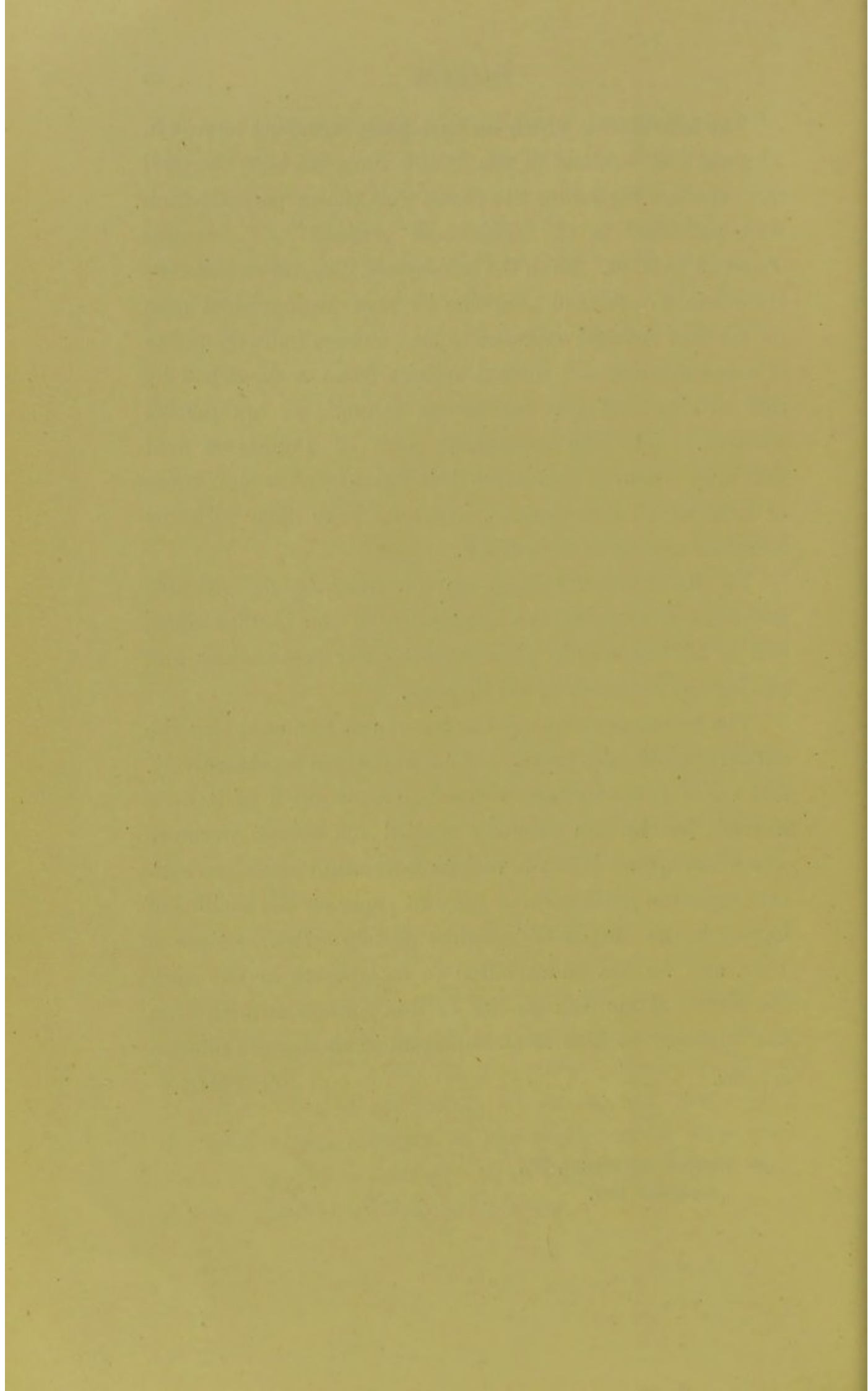
We regret that our space has not allowed us to make the use which it merits of Dr. Vandyke Carter's original and valuable work—*Leprosy and Elephantiasis*—which is almost indispensable to any one who seriously undertakes the investigation of the pathology of leprosy. There are points connected with the pathology of the disease, particularly in regard to the changes in the nerves, which have been nowhere so fully described and portrayed as in this book, and the Plates by which it is illustrated.

The information which we have given regarding leprosy in England and Scotland in the Middle Ages has been obtained from the late Sir James Simpson's well-known papers, which were published in the *Edinburgh Medical and Surgical Journal*, 1841-42. Even the subsequent discoveries and contributions to practical medicine by that distinguished man do not bear stronger evidence to his immense industry, power of concentration, and mental activity, than is furnished by this striking and very interesting example of antiquarian research. Like the subsequent work of Danielssen and Boeck, by whom it was utilised, it has proved a storehouse of facts for all subsequent writers who have dealt with the historical aspects of the subject.

To Mr. Andrew Pringle we are indebted for valuable assistance in studying the morphology of the bacillus lepræ, and for his kindness in photographing our preparations, and placing the negatives at our disposal.

The literature of leprosy has become so immense, that the author disclaims any pretence of having treated it exhaustively, and has of necessity been obliged to leave much of it even unread; but he has carefully studied the recent literature which has appeared in the various European medical periodicals, since the publication of his own paper on the bacillus of leprosy in the *Medico-Chirurgical Society's Transactions* in 1883, and he has endeavoured to incorporate in the work the results of his own studies in this connection with what has appeared to him most important in these more modern records.

G. THIN.



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PLATE I.

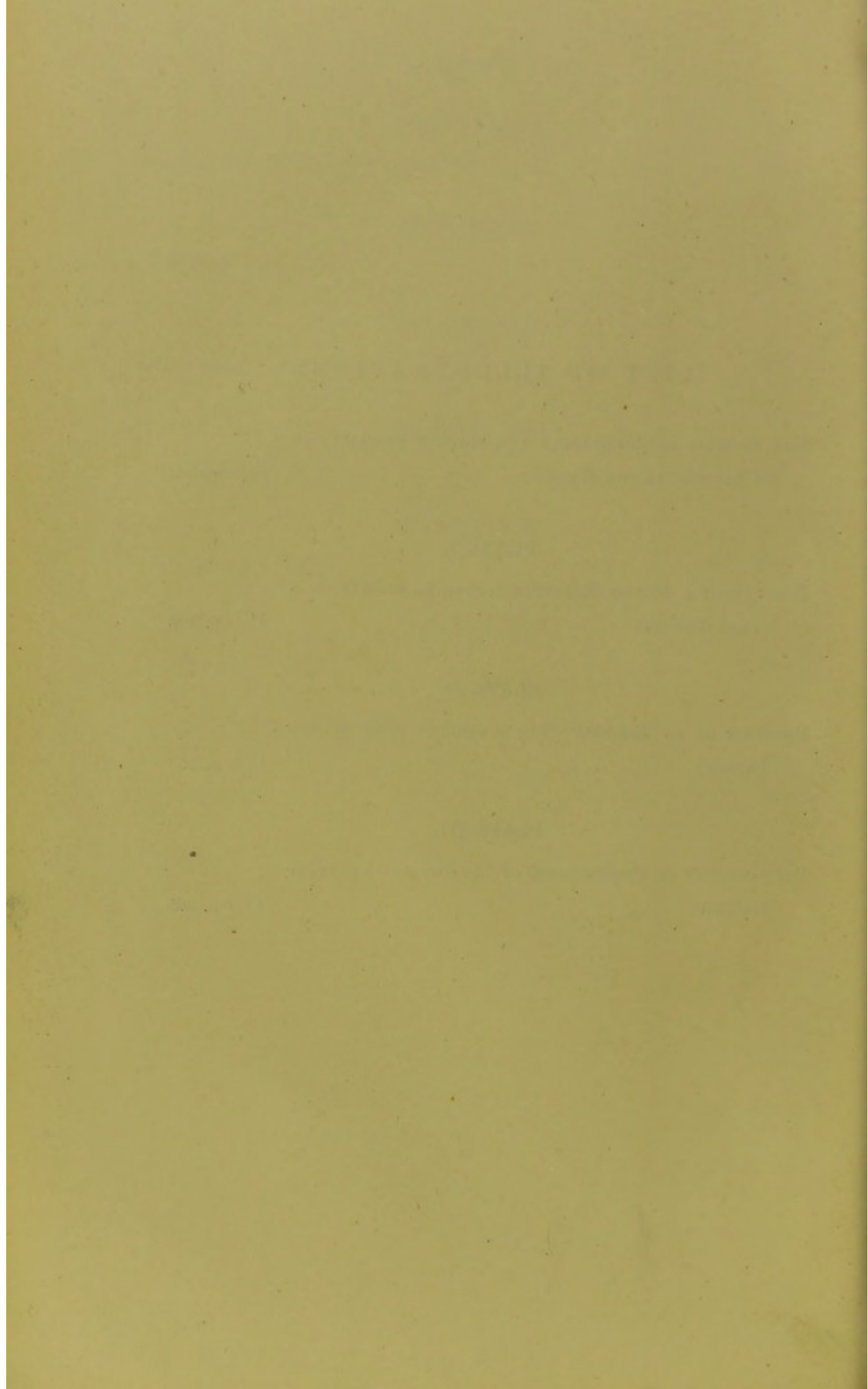
PORTRAIT OF A LAD OF NINETEEN SUFFERING FROM TUBER-
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PLATE II.

PORTRAIT OF AN ELDERLY MAN SUFFERING FROM NERVE
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PLATE III.

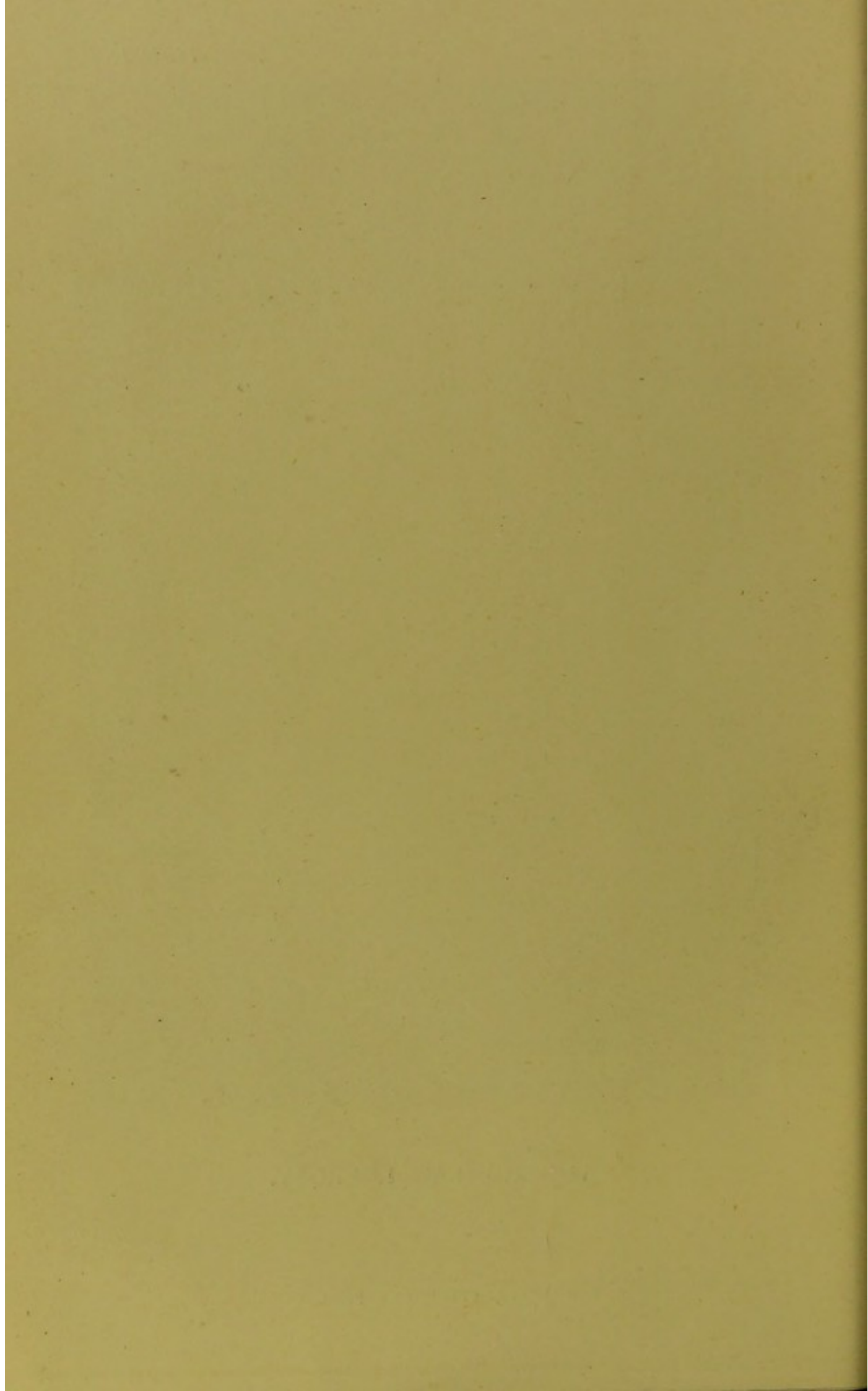
REPRODUCTION OF PHOTOGRAPHS OF LEPROSY AND TUBERCLE
BACILLI *Vide p. 265*





TUBERCULAR LEPROSY.

FOR EXPLANATION SEE PAGE 263.





NERVE LEPROSY.

FOR EXPLANATION SEE PAGE 263.

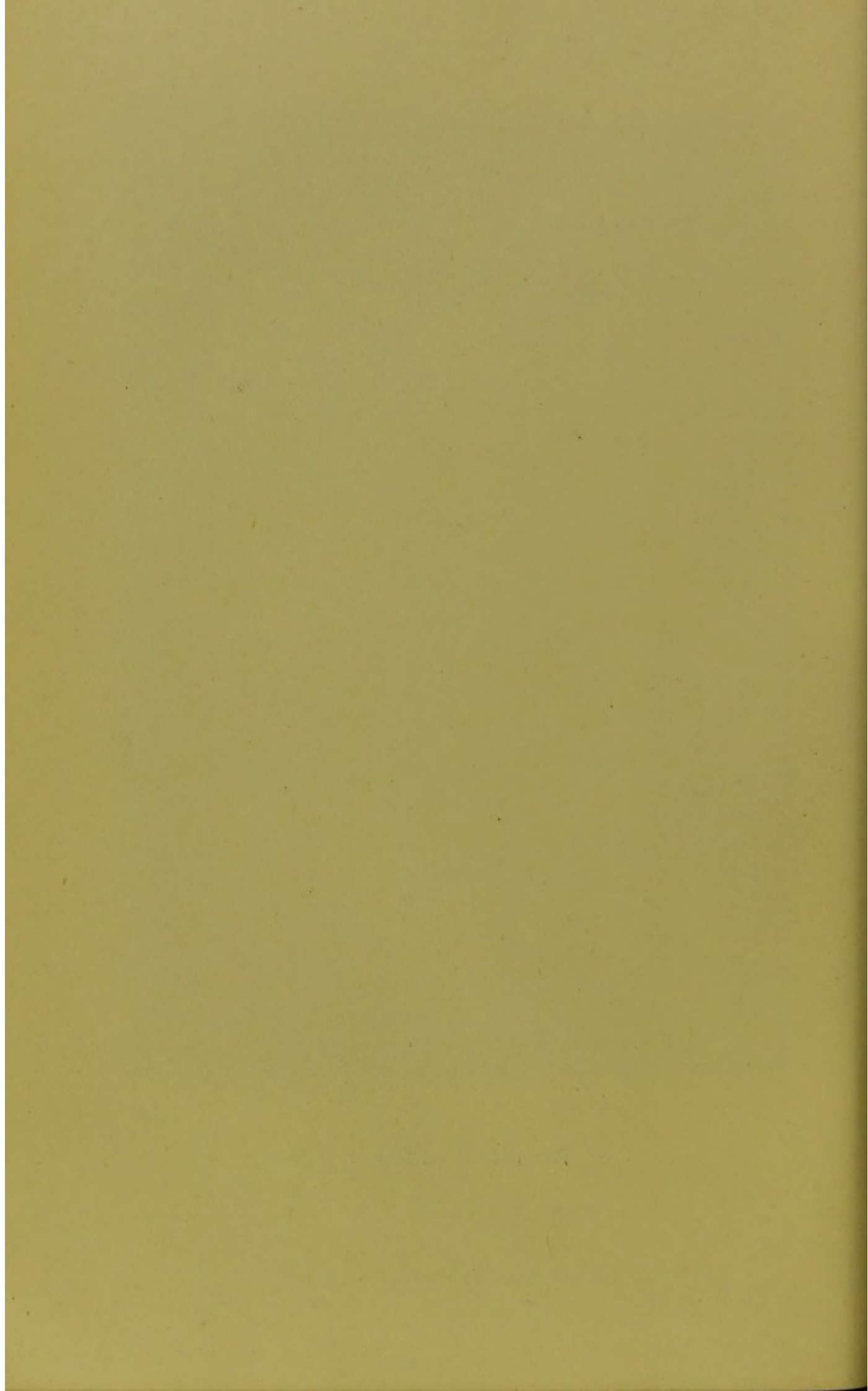


Fig. 1.



Fig. 2.

Plate III.

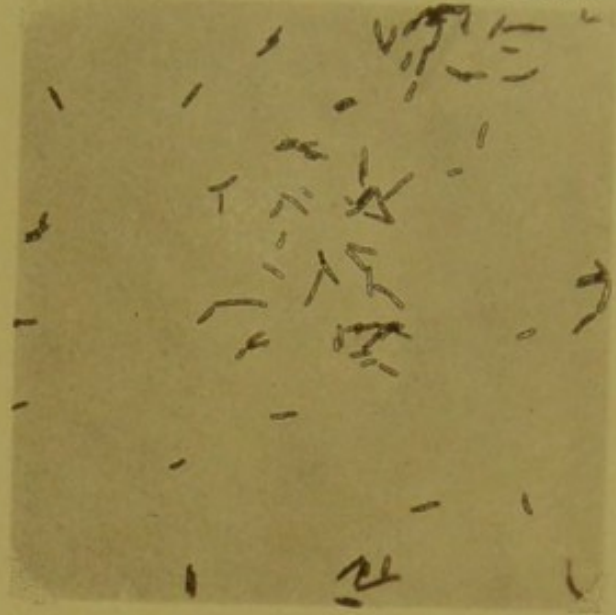


Fig. 3.

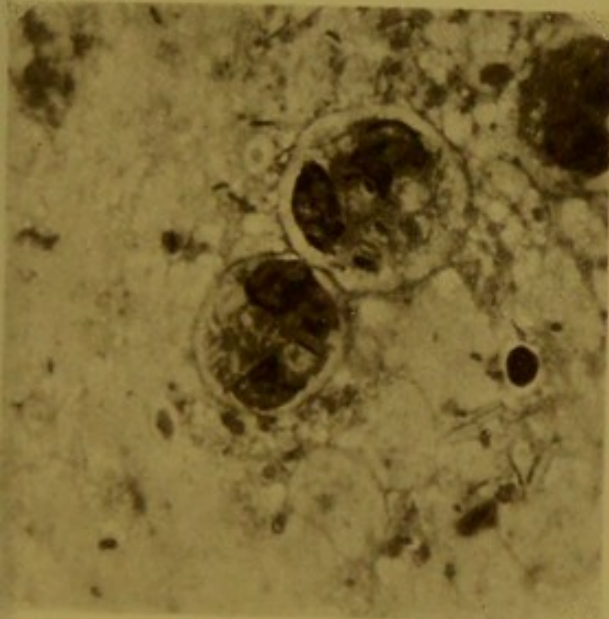
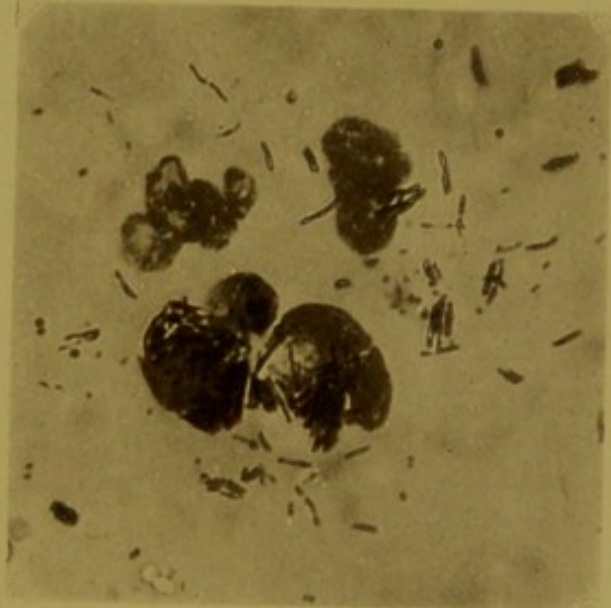


Fig. 4.



LEPROSY AND TUBERCLE

BACILLI.

X 1000 DIAMETERS.

FOR EXPLANATION SEE PAGE 265.



CHAPTER I.

HISTORY

THE difficulty in tracing any disease from the most ancient times does not cease with the beginning of authentic literature. The capacity to observe with sufficient accuracy, in order to distinguish and classify diseases, has been of slow growth, and it may be almost entirely absent in conditions of society in which a comparatively high degree of civilisation prevails. We need not, indeed, be surprised at the indefiniteness with which diseases are alluded to or described by ancient writers, when we consider that two such distinct maladies as enteric and typhus fever were not distinguished until the time of medical men now living. There can be no doubt that ague, dysentery, acute rheumatism, and probably all the exanthemata, prevailed in ancient times as much as they do now; but yet we search in vain—in the Hebrew scriptures, for example—for descriptions by which we could certainly identify any one of them. We need not wonder, therefore, that the earliest references to leprosy are vague, incomplete, and even inaccurate, but rather feel astonished that the disease should be mentioned at all. The mere fact that, in the earliest sacred writings of the world, there are allusions to a disease which had evidently, more than all others, impressed primitive peoples by its gravity and terrible nature, at once points to leprosy as the malady which was likely to stamp itself on the popular imagination. Beyond, however, the disfigurement and incurability produced by leprosy, it is not to be expected that a definite description should be found in these writings; for in the pre-scientific era (which embraces

the history of the whole world before the time of Christ, with the exception of Greece, from the time of Aristotle and Hippocrates), it is hopeless to expect accurate observation in regard to disease, any more than in other branches of natural science.

The earliest attempts at classification of disease, the recognition that the objective symptoms of pain, sleeplessness, and disfigurement were due to different morbid entities, appear to have been made by the Egyptians; but it is clear from the Hebrew scriptures, that amongst the Jews very little progress had been made in this direction. The fact that a distinct malady, known by the word which we translate 'leprosy,' is recognised at all by the Jewish writers and by the Egyptians, shows that there existed then, as now, one particular disease which stood out from all the other ailments with which they were familiar, by the severity of its symptoms, its incurability, and by its grossly disfiguring and mutilating character. It seems to have required a disorder not less characteristic and remarkable than leprosy to be recognised at all as something unique and specific; but that any early description of this disease should be defective and deficient in precision is only to be expected. Some of the symptoms would be overlooked because the observers were not trained to observe; others would not be chronicled, because they were so universally recognised as present that they were not remarkable enough to be specially described. It would not occur to a writer that it was necessary to mention them at all, any more than it would have occurred to him, in speaking of the ass, to describe the special features by which it would be scientifically distinguished from the horse, or even from the ox. The writers in the ancient records which constitute the early books of the world's history, could no more be expected to give even an approximatively accurate description of the disease, than any modern literary man is capable of describing the symptoms by which diseases like pleurisy, pneumonia, scarlet fever, and measles are distinguished from each other. Even now there are few men not specially trained who are able to distinguish the diseases which lead to the grosser disfigurements occasionally observed in the persons we meet in the streets. It would be idle, therefore, to

consider that the references to a disease like leprosy in ancient writers are valueless because they are defective and overlook what we consider special or essential symptoms.

From the most ancient literature downwards to the present time, there is an unbroken chain of references to this disfiguring and terrible scourge which finally came to be termed leprosy, from the Greek word *lepra*. The various terms previously used to designate the malady can be linked together, affording evidence of historical unity as regards the disease which, above every other, has in all ages assumed exceptional prominence by the extraordinary and long-enduring misery it inflicts on its victims.

From many points of view, the allusions to leprosy in the Biblical record possess for us, in these times, more interest than the references in any other ancient literature. They are fuller, and they are familiar to all readers in every Christian country. For these reasons, we consider it appropriate to introduce the consideration of leprosy, as regarded historically, by an examination of the leprosy of the Bible.

Leprosy has existed amongst the Jews from the earliest times of which we have any record, until the present day. It has been generally accepted that they acquired the disease during their residence in Egypt. The statement of Manetho, quoted in Josephus, bearing on this matter is, by the best modern authorities, believed to be a fable inspired by his hatred of the Jews. This Egyptian priest, who lived about 260 years B.C., was the guardian of the sacred archives of the temple of Heliopolis, and composed an universal history of Egypt, which is unfortunately lost, but of which fragments quoted by Josephus, Eusebius, Julius Africanus, and Georgius of Syncelle, remain. Manetho states that the enormous number of 90,000 Jews, affected with leprosy, were expelled from Egypt. Although this statement, so far as historical record is concerned, is false, the fact that it was made at all associates together Egypt, the Exodus, and leprosy, and is a proof that tradition pointed to the existence of leprosy amongst the Jews from the time they were in Egypt.

It is clear, however, from the almost unbroken tradition handed down through the Mosaic records, the Talmud, and the Gospels, and collaterally supported by the Septuagint

translation, that during all the periods of their history leprosy was common amongst the Israelitish race. We have already remarked that in the records of ancient literature in all countries descriptions of disease are usually so vague that it is very difficult for us, in most instances, to identify the diseases which are known and classified by ourselves; and the descriptions of disease in the Bible form no exception to this rule. The author of Leviticus (chapter xiii.) associates with the plague of leprosy 'a rising or a scab or a bright spot in the skin of his flesh,' and if the hair in the affected part becomes white, and if the affected part becomes 'deeper than the skin,' it is adjudged to be leprous. The case was doubtful if the white spot was not deeper than the skin, and had no white hairs; but if after a period of twice seven days the colour was 'dim' and the patch had not spread, it was pronounced not to be leprous. But this decision is not final, because it is expressly stated (verses 7 and 8) that the patch might still spread, in which case it was considered leprous. When, in addition to a white 'rising' in the skin with white hairs there was 'quick raw flesh' in the rising, it was at once pronounced leprous; but universal albinism, total loss of pigment all over the body (verses 12, 13), was not leprous unless it was associated with 'raw flesh'; but if the raw flesh healed, leaving absence of pigment, it was pronounced not to be leprosy.

Verses 18 to 20 contain a very important statement. When a 'boil' healed and left a white rising or bright spot—reddish white—the appearance of which was 'lower than the skin,' and the hair of which was white, it was pronounced to be leprosy. This description, we believe, applies without doubt to the bulla or blister that forms in Nerve Leprosy, which, when it heals, leaves an unpigmented, slightly depressed cicatrix. In the case of a suspected scar, if there are no white hairs and the patch does not spread, leprosy is excluded.

A depressed patch with 'scall,' or 'scab,' and yellow thin hair on the head or beard, was considered leprous. There is here an evident mixture of accurate and inaccurate observation. Leprosy in any form does not occur at all, or at least in very rare instances, in the head. The yellow, thin hair in

the beard, with an abnormal condition of the skin, a 'scall,' is in accordance with leprosy.

The chief points in the Mosaic diagnosis of a 'scall' as leprous are that there should be thin yellow hair, that the scall should be 'deeper than the skin,' and that it should spread; the essential one being that the patch should become larger; the scall in which black hair again grows, and which does not spread, is not leprous. The priest who for so many years had to judge by this description of the scall must necessarily have made numberless errors, the allusions to the scall in the head and beard being the weakest and most confused part in the Mosaic account of leprosy.

A 'reddish white plague' on the bald head or on the forehead was regarded as leprous, a description which it is almost needless to say is applicable to many different conditions which have nothing to do with leprosy. The Mosaic verdict regarding leprosy, forming a precedent which has been more or less followed in all time, was that the leper should have his clothes rent, his hair loose; he should cover his upper lip and cry 'unclean,' and 'should dwell alone without the camp.'

It is needless to remark on the vagueness that applies to some of the terms used in the chapter of Leviticus to which we have referred—a vagueness which is more probably due to the want of clear observation on the part of the ancient Jewish writer, than to the difficulty of translation.

Professor Robertson Smith informs us that the interpretation of the word translated 'rising,' as a swelling or protuberance from the skin, does not seem to suit the context. He suspects that the word is really the same as the Arabic *shiatun*—'a patch on the skin of a different colour, a discoloration.'

In verse 3 it is stated that the appearance of the plague is 'deeper than the skin of the flesh.' Professor Robertson Smith considers that here the natural sense of the Hebrew idiom is, that to the eye the affected spot seems to be deeper—that is, depressed—or possibly, as in the Mishnic Hebrew, deeper in colour, though the oldest exegetical (the Septuagint) description is against the latter view.

The word 'dim' in verse 6—'if the plague be dim, and

not spread'—he considers to mean 'less different from the surrounding skin'; as a matter of fact, the spot that soon regained its natural colour would not be leprous.

It seems impossible to define the word 'scall' in a precise sense from its derivation (it is connected with a word meaning 'to tear away'). It has been supposed that an itching scab is meant. In any case, it may be taken as certain that it refers to something more than a mere change of colour—some pathological change in the skin itself.

Comparing the text of Leviticus which we have thus summarised, with the more obvious naked eye appearances of leprosy, there are certain important inferences which seem to rest on a sufficiently secure basis to justify us in submitting them to pathologists who wish to study the question from its historical side. The want of precision in the references to leprosy in the Bible might certainly render it open to doubt whether the word translated 'leprosy' refers to the malady known to us by that term. Kaposi, whose opinion on such a point is entitled to full consideration, states that the leprosy of the Old Testament is not leprosy at all, but vitiligo—a mere pigment defect—cases of which undoubtedly must have been considered by the ancient Jews as leprous. An examination of the description given in Leviticus seems to us, however, to show that all the cases described as leprous could not have been simple cases of vitiligo. The essential features referred to in chapter xiii.—namely, a slightly depressed discoloration of the skin in which the hair grows white, the skin being also white—apply to vitiligo quite as much as to leprosy; but there are other symptoms mentioned as occasionally accompanying this 'rising'—that is, change of colour—which are not applicable to vitiligo or absence of colour, but which are applicable to nerve leprosy. With the white hair and white skin there is sometimes associated 'raw flesh,' that is, ulceration—a complication which is not known in vitiligo, and is characteristic of advanced stages of nerve leprosy. It is distinctly stated that 'raw flesh' is an element which goes to decide that a suspected person was unclean, or a leper. A 'scall' on the head or beard, in which the hair grows yellow and thin, is stated to be diagnostic of leprosy. The word *scall*, from its derivation—connected, as already

remarked, with a word meaning 'to tear away'—is supposed to refer to an itching scab, and anything in the nature of a scab is again distinctive of leprosy, but not of vitiligo.

It is not justifiable to attach too much importance to verse 24 of this chapter—'When the flesh hath in the skin thereof a burning by fire, and the quick flesh of the burning become a white spot, reddish white or white'; but it is worth bearing in mind that in nerve leprosy burns are not uncommon, on account of the loss of sensation preventing the attention of the leper being directed to the fact that his skin is being burned. More importance may be attached to the story of Miriam. In Numbers xii. it is stated that when Miriam became a leper 'white as snow,' Aaron said to Moses: 'Let her not be as one dead of whom the flesh is half consumed when he cometh out of his mother's womb,' showing that in the mind of the author of Numbers there was associated with 'leprosy,' or white patches on the skin, a changed condition of the nutrition of the flesh. To an uninstructed person, it is easily understood how the condition present in nerve leprosy would suggest the withered condition of the skin in a still-born child—a comparison which would not occur to any one in connection with vitiligo.

Notwithstanding these diagnostic points, which in our opinion sufficiently establish the fact that the leprosy of the Old Testament was the nerve leprosy of our own days, it is almost certain that from the unusual stress laid on the most prominent symptom by the Jews—absence of colour—instances of the harmless affection vitiligo must have been subjected frequently to the terrible pains and penalties of the true leper, although it may be taken as almost equally certain that the persistence of health and strength in such suspected persons must, in the long-run, have led to their social exclusion being reduced to a minimum. It is difficult to believe that any man or woman would be permanently driven out by their relations, simply because a part of the skin became white, when no mutilation or other infirmity followed.

The Hebrew name for leprosy, as described in Leviticus, *sara'ath*—literally a stroke or a blow—indicates the fell character of the disease; and it is not likely that such a term would have been applied to simple localised changes of colour

in the skin, had these changes never been associated with severe symptoms. There can be little doubt that the word *sara'ath*, continued during the course of Jewish history to be used in the same sense; and we find in the Septuagint, nearly 300 years before Christ, *sara'ath* rendered by the Greek word *lepra*, indicating a scaly or scabby appearance in the patch. Going down towards the time of the Gospels, we find the same disease referred to in the same light of a grievous affliction; and there can be little doubt of the continuity, both of the expression used and of the disease referred to as leprosy, during the whole period of Jewish history. That the Mosaic leprosy included with the harmless vitiligo cases of true nerve leprosy, is further shown by the disease being recognised as hereditary. We know that in cases of true leprosy the disease is apt to appear in several generations, the common people everywhere, and indeed many physicians at all times, and even now, inferring from that fact that leprosy is an hereditary disease. This conception was clearly present to the mind of the author of 2 Kings, when he stated that Naaman's leprosy was to cleave unto Gehazi *and his seed for ever*. The idea of heredity would not have been associated with the term used, if all the cases had been simple instances of vitiligo. Had changes of colour in the skin been associated in the minds of the ancient Jews with examples of vitiligo only, they would never have been so impressed with its gravity. As the Jews fully recognised the incurable nature of the disease (Luke iv. 27, there were many lepers in the time of Eliseus the prophet, *none of whom were cured, saving Naaman*), and were apparently possessed with a strong fear of contagion, the unfortunate man who either was a true leper, or who, on account of some harmless pigmentary change in the skin, was supposed to be a leper, was not only driven from society ('Azariah was a leper till the day of his death, and dwelt in a separate house'), but they even buried the lepers in a separate burial-ground ('They buried King Uzziah in the field of the burial of the kings, for they said, He is a leper').

It required no training on the part of the untutored Israelite to associate, in certain cases, pigmentary changes in the skin with graver symptoms, giving the condition a name

expressive of his idea that the disease was an act of retribution by the Deity for some crime committed; and if we fail to find in the Mosaic record other symptoms which to us seem to be no less striking and palpable, we must consider the primitive methods employed by these people in making what we call a differential diagnosis. The arbitrary periods of isolation for seven and fourteen days correspond to nothing that actually occurs in connection either with leprosy or any other disease of the skin, and the importance attached to the simple spreading of the skin eruption shows with what an unobservant eye the Levite looked upon all skin affections. The harmlessness of albinism seems, however, to have been appreciated, for, (verse 13) 'if the priest find that *all the skin* is turned white, he is clean.' The one most easily observed symptom—absence of pigment—seems to have so satisfied them that their investigations were not pushed much further. It is only in this way that can be explained the absence of reference to two prominent features in nerve leprosy, namely, anæsthesia and mutilation, although it is probably to the latter symptom that allusion is made in Aaron's prayer to Moses regarding Miriam: 'Let her not be as one dead, of whom the flesh is half consumed when he cometh out of his mother's womb.'

The simplicity of a primitive people, when brought face to face with the problems of a dire disease, is well shown, in the remarks regarding leprosy in clothes. The greenish or reddish plague of leprosy referred to in Leviticus xiii. 47, 58, is nothing more than the growths of fungi on a damp organic substance,—probably *penicillium glaucum* ('greenish'), and a red micrococcus.¹

Whilst it is not possible to detect in the Mosaic record any description applicable to tubercular leprosy, there seems fair reason to believe that that is the disease referred to in the Book of Job. The passages from which it is possible to infer something of the nature of the malady are the following:—

Chap. ii., verses 7 and 8. 'So went Satan forth from the presence of the Lord, and smote Job with sore boils from the sole of his foot unto his crown.

¹ The thrift of a people who could not bring themselves to destroy even an old garment unless it were officially condemned by the priest!

‘And he took him a potsherd to scrape himself withal; and he sat down amongst the ashes.’

Chap. vii., verses 4 and 5. ‘When I lie down, I say, When shall I arise, and the night be gone? and I am full of tossings to and fro unto the dawning of the day.

‘My flesh is clothed with worms and clods of dust; my skin is broken, and become loathsome.’

Chap. ix., verse 17. ‘For he breaketh me with a tempest, and multiplieth my wounds without cause.’

Chap. xix., verses 13 to 20. ‘He hath put my brethren far from me, and mine acquaintance are verily estranged from me.

‘My kinsfolk have failed, and my familiar friends have forgotten me.

‘They that dwell in mine house, and my maids, count me for a stranger: I am an alien in their sight.

‘I called my servant, and he gave me no answer; I entreated him with my mouth.

‘My breath is strange to my wife, though I entreated for the children’s sake of mine own body.

‘Yea, young children despised me; I arose, and they spake against me.

‘All my inward friends abhorred me: and they whom I loved are turned against me.

‘My bone cleaveth to my skin and to my flesh, and I am escaped with the skin of my teeth.’

Chap. xxx., verse 10. ‘They abhor me, they flee far from me, and spare not to spit in my face.’

Verse 17. ‘My bones are pierced in me in the night season; and my sinews take no rest.’

Verse 18. ‘By the great force of my disease is my garment changed: it bindeth me about as the collar of my coat.’

Verse 23. ‘For I know that thou wilt bring me to death, and to the house appointed for all living.’

Verse 30. ‘My skin is black upon me, and my bones are burned with heat.’

Verse 31. ‘My harp also is turned to mourning, and my organ into the voice of them that weep.’

It has been supposed by some commentators that Job’s disease was elephantiasis Arabum, but the symptoms referred to in the Book of Job are not only different, but are of much

too severe a nature to apply to that affection. Whilst elephantiasis Arabum is a condition of extreme thickening and œdema in the legs or scrotum, the symptoms from which the patient suffers are more those caused by the weight of the tumour than by any special constitutional disturbance which it provokes. The symptoms described in the various chapters in which the story of Job's physical sufferings is related show that the affection was one in which there were breaches of surface (sore boils) over every part of the body, that the skin was ulcerated and loathsome, that there was pain in the limbs and internal pains in the bones, that the skin became darker in colour and wrinkled, that there were deep-seated pains, and that the voice was altered. The phrase, 'My face is foul with weeping, and on my eyelids is the shadow of death,' may possibly refer to the peculiar changes in tubercular leprosy. That the disease referred to was a chronic one, is evident from the fact of its being associated with isolation: even his brethren, acquaintance, kinsfolk, friends, and servants treated him as a stranger. The disgusting appearance produced by the disease is indicated by the fact that young children despised him, his friends abhorred him, and those whom he loved turned against him. This is inconsistent with an acute or passing disease, but is quite consistent with what experience tells us is the effect produced by the ravages of tubercular leprosy. Ulceration, distortion, discoloration of the skin, pains in the limbs, hoarseness or loss of voice, chronicity of the disease, and the social exclusion which follows, are all reconcilable with what we know of severe types of leprosy, and do not correspond to any other chronic disease of which we know.

The fact that Job is described as having eventually recovered his health, position, and wealth by the direct intervention of the Deity, in no way militates against this view. The disease is described as having been miraculously brought on the sufferer, and in the mind of the author it would not appear strange that God should by a miracle cure a disease generally recognised as incurable. The important point is to observe that the writer of the Book of Job was familiar with a disease that had all the most striking objective characters of tubercular leprosy.

We understand that the general opinion amongst scholars now, is that the Book of Job was written in the time of Solomon, by an anonymous author, concerning a wealthy flock-master who lived between Egypt and Arabia. This would fix the date about 800 B.C., and therefore, if modern criticism is correct, it is earlier than the references in Leviticus; the weight of opinion being now, we understand, to the effect that the priestly code and ordinances as to the ceremonial law were devised by Ezra and Nehemiah about 440 B.C. It is probable, however, that all references to diseases in the Old Testament are founded upon the knowledge which existed during the Captivity and the following century. It is interesting to note that about the same time that the Jews were occupied with framing regulations for the isolation of lepers, laws existed amongst the Persians for their expulsion. Dr. Munro suggests that this coincidence may have some connection with the captivity of Israel and Judah when they were carried into Assyria and Babylon, neighbouring nations to Persia.

It is probable that the tubercular form of leprosy is alluded to in Deut. xxviii. 27: 'The Lord will smite thee with the botch of Egypt, and with the emerods, and with the scab, and with the itch, whereof thou canst not be healed.' It is evident that the writer here refers to an incurable disease which was common in Egypt, in which the skin was greatly disfigured. As in the description there is no reference to the whiteness of leprosy, the writer probably had in his mind a different form of disease from the nerve leprosy referred to in Leviticus xiii.

In reference to the word 'botch' we have been favoured by the following information from Dr. Koelle:—

'The Hebrew word used is *Shekhín*, literally 'inflammation, burning.' It is rendered in dictionaries by—ulcer, plague-boil, eruption, leprosy. It is derived from the verb *Shakhán*, to glow, burn, be hot. The verb occurs also in Arabic, as *Sákhuna*, to be or become hot, heated; used especially of the inflamed red eye, consequent on weeping and grief.

'The Hebrew word is employed in Leviticus xiii. 18, 19, 20; Deut. xxviii. 27, 35; Job ii. 7; 2 Kings xx. 7. In all

these places it is rendered in the Septuagint by *élkos*, in the Vulgate by *ulcus*, in the Authorised and Revised English Versions by 'boil,' with the only exception of Deut. xxviii. 35, where the Authorised (*not* the Revised) translation renders it inconsistently by 'botch.' Luther gives it in all the passages by *Drüse*.

'In Job ii. 7, and Deut. xxviii. 35, the noun is qualified by the adjective "ra," bad, evil, malignant.

'Considering all the passages, there seems to me no doubt that the word refers to a malignant swelling or boil of a definite and well-known character. This is especially apparent in Deut. xxviii. 27, by the expression "Shekhín (boil) of Egypt," as intimating that the complaint was endemic in Egypt. In this latter passage commentators explain it by "elephantiasis, lepra nodosa, or tuberculosa."'

It is interesting to observe how the regulations of Moses, which were evidently based on a comprehensive and far-seeing conception of the elements of sanitation, became in the course of time a mere ceremonial associated with ideas of religious fitness. It is clear from the Talmud, that eventually the primary object of the isolation enjoined in the Levitical law—namely, the preservation of the healthy—was entirely lost sight of.

In the Talmud, which contains a great number of minute regulations connected with inspecting supposed lepers, there is nothing to indicate that any progress had been made in understanding the disease from the time of the Mosaic writings.

In the third chapter of the *Negaim* (Rabe's German translation of the Talmud, 1762), we read that any one—that is, any Jew—can be made unclean by leprosy, *except a heathen, or the stranger who lives within the house*; that is to say, a heathen or stranger leper may live in the house of a Jewish family, without being expelled or considered unclean; and even a Jew, if he is a bridegroom, if he is suspected of leprosy, is not examined by the priest until after the expiry of the seven days of honeymoon (*Mahls Zeit*), after which time both the husband, his house, and his clothes are to be examined. If it is the time of a feast, the feast-days are added to the seven days. This seems to prove conclusively

that the Jews of the Talmud had no idea that a leper could contaminate a healthy person, or the new-married bride would never have been condemned to seven days' cohabitation before the husband was inspected.

This view is confirmed by a letter, for which we have to thank the Chief Rabbi, the Rev. Dr. Adler:—

'In reply to your letter,' this gentleman remarks, 'I have to state that you are right in your surmise that the uncleanness of the leper seems, according to the Talmud, to have been an ordinance for the purpose of securing Levitical purity, and not with the view of preventing contagion. For this reason, the heathen or stranger, when a leper, was not considered unclean. This is the view of the subject taken by Rabbiner Hirsch, in his *Commentary on Leviticus*, pp. 312-322. The author quotes the Report of Leprosy issued by the Royal College of Physicians, as proving that leprosy is not contagious.'

Amongst the many uses to which this often quoted Report has been put, probably even its authors would be surprised to know that in the hands of the Rabbi Hirsch it has been found serviceable in the elucidation of Leviticus!

That the leprosy now prevailing in India is the lineal descendant of the same disease which has been transmitted without a break through generations, over a period of more than three thousand years, seems to be fairly made out on philological grounds. The vernacular forms for leprosy are *kushtha*, *kúth*, *kút* or *kúd*, a word that can be traced back into ancient Sanscrit in the form of *kustha*. Babu Rajendralala Mitra, LL.D., states that Susruta, writing about 400 B.C., in his chapter on Leprosy, quotes Charaka, who probably lived 200 years before him. Charaka again quotes Atreya. The name of Atreya is quoted in the Panini, whose date is nine centuries before Christ, and is also met with in the Rig-Veda Sanhita, which dates from the fourteenth century B.C. Manu also mentions leprosy in the sixth century B.C. Similarly to what is found in other ancient literature, in Susruta's work the word *kushtha* includes, with leprosy, other cutaneous diseases which are not leprosy; but from the descriptions by Atreya, quoted by Charaka, it would appear that the word primarily meant leprosy. Atreya quotes as

premonitory symptoms of leprosy absence or excess of perspiration, roughness, discoloration, itching and insensibility of the skin, pain, horripilation, eruptions, and excessive pains on the parts that are about to fall off. Some kushtha eruptions are red, rough, spreading, and small. In addition to horripilation, slight itching and pain, discharge of matter and sanies, are mentioned as symptoms. Therefore, on philological as well as other grounds, it may be assumed as certain that leprosy is referred to in Sanscrit works dated so far back as the fourteenth century B.C.

Reversing the chronological order, we may now refer to the evidence as to the existence of leprosy in ancient Egypt, where the earliest attempts to classify diseases appear to have been made, and where it seems highly probable the Israelites acquired the disorder which they have never since lost.

Professor Macalister of Cambridge, who has been so good as to interest himself in our inquiry, writes as follows: 'In the medical Papyrus of Berlin there are frequent references to a dangerous and severe disease, *uchetu*, which I believe there is sufficient evidence to identify as leprosy. If so, it seems to have been very common, for both in this work and in the Papyrus Ebers there are many prescriptions for it. It sometimes attacked the head, sometimes the feet, sometimes the body. It caused the person suffering from it much pain, deformity, and often death; and, if one may judge from the number of prescriptions for it—both of external applications and internal remedies—it was an intractable disease; indeed this is expressed in the Papyrus Ebers. The Papyrus Ebers was transcribed in the fifteenth century B.C., so if *uchetu* be the same as the Coptic *ou seht*, it would be evidence that the disease prevailed then. This Coptic word is used in the Pentateuch for leprosy, *ou* being the indefinite article.'

'Brugsch and other dictionary writers give *uchetu* as "pain or inflammation," but the word is always used as the name of a specific disease, and I cannot get its characters to fit any other than leprosy.'

Brugsch, in his *History of Egypt under the Pharaohs*, 1881, quotes the following words from the Berlin Papyrus:—

'This is the beginning of the sum of all methods for the cure of bad leprosy. It was discovered in a writing of very ancient origin, in a writing-case underneath the feet of the divine Anubis in the town of Sokhem (the Letopolis of the Greeks and Romans), at the time when the deceased Sapti was king.'

'Hesep'ti (Sapti),' we again quote Dr. Macalister, 'was the fifth king of the first dynasty, who lived about 4166 B.C., according to Brugsch's chronology.'

'The Berlin Papyrus, found in the Necropolis at Memphis, contains many prescriptions for the cure of malignant leprosy, as well as many other kinds of illnesses and fractures. It is an eighteenth-dynasty Papyrus, which professes to be a copy of a much older one; but it appears that some Egyptologists consider that this profession was made as a means of giving fictitious value to the document.'

The origin of leprosy in China is not known, and, so far as we have been able to ascertain, the earliest references to the disease in ancient Chinese literature have not yet been sufficiently defined.

In 1868 the author of this book, who was at the time in China, was assisted by a learned native antiquary and scholar in an endeavour to trace the earliest references to syphilis in Chinese books. The results of the inquiry were published in the *Edinburgh Medical Journal* for July 1868. The chief difficulty in connection with the inquiry was that of distinguishing, in the earliest references, between leprosy and syphilis, Mr. Kung believing that under the word 'li' (pronounced 'lee') cases of both syphilis and leprosy were probably included. It is stated in the paper referred to, that 'leprosy has been common in China from a very early date, and there are frequent allusions to it in early writers. These are often vague enough, and distinguished by poetic names.' In the same paper the author (inspired by Kung) stated 'that the exact meaning of the Chinese written character, as transmitted in ancient records, is sometimes difficult to ascertain. There are certain characters applied to severe types of disease, which were used not so much to indicate the specific nature of the malady as the structure involved. The character 'li' is used by the old writers as one of the

names of leprosy, and it is also undoubtedly applied to syphilitic affections.

Amongst the characteristics of this 'li' disease given by Chang Kwoh Tseh—a writer of the earlier Han dynasty, two thousand years ago—are 'destruction of the nose, and falling off of the hair,' symptoms which unfortunately do not help us to decide whether the disease referred to was leprosy or syphilis.

There seems no doubt, however, that leprosy existed in China before our era. Dr. Dudgeon and Dr. Lockhart, quoted by Dr. Munro, agree on this point. Dr. Munro suggests that leprosy may have been introduced into China from India, inferring, from the absence of distinct evidence to the contrary in early Chinese works, that the disease was less common in ancient times in China than it is now.

The subject is one of great historical interest, and is probably capable of considerable elucidation by the combined efforts of foreign and native Chinese scholars.

If leprosy had existed in Greece at the time of Hippocrates, it would undoubtedly have been described in unequivocal terms in the Hippocratic writings; and the fact that no such clear description occurs may be taken as conclusive evidence that up to that time the disease had not made its way into Greece.

Hippocrates, 460 B.C., writes of the *leprai* as designating a common exanthema appearing in the spring (Danielssen and Boeck); and although he says in another part that in certain circumstances it may constitute a real malady, there is nowhere a definition to be found, and the same term is used for different maladies. The *leprai* are, in fact, applied by Hippocrates, in the sense of the derivation of the word *lepos*, a scale, to various skin affections attended with desquamation or scurf. Psoriasis, scabies, and similar diseases attended by desquamation were evidently grouped under the term *leprai*, but, as Dr. Munro remarks, this is shown still more clearly by the fact that Galen, who follows Hippocrates, uses the word *leprai* as indicating a disease distinct from leprosy, elephantiasis being the term which he applies to what corresponds to true leprosy.

Whether Hippocrates knew of the existence of leprosy at all depends upon the interpretation given to a doubtful

reading. He states that the *leukai*—white diseases—spring from the most deadly diseases, such as what is called the ‘Phœnician disease,’ and this ‘Phœnician disease’ has been understood by those who accepted that reading to mean leprosy.

Galen states that the Phœnician disease, *Nousos Phoinikie*, was common in Phœnicia and in other Oriental parts, and translates the term with *Elephantiasis*, the designation used by Greek writers for true leprosy.

Danielssen and Boeck state that in most of the oldest editions the word *phthinike* or *phthisis* is given. Even if the reading ‘Phœnician disease’ be accepted, it does not follow that because Hippocrates knew of the existence of leprosy in Phœnicia, that the disease was known personally to himself.

As regards the nature of the *leukai*, or white diseases, it seems difficult, if not impossible, to form a correct idea of the special maladies to which they refer; but it is very probable, at all events, that at a later period certain forms of true leprosy—probably nerve leprosy—were confounded with other diseases under this term.

A deadly incurable disease associated with whiteness of the skin, whether it was known as the Phœnician disease or not, may with fair reason be accepted as nerve-leprosy. The *sara'ath* of the Hebrews, the *baras* of the Arabs, and the *leuke* of the Greeks, have the same signification in reference to this affection.

Aristotle refers to a disease which he calls *satyria*, in which the countenance seems to resemble that of an animal or a satyr, and Danielssen and Boeck state that from his description he must have referred to tubercular leprosy. This view is confirmed by Aretæus and Galen, although it is not known whether Aristotle saw the disease.

Dr. Munro remarks that ‘Aristotle does not say where he saw this leprosy; but as he spent all his life in Greece or the adjacent coast of Asia Minor, and as from the description he gives (a very full one, considering that it is only given, by way of illustration, in a work on the generation of animals) he must have seen the disease, it can hardly be doubted that when he wrote—about 345 B.C., or fully half a century after

Hippocrates—leprosy, although still probably a rare disease, had found its way at least to the coasts of Asia Minor, near Greece, and probably to the latter.’

Aretæus says that *Elephantiasis Græcorum* (or true leprosy) is called *satyriasis*, on account of the supposed libidinous tendencies of the patients,¹ whilst Galen states that the word has been used on account of the resemblance of the leper’s face to that of a satyr. It was called *leontiasis* by Archigenes, and *leontia* by Aretæus, on account of the supposed resemblance to the leonine face produced by the thickened folds of skin on the forehead. Lucretius, in whom we first find the use of the word elephantiasis for leprosy, states that elephantiasis is a disease which, on account of the waters of the Nile, takes its origin in the midst of Egypt, and does not extend beyond that region.² Aretæus explains the use of this term by the malady being hideous and terrible, like the animal so called. The Arab writers employed the word *elephantiasis* (*Elephantiasis Arabum*) to a totally different affection—namely, to the swelling of a part of the body, with hypertrophy of the skin and subcutaneous tissue, caused, as we now know, by the blocking of the lymphatics, and to this disease the name elephantiasis is now confined. *Elephantiasis Græcorum* is a synonym for leprosy, but is little used.

Dr. Munro makes an ingenious inference from the use of the word Elephantiasis to designate leprosy, as bearing on the introduction of the disease into Greece. He says: ‘Thus we find that leprosy was known under the names *elephantiasis* and *elephas*, from a fancied resemblance to that animal, and that this became its common name among them. Now this, I think, is a very strong argument in favour of its being introduced into Greece only a very few centuries before Christ, as neither Homer nor Pindar use the word *elephas* to indicate an elephant, but ivory, they not being acquainted with the animal itself. (Pindar’s writings preceded those of Hippocrates by fully half a century.) Herodotus, writing

¹ The ancients were strangely in error in supposing that lepers are libidinous. The sexual appetite is, on the contrary, early weakened, and soon becomes extinguished.

² ‘Est elephas morbus qui propter flumina Nili gignitur Ægypto in medio neque præterea usquam.’

about 446 B.C., or four years before the death of Pindar, was the first to use the word for the animal, and he only refers to it as existing in Ethiopia among other wild beasts. He mentions horses, camels, and asses in the great expedition of Xerxes, but no elephants.'

In regard to the means by which leprosy may have been brought from Asia into Greece, the same author remarks as follows:—

'Now up to the time of Cambyses, 525 B.C., Egypt, the country where we have seen leprosy had been so long endemic, was as much closed to the Greeks as Japan was to a very recent date to Western nations. In 650 B.C. the first Greek factory was opened in Egypt, and a hundred years later Greek mercenaries served in the Egyptian army; but till the conquest of Egypt by Cambyses, 525 B.C., Egypt was practically closed. Close after this came the conquests of Darius, and then of Xerxes, 480 B.C., who led, according to Herodotus, a host of about six million people into Europe from all the nations of Asia and Africa under his rule, and when he retired left thousands behind. These two historical events, and especially the latter, have a close connection with the spread of leprosy, which, it can hardly be too much insisted on, is essentially a slow disease. We will see hereafter that it seemed to take between one and two centuries to spread fully over Scotland, after it was in England; and it has taken nearly a century, even in these days of quick travel, to reach the Sandwich Islands. It cannot, therefore, be a matter to cause surprise that it was not known in the south of Greece in the time of Hippocrates, only three-quarters of a century after Xerxes had entered it, and abandoned part of his army in the north, while just what has taken place in modern times took place then. Half a century after Hippocrates it was noticed, and then gradually spread, and a century or two later was a common disease.'

Up to the time of Galen, the confusion between true leprosy and less grave diseases continued. Danielssen and Boeck state that the ancient physicians at this time placed in the same category scabies, impetigo, and the trivial affection which at that time they designated 'leprosy'—true leprosy being known under the name of *elephantiasis*.

Some of these authors were disposed to consider leprosy to be simply an advanced degree of more trivial maladies, and Galen quotes two cases in which *elephantiasis*, or true leprosy, became by appropriate treatment changed into one of the slighter skin affections attended with scaling, to which they applied the term *leprai*.

When we consider the difficulty that is frequently even now experienced in making a correct diagnosis of skin diseases, this confusion is not at all to be wondered at, and is certainly not greater or more remarkable than the confusion between leprosy and comparatively innocuous affections of the skin, of which there is sufficient evidence in reports that have at various times been obtained from countries in which leprosy is endemic.

Although it is clear enough that under the title *Satyriasis* Aristotle (384 B.C.) designated true leprosy, the first thoroughly satisfactory account of the symptomatology of the disease is given by Aretæus in the first century of our era.

The description of tubercular leprosy by Aretæus is for several reasons of great importance. It is remarkable in itself as a striking example of the capacity to observe and describe possessed by the Greek physicians, and it enables us to identify with certainty the elephantiasis of the Greeks with the tubercular leprosy of modern times. In comparing the description of Aretæus with the vague and imperfect allusions in Hebrew, Sanscrit, and Egyptian literature, we appreciate the enormous intellectual advances which had been made by the genius of the Greek race.

‘The disease named *elephantiasis*,’ Aretæus remarks, ‘and the animal named elephant, have many properties in common. Formerly this affection was called *Leontiasis*, on account of the resemblance between the disease and the lion, produced by the appearance of the lower part of the forehead, which I shall mention later on; *Satyriasis*, on account of the redness of the cheeks, as well as by the insurmountable and shameless inclination; *Herculean*, because there is no disease which is graver and more violent. Its power is indeed formidable, for of all diseases it is the one which possesses the most murderous energy.

‘Like the elephant, it is terrible and hideous from many

points of view. It is irresistible, inasmuch as, from the beginning, it carries in itself the cause of death—that is to say, a chilling of the congenital heat, or a glacial cold like that of a rigorous winter, in which water is transformed into snow or ice—a horrible cause of sickness and death indeed!

‘At the beginning the disease is not characterised by any distinctive sign, the patient not being affected by any unusual symptom. It does not show itself at first on the surface of the body, so that it cannot be observed and remedied at the outset, but is concealed in the bowels as in a subterranean abyss; and after having burnt internal parts it kindles up a fresh inflammation on the external surface; and most frequently the horrible fire, visible at a distance, manifests itself first in the face; but sometimes on the contrary it begins on the elbow, knee, and the joints, as well as on the feet and hands. Persons thus attacked have no hope of cure, because the physician, by carelessness or ignorance of the true nature of the disease, does not apply his art when the first symptoms appear.

‘The patients are dull, taciturn, drowsy for a time, and suffer from constipation, but all these symptoms are not in themselves extraordinary, for they occur in people otherwise healthy. When the disease has made progress the breath becomes fœtid on account of the internal decomposition of the vital forces. The urine becomes thick, white, frothy, like that of a beast of burden. The patient digests without difficulty raw food, and does not appear to observe whether the digestive functions are affected. The loss of digestion in them is not noticed, for though in general they receive no benefit from their food, digestion appears to be easy, as if the disease devoured food for its own sustenance.

‘Tumours arise, one by the side of another, not continuous, but thick and unequal. Amongst the tumours there are fissures as in the skin of the elephant. The veins are increased in volume, not by abundance of blood, but by the thickness of the integuments. The hairs, for the most part, die. They become scanty on the hands, thighs, calves of the legs, groins, and on the chin. The hair of the head becomes thin, grey, and a rather pronounced baldness appears prematurely. Soon the groins and chin are completely denuded of hair, and if any remains, however little, it serves only to

disfigure the patient. The skin of the head is deeply wrinkled. Hard, prominent tumours appear on the face. They are sometimes white at the summit but greenish at the base. The pulse is feeble, heavy, slow, as if it moved with difficulty. The vessels in the temples and under the tongue are swollen. The stomach is filled with bile. The tongue becomes unequal on account of granular nodosities, and it is not surprising to see the whole body also covered with similar nodules. But if the disease develops rapidly in the internal parts, and shows itself on the extremities, lichenous eruptions develop which sometimes surround the chin in a circle. The cheeks become red, and swell a little. The eyes are dark and copper-coloured, the eyebrows prominent, thick, bare, and overhanging. The space between them is contracted. The colour is a leaden-grey and blackish. The lower part of the frontal skin is drawn downwards and conceals the eyes, as in mad persons and lions. This is why the affection is also called *leonine*. There are dark tumours on the nose, which is pointed and prominent. The lips are thick, the lower one being blue-black in colour. The teeth are destitute of whiteness, and are blackish. The ears are red, but inclined to become black, the apertures apparently larger than usual, and at their lower part there are ulcers from which flows a very pruriginous matter. There are upon the whole body wrinkles, deep incisions, as well as furrows. This is why the disease bears also the name *elephantiasis*. The soles of the feet, as far as the middle of the toes, are cracked. If the disease increases the nodosities of the cheeks, chin, fingers, and knees become ulcerated. These ulcers are fœtid. They are incurable, and appear in continuous succession. Sometimes the limbs perish before the individual, and at last there is seen to fall the nose, the fingers and toes, the feet, hands, and genital parts, for it is only after the patient is dismembered that the disease causes death as a deliverance from a horrible life and fearful sufferings. But this affection has the same tenacity of life as the elephant. The taste is lost. Neither eating nor drinking gives pleasure to the patients. In consequence of their sufferings they have an aversion to everything. They abstain from food and have a strong inclination to the sexual appetite. Languor is manifested. Weakness is particularly revealed in every limb, and even the small members are a

burden to the sufferer. The body finds everything repugnant. It does not feel satisfaction either in the bath or in abstinence from it, eating or fasting, exercise or repose, for the malady is in enmity with everything. Sleep is insignificant. Watching is worse, on account of hallucinations. The respiration is greatly disturbed. The patients often feel, as it were, strangled by a cord. Some thus finish a remnant of existence in sleeping, a sleep from which there is no rousing until death occurs. Such being their condition, who can avoid flying from them? Who will not turn away from them, were it even his father or son or own brother? There is also the fear that the disease may be communicated. Many, for this reason, remove their dearest ones to solitude or to the mountains. Some preserve them from hunger for a time, others not at all, desiring their death.'

But before Aretæus wrote, Celsus had already given an unmistakable description of both kinds of leprosy, particularly the tubercular form.

Celsus states that the disease which the Greeks called *elephantiasis*, and which was almost unknown in Italy, occurs very frequently in certain countries, and that it affects the whole body, on the surface of which there is an eruption of thickly-set spots and tumours, the colour being at first red, and finally changing to black. The cutis is unequally affected, being variously thickened or thinner, hard or soft, and rough with scales. The body atrophies; the mouth, legs, and feet swell; whilst the fingers and toes are specially affected. This description is applicable to tubercular leprosy.

Of the diseases which Celsus describes as species of vitiligo, and of which there are three forms distinguished by their colour, viz. white, black, and a third variety in which the whiteness is paler than the first, and in which the hairs become white, the last, the *leuke*, is distinguished by its obstinacy, and probably included cases of leprosy.

Some cases of nerve-leprosy may have been included amongst the maladies so designated, but the description is not sufficiently full to make this clear. There is no doubt, however, that, at the time of Celsus, leprosy, which had existed in Greece, was still very rare in Italy (*ignotus autem pene in Italia*).

It is clear, therefore, that in the first century leprosy had scarcely made its appearance in Italy. Lucretius had already stated that it was confined to the valley of the Nile, and Celsus (53 B.C.—7 A.D.) states that it was *almost* unknown in Italy, implying that rare cases were seen there; whilst Pliny the elder states that the disease was imported there in the time of the first emperors from Egypt and Asia Minor, and that it was unknown until the return of Pompey's soldiers from the East (B.C. 62).¹ Galen also refers to Egypt as the home of the disease. Its extension to Europe soon took place. The malady, which in the first two centuries was rare in Italy and Greece, soon spread over Europe. Galen (A.D. 131-200) states that leprosy occurred, although very rarely, in Germany and Mysia, showing that it had already spread beyond Italy; and, according to Aretæus, it had in his time spread amongst the Celts—that is to say, into Western Europe. In the centuries immediately following it multiplied enormously in these countries.

That the disease referred to in the time of Christ was the same as that described by the physicians of the Middle Ages can be at once seen by comparing the description of Gordon of Montpellier with that of Aretæus. After describing the general constitutional symptoms, Gordon remarks that amongst the infallible signs are loss of the hair of the eyebrows, with thickening of the skin, dilatation of the nostrils and narrowing of the nasal cavities, with consequent difficulty in breathing and nasal speech, insensibility of the limbs, ulceration of the feet and hands, thickness of the lips, hoarseness of the voice, and the dark colour of the skin of the face, with its terrible appearance.

Whilst the existence of leprosy in Egypt and Syria in ancient times is certain, it is probable that it prevailed at the same period in Arabia, although there does not seem to be any direct evidence in literature. It is certain, however, that it existed at the time of Mohammed, who states that Jesus was enabled by God to heal those born blind and lepers. The word in the Koran translated leprosy is the same as that still used, *barash*, the word, like the Hebrew *sara'ath* and the Greek *leuke*, having special reference to the discoloration of

¹ 'Ægypti peculiare hoc malum est.'—PLINY.

the skin, which is significant of the disease. Taken literally, the word refers to white spots on cattle, small specks differing from the rest of the colour, a spotted or piebald horse, etc. The Turkish or Tartar word is *ala*, a leper, and also has the signification of speckled or spotted, and there can be no doubt that, both amongst the Arabs and Tartars, as well as amongst the Hebrews, cases of vitiligo were confused with those of leprosy. It may be noted that while the Arabic and Turkish words refer to discoloured spots on the skin—the Greek word both to the whiteness and roughness of the affected parts—the Hebrew word points to its malignant nature, as a blow, or grievous visitation. The word used by Mohammed is still in use amongst the Arabs. At a later period Arabian physicians wrote extensively on leprosy, and by them it is known under another name, *judam*—*dsjudam* as written by the learned, and *madsjurdam*, according to the pronunciation of the people. These names still exist. Niebuhr states that there are three kinds of leprosy recognised in Arabia: *bohak*, which is not contagious (the 'freckled spots' of the Mosaic record, and which is evidently a pigmentary affection); *baras*, which is not considered dangerous, and which included simple nerve-leprosy with its pigmentless spots; and *dsjuddam*, which corresponds to tubercular leprosy, and amongst the symptoms mentioned are stiffening of the fingers and toes, bad breath, difficult respiration, swellings of the ears and cheeks. It is clear, therefore, that from time immemorial leprosy has existed amongst the Arabs in both its forms. We know from the records of ancient literature that it existed in Egypt and in India more than fifteen hundred years B.C., and as Arabia is on the route between these two countries, it is very probable that it existed there at a time equally remote. It is not improbable that the disease may have been conveyed through Arabia to India.

Serapion, Syria Rhazes, Bagdad, Haly Abas, Persia, Ben Sina, Bucharey, Ben Zoar, Morocco, Eben Roschid, and Abul Casem in Moorish Spain, are referred to by Kaposi as having produced long treatises on leprosy; partly borrowing from the Greeks, particularly Galen, and partly basing their descriptions on their observations of the disease. Haly Abas has made the important observation that there are two kinds

of leprosy, one of them being attended by the dropping off of the extremities. This he makes a point of distinction, a distinction again made in the eighteenth century by Towne, who apparently was not aware that Haly Abas had called attention to the point hundreds of years before.

Leprosy appears to have been very prevalent from the second to the seventh century over the whole of Europe, since all the physicians who, during that time, have described it mention it as one of the most common affections:—Quint. Seren. Sammonicus, in the third century, Marcellus Empiricus and Theodoricus Priscianus in the fourth century, Ætius Alexander and Julius Firmicus in the sixth century. It is a proof of the hold which this disease had on the popular imagination, that the last named of these writers declared to any one in casting his horoscope whether or not he would be attacked by leprosy. Raymond, in the biography of St. Antonin—fourth century—refers to a case of *horrendissimæ elephantia lepræ*. Although from the sixth to the eleventh century there do not appear to be descriptions by European physicians of the malady, it is quite certain that it continued to prevail during this period, as is shown by ecclesiastical writers, and by the laws and ordinances to which it gave rise. Gregory of Tours mentions a place set aside for lepers to bathe themselves, and the hospitals destined to receive them. Isidore of Seville, in 582, described affections of the skin, and mentions most of the symptoms of the leprosy, from which it may be inferred that the disease prevailed in Spain during his time. During this epoch, leprosy, which in the first century of the Christian era was scarcely known in Italy, had spread so greatly that the Lombards were affected to such an extent that other people avoided them. This is further shown by the law of King Rothar, 630, declaring that lepers should be considered civilly as dead, and if necessity compelled them to beg, they were forbidden to approach too near to healthy individuals. The Code Carolinus, about the year 770, refers to the Lombard people as ‘perfidious and fœtid, amongst whom it is certain that the race of lepers took their origin.’ Pope Silvester I. is said to have dissuaded King Pepin of France from marrying a Lombard princess, on account of the risk of leprosy. We find Parliamentary

enactments in France regarding lepers in 757, and by Charlemagne in 787, whilst shortly afterwards we find the first trace of the existence of the disease in England.

The popular idea that leprosy was brought into Europe by the returning Crusaders is an erroneous one. We have seen that the disease was extensively spread in Western Europe centuries before the Crusades, and, as we shall see, the first notice of it in England is of a date anterior to the first Crusade; but there is little doubt that the Crusades, as well as the previous intercourse between Western and Eastern Europe and Asia Minor, afforded a means by which leprosy was extended. There is no record of its first appearance in England, and it is quite possible that it had been brought there by the Roman armies before they were finally withdrawn from the island; but even before the Roman armies left Britain in 418, pilgrimages had been made to Jerusalem. References to these pilgrimages are to be found in Jerome's epistle xvii. A.D. 386. In a letter to Marcelea, 386, it is stated that pilgrims flocked to Jerusalem from Armenia, Persia, India, Ethiopia, and even Gaul and Britain. St. Jerome writes from Bethlehem in 393 against pilgrimages, remarking that heaven is just as open from Britain as from Jerusalem. About A.D. 375, St. Chrysostom writes that a pilgrimage commonly practised was to Arabia to see the dunghill on which Job sat, and that by visitors from 'the ends of the earth,' at that time Britain being always thus referred to. In 370 St. Gregory Nyssa writes strongly against pilgrimages, as the immorality and irreligion of Jerusalem itself were gross and notorious.

Even when Christianity had been swept out of England by the Saxons, and until it was re-established by St. Augustine in 601, it is difficult to believe that there was not intercourse of some kind between Britain and the Continent. After the re-establishment of Christianity, however, pilgrimages were again made on a large scale.

Beda says that nowhere was the pilgrimage to Rome more popular than in Saxon England, and among the crowd of penitents who made the journey were four kings, all of whom died in Rome. It is known that at that time leprosy was extremely common in Lombardy, where it was stated

were many English women who lived incorrect lives. A letter is extant from the Englishman Boniface, of Mainz, to Cuthbert, Archbishop of Canterbury, about A.D. 743, asking him to forbid the pilgrimage to Rome, especially to nuns, on the ground of the moral perils of the road; stating that no city of France, Lombardy, or Italy was without English women whose happiness had been sacrificed to the dangers of the pilgrimages.

About 925, a Saxon nobleman, Alfred, was ordered to go to Rome to clear himself of a charge of murder. In the English College a building was erected for the reception of Anglo-Saxon pilgrims, and so appropriated until the sixteenth century.

We have introduced these historical references to show that sufficient opportunities, during the early centuries of our era, were given for the transmission of any contagious disease from Italy to Western Europe, and to England. It was an age of pilgrimage, and a connection between Britain and Rome, and to a less extent Jerusalem, must have been constant, except during the comparatively short period when Christianity was eclipsed in Britain.

In the Holy Land leprosy has existed from time immemorial, and at the period to which we refer the disease abounded in Italy, while the conditions of travel at that time were such as to necessitate close contact between the traveller and the inhabitants of the country in which he moved. Long slow journeys, with frequent and prolonged stays in different towns, under conditions of life probably much more favourable to the communication of disease than those which now exist, must have infallibly brought the pilgrims into contact with lepers; and although there is no historical record of the particular time when the disease was introduced into Britain, it is quite clear that every facility was afforded for the extension of leprosy into these islands.

In 1841 the late Sir James Y. Simpson published in the *Edinburgh Medical and Surgical Journal* two articles entitled 'Antiquarian Notices of Leprosy and Leper Hospitals in Scotland and England,' and nothing afterwards written by that, in many respects remarkable, man affords greater evidence of the enthusiasm, enormous industry, and critical acumen which he brought to bear on any subject which

seriously engaged his attention. As regards the historical notices of the disease, nothing which it has been our duty to read in collecting the information given in this volume seems in any way to approach in interest and research these very important papers. The facts which we now give regarding the early history of leprosy in Great Britain are almost entirely taken from Dr. Simpson's articles on the subject.

It has been long a popular error that leprosy was brought into Europe by the Crusaders. What we have already said respecting the evidence of the existence of leprosy in Spain, France, and Italy before the time of the Crusades sufficiently disposes of that hypothesis. Nor is it true for Britain any more than for other parts of Europe. Amongst the earliest extant code of laws enacted in any part of Britain, those, namely, of the Welsh King Hoel Dha, who died about the year 950, there is a canon to the effect that a married female was entitled to separation and the restitution of her goods, provided her husband was affected with leprosy. Although, as was almost certainly the case, other skin affections would be at that time confounded with leprosy, there is no other skin disease of such a malignant nature as to have given rise to a law of this kind, except leprosy. A further proof that the Crusades did not bring the affection to England is given by the fact that several English leper-houses were founded before the first Englishmen engaged in the Crusades left in 1096. Lanfranc, Bishop of Canterbury, died, according to the evidence of the Saxon Chronicle, in 1089—seven years previous to the first Crusade. During his lifetime he founded two hospitals near Canterbury, one a stone house for patients affected with general diseases; the second, a hospital constructed of wooden houses specially set aside for lepers (*lignæ domos ad opus leprosororum*). Brigges alleges that the leper-house of St. Leonard's in Northampton was founded in the reign of William I., or before 1087; and according to Bishop Tanner one at Chatham existed before the termination of the reign of his son William Rufus.

But that leprosy existed in England before there was any historic mention of it is indicated philologically. The Anglo-Saxon language possesses special words to designate this affection—namely, *hreoƿ* and *licprower*. After the year 900, this language began to be replaced by other dialects; so that

the two words mentioned must have been in use before that epoch. That the disease was very prevalent in the twelfth, thirteenth, and fourteenth centuries, both in England and Scotland, is shown by the number of leper-houses that existed, and by the ecclesiastical and other legal regulations that were promulgated in respect to them.

When leprosy was first introduced into Scotland is unknown, but that it was already established there in the reign of William the Lion is evident from a manuscript cartulary of the Priory of Coldingham, preserved in the Advocates' Library, Edinburgh: 'William I., by the grace of God king of the Scotch, makes known that he confirms the donation of land given to the hospital of Aldcambus in Berwickshire, and to the lepers who reside in it.'¹

In the Melrose Chartulary there is preserved a charter headed 'the Charter of the Lepers of Morestum,' in which Walter Fitzallan, Steward of Scotland, made a grant of land to the hospital of Auldnestun in Lauderdale. At Kingcase, in Ayrshire, there existed for several centuries a leper hospital, which tradition states was founded by King Robert the Bruce. Certain privileges possessed by the proprietors of an estate in that neighbourhood, in connection with the leper hospital, were purchased by the burgh of Ayr in 1734, and from the right thus acquired the magistrates exact feu-duties to the annual extent of sixty-four bolls of oatmeal and eight merks Scotch money. The revenue was made over to the poor's-house at Ayr, and in virtue of it the magistrates have the privilege of presenting a certain number of inmates to that institution. In later years the number of lepers admitted to the Kingcase hospital was limited to eight. When Simpson wrote his paper, the only remains of the building consisted of a massive side wall of a house, supposed to be the ruins of a chapel. Sir Robert Gordon, in a description of Kyle, pub-

¹ 'Willelmus Dei gratia Rex Scottorum omnibus probis hominibus totius terræ suæ Clericis et laicis salutem. Sciant presentes et futuri me concessisse, et hac carta mea confirmasse donationem illam, quam David de Quicheswded fecit Hospitali de Aldcambus et Leprosis ibi manentibus, de illa dimidia carucata terræ in Aldcambus quam Rudulfus Pelliparius tenuit tenendam; in liberam et puram et perpetuam ellemosinam, cum omnibus libertatibus et aisiamentis ad predictam terram juste pertinentibus, ita libere et quiete sicut carta predicti Davidis testatur, Salvo servicio meo. Testibus Willelmo de Bosch, Cancellario meo, Waltero Cuming, Davide de Hastings. Apud Jeddewrith, xvi. die Maij.'

lished in 1654 in Blaeu's Atlas, states that the persons admitted to the charity were then lodged in huts in the vicinity of the chapel.

A leper hospital was founded at Glasgow in 1350, and a report given in 1589 states that there were then six lepers in the hospital. In the Edinburgh City Council records for 1584, reference is made to the foundation of a leper-house in the city, and in 1589 an Act was passed for building a similar institution at Greenside, which was then a suburb of Edinburgh; and on November 23rd, 1591, five leper inhabitants of the city were consigned to the hospital.

A chapel for a leper-house in Aberdeen was built in 1519, and reference is made to an order from the Lords of the Privy Council to the magistrates of Aberdeen, on August 18th, 1574, in reference to the amount of dues pertaining to the lepers. A leper hospital existed at Rothfan, Elgin, previous to 1226, and from the phraseology of charters in connection with this hospital they seem to have been in existence previous to the reign of Alexander II. or III. The lands pertaining to this hospital were still known (1841) as leper lands. Till about 1742 leprosy prevailed also in the Shetland Islands, where cases existed long after the disease had disappeared from Scotland. Multiplied evidence seems to show that King Robert the Bruce himself died of leprosy. *La grosse maladie* is the term used by Froissart, the French equivalent of the Anglo-Saxon *seo mycle adl, mickle ail*. It is stated in the Chronicle of Lanercost that the Scottish army which entered England in 1326 was not led by Bruce in person because *factus erat leprosus*, and it is stated that in the year 1329 *mortuus est dominus Robertus Brus Rex Scotiae leprosis*. The extent to which leprosy prevailed in England is shown by the fact that before the year 1200 three leper hospitals, situated in Northumberland, Cumberland, and Durham, contained as many as ninety-one lepers. The prevalence of leprosy in former times in these islands will be best understood by examining the list of leper hospitals given by Simpson.¹

¹ Simpson refers, as his authorities, to Leland, Dugdale, and Tanner's investigations regarding the monastic history of England, and to the *Monasticum Anglicanum*. Bloomefield mentions eighteen leper-houses in Norfolk alone, and Taylor, in his *Index Monasticus*, enumerates twenty in that single county. Six of these were in Norwich or its vicinity, and five at Lynn Regis.

LIST OF LEPER HOSPITALS FORMERLY EXISTING IN GREAT BRITAIN.

Town and County.	Designation of Hospital or Locality.	Date of Foundation or Earliest Notice.
Aberdeen,	St. Anna's.	
Aldcambus, Berwickshire,		Before 1214 A.D.
Aldnestun, Berwickshire,		Before 1177 A.D.
Appleby, Westmoreland,	St. Nicolas's.	
Athelington, Dorsetshire,	St. Mary Magdalene's.	
Aylesbury, Buckinghamshire	St. John's and St. Leonard's	Time of Henry I., or before 1135.
Banbury, Oxfordshire,	St. John's,	Time of King John, or before 1216.
Beccles, Suffolk,	St. Mary Magdalene's,	About 1327.
Berkhamptstede, Hertfordshire	St. John the Evangelist.	
Berwick-upon-Tweed,		Before 1283.
Blythe, Nottinghamshire,	St. John the Evangelist	In time of Pope Honorius.
Bolton, Northumberland,	Holy Trinity,	Before 1225.
Bristol, Somersetshire,	St. Mary Magdalene's.	
" " "	St. Lawrence's,	Before 1135.
Brookstreet, near Brentwood, in the parish of Southweald, Essex	St. John's,	Before 1292.
Burton, Leicestershire,	Blessed Virgin and St. Lazarus's; Burton Lazars	Time of King Stephen.
Bury St. Edmond's, Suffolk	St. Peter's,	About 1327.
Colchester, Essex,	St. Mary Magdalene's.	
Cambridge,	'Hospital of Lazars,'	Before 1397.
Canterbury, Kent,	St. Nicholas's.	
Chatham, Kent,	St. Bartholomew's,	In time of William II., or before 1100.
Chichester, Sussex,	St. James' and St. Mary Magdalene's	Before 1199.
Chesterfield, Derbyshire,	St. Leonard's,	Before 1208.
Crowmersh, Oxfordshire,		About 1248.
Dartford, Kent,	Trinity.	
" " "	St. Mary Magdalene's,	About 1330.
Devizes, Wiltshire,		Before 1207.
Doncaster, Yorkshire,	St. James',	Time of Henry III., or before 1272.
Dunwich, Suffolk,	St. James',	Before 1199.
Edinburgh,	Greenside,	In 1591, but probably a previous hospital.
Exeter, Devonshire,	St. Mary Magdalene's,	Before 1163.
Eye, Suffolk,	St. Mary Magdalene's,	About 1330.
Glasgow, Lanarkshire,	St. Ninian's,	In 1350.
Gloucester,	St. Margaret's,	Before 1320.

Town and County	Designation of Hospital or Locality.	Date of Foundation or Earliest Notice.
Goreleston, Suffolk, . . . . .	. . . . .	Mentioned in 1372.
Hardwick, Norfolk,	St. Lawrence's,	Time of Edward II., or before 1327.
Hedon, Yorkshire,	St. Sepulchre,	Before 1216.
Hereford,	St. Giles'.	
Herting, Sussex,	St. John the Baptist,	Before 1199.
Hexham, Northumberland, . . . . .	. . . . .	About 1210.
Hithe, Kent,	St. Andrew's,	Before 1336.
Huntingdon,	St. Margaret's,	Time of Malcolm IV. of Scotland, who died 1165.
Ipswich, Suffolk,	St. Mary Magdalene's.	
" "	St. James'.	
Kingcase, Ayrshire,	St. Ninian's,	Before time of Robert Bruce.
Kirby, Westmoreland,	St. Leonard's.	
Lancaster, Lancashire,	St. Leonard's,	About 1190.
Langwade, Norfolk.		
Langport, Somersetshire,	St. Mary Magdalene's,	About 1310.
Lerwick, Shetland.		
Leicester,	St. Leonard's.	
Linlithgow,	St. Magdalen's,	Before time of Alex- ander II.
Little Maldon, Essex,	St. Giles'.	
Lincoln,	Holy Innocents.	
London and Vicinity,	St. Giles',	In 1101.
" "	Highgate,	In 1472.
" "	Between Milesend and Stratford Bow.	
" "	At Kingsland.	
" "	At Shoreditch.	
" "	Lock, Kent Street, without Southwark.	
" "	St. James', Westmin- ster.	Very early.
Long Blandford, Dorset- shire.		
Lowcross, Yorkshire,	St. Leonard's.	
Lynne, Dorsetshire,	St. Mary Magdalene's,	Before 1336.
Lynne, Norfolk,	St. Mary Magdalene's,	In 1145.
" "	St. John's.	
" "	West Lynne.	
" "	Cowgate.	
" "	Letch Hithe.	
" "	Virgin Mary,	Before 1135.
Mayden Bradley, Wilts,	St. Mary Magdalene's,	Before 1119.
Norwich, Norfolk,	St. Mary's.	
" "	Without St. Magda- lene's Gate.	
" "	Without St. Bennet's Gate.	

Town and County.	Designation of Hospital or Locality.	Date of Foundation or Earliest Notice.
Norwich, Norfolk, . . .	Without St. Giles' Gate.	
" " . . .	Without St. Stephen's Gate.	
Northampton, . . .	St. Leonard's, . . .	In 11th century.
Otteford, Kent, . . .	. . . . .	Time of Henry III., or before 1272.
Ottely, Yorkshire, . . .	. . . . .	Time of Edward II., or before 1327.
Oxford,	St. Bartholomew's.	
Papa Stour, Shetland.		
Peterborough, Northamp- tonshire	St. Leonard's, . . .	Before 1154.
Pilton, Devonshire, . . .	St. Margaret's, . . .	Before 1197.
Plymouth, Devonshire, . . .	St. Mary Magdalene's.	
Plympton, Devonshire.		
Pontefract, Yorkshire, . . .	St. Mary Magdalene's.	
Racheness in Southacre, Norfolk	St. Bartholomew's, . . .	Before 1216.
Ripon, Yorkshire, . . .	St. Mary Magdalene's,	Beginning of 12th century.
Rochester, Kent, . . .	St. Katherine's, . . .	About 1316.
Romendale or Rumney, in Kent	St. Stephen and St. Thomas	Time of Baldwin, Archbishop of Canterbury.
Rothfan, Elgin, . . . . .	. . . . .	Before 1249.
Selwood, Somersetshire, . . .	. . . . .	About 1212.
Sherburn, Durham, . . .	The Virgins', Lazarus',	Before 1181.
Shrewsbury, Kent, . . .	St. Giles',	Before 1189.
Southampton, Hampshire,	St. Mary Magdalene's.	
St. Albans, Hertfordshire,	St. Julian's,	Between 1100 and 1135.
Stamford, Lincolnshire.		
Sturbridge, Cambridge- shire	St. Mary Magdalene's,	Very early.
Tannington, Kent, . . .	St. James',	Before 1189.
Tavistock, Devonshire, . . .	St. Mary Magdalene's.	
Taunton, Somersetshire.		
Tenby, Pembrokeshire, . . .	St. Mary Magdalene's.	
Tewkesbury, Gloucester- shire.		
Thetford, Norfolk, . . .	St. John's,	Time of Edward I.
" "	St. Margaret's,	About 1390.
Towcester, Northampton- shire	St. Leonard's,	About 1200.
Walsingham, Norfolk.		
Warwick,	St. Michael's,	Time of Henry I. or Stephen.
Wycomb, Buckingham- shire	St. Margaret and St. Giles'.	
Yarmouth, Norfolk, . . .	Outside North Gate, . . .	Before 1314.
York, Yorkshire,	St. Nicholas',	About 1110.

The last known leper in Scotland died in the Shetland Islands in 1798.

Although the existence of leprosy in Ireland is not often referred to, there is no doubt that the disease extended to that island. We are indebted to the kindness of Dr. Hillis for the following information. He writes us that the leper hospital at Waterford was said to have been established by King John for the treatment of lepers, although this is only hearsay. In Sir Charles Cameron's History of the Irish College of Surgeons, it is stated that in the sixteenth century, in the parish of St. Peter, Dublin, there was a leper-house, or hospital of St. Stephen, a monastic institution. In 1692, Dr. Joseph Pratt, who studied at Leyden and practised in Dublin, published a volume on leprosy. This volume is now in Trinity College Library—*Disputatio medica Inauguralis de Lepra*, 1692—in which he gives a very good description of the disease:—'*Signa pathognomonica talia recenseri possunt; extuberationes in plerisque corporis partibus sed in faciei magis et præsertim secundum frontem; auris acuminata, nasus simus, labia crassa, adeo ut aspectus reddatur horrendus; cui etiam oculorum rotunditas et color faciei ex rubro livius non parum contribuit.*' In Smith's History of Waterford, referring to the leper hospital in 1796, it is stated that it was thought that a public infirmary would best answer the interest of the pious founder, since leprosy was not then a disease much complained of.

From the number of leper hospitals, it appears clear that leprosy extensively prevailed in Ireland during the fifteenth and sixteenth centuries.

Whilst leprosy had spread to such an extent in England, it prevailed to no less a degree on the Continent of Europe. Papal Bulls were issued for the protection of the sick, and leper hospitals were everywhere instituted to receive them. Leo VIII. promulgated, in 1226, a code of laws for the regulation of French leper hospitals, which at that time were computed to number 2000 in the then limited kingdom of France. They afterwards, according to Velley, increased in number so greatly that there was scarcely a town in the country which was not provided with a leper hospital. It

prevailed equally in France during the twelfth century, and Muratori gives a nearly similar account of the extent of the disease during the Middle Ages in Italy. We find a hospital established at Bergen, in Norway, in 1276, and the number of lepers there was found increasing in 1745. A hospital was established at Oslo in 1301, and there is evidence that a leper hospital existed at Lund, in Sweden, in 1248. There is further evidence that, about the same time, leprosy was common in Denmark. Of the leper hospitals existing in Iceland in 1841, the oldest was apparently founded in 1652; but leper hospitals existed there before that time.

Danielssen and Boeck relate that, in the ancient Norwegian law—the Gulathing—of which the least ancient part is anterior to 1263, and of which the oldest precedes the introduction of Christianity, mention is made of those who are freed from military service, and especially excepted are the bishop, the curate, and all the lepers.

It was enacted in Denmark, in 1443, that every one who contracts leprosy in the town should be forced to enter the hospital St. George within a certain time fixed by the city authorities, and if he did not carry out their instructions, he was to be forcibly taken there at his own cost.

The same authors relate how, in the Middle Ages, leprosy prevailed to such an extent that in many localities the lepers had their own priests, their own churches, and their own cemeteries.

Whilst, as we shall see, it was an especial merit of some Christians to overcome the disgust which leprosy inspired, there can be no doubt that the general feeling towards lepers was one of terror and dislike. Alienated from the rest of the population, they naturally formed a kind of community apart, and, it appears, were on occasion in a position to accumulate property.

Philip v. is said to have appropriated their goods, and, accusing them of having poisoned the wells and being in conspiracy with the Jews and against France, he ordered them to be burned, in order that their bodies and souls might be purified together.

The absence of historical records renders it impossible to know to what extent leprosy prevailed in ancient times

in other parts of Africa except the basin of the Nile, but it is very unlikely that the disease was confined to Egypt. On the contrary, it is very probable that the affection which we know has prevailed in many parts of Africa since European travellers and settlers became acquainted with the people along the coast—east, west, and south—is the lineal descendant of the leprosy which had long previously existed in these parts. The first leper-house was erected in the Canary Islands in 1542, and a leper hospital now existing in Madeira was founded in 1658. But the erection of these hospitals is probably due, not to the development of the disease or its increase, but to the progress of civilisation, which led to the care and isolation of the sick.

There seems good reason to believe that leprosy was unknown in America until the arrival of negroes from the west coast of Africa.

DIMINUTION OF LEPROSY IN EUROPE.

When the persistency with which leprosy continues to prevail in India, China, Africa, and many parts of America is considered, its diminution in Europe, and ultimate cessation in many parts of it, is a remarkable fact. It had already begun to diminish in England in the fourteenth century. In the preface to the statutes of the leper-house at St. Albans, drawn up about 1350, it is stated that the number of lepers presenting themselves for admission had diminished so much at that time, that the expense of the establishment was below the revenues. In general, it is added, there are now not above three, sometimes two, and occasionally only one.

Its prevalence and spread in Scotland after it began to diminish in England, is shown by the fact, that in this very year it was thought necessary to institute a leper-house at Glasgow, and that nearly one hundred years later—in 1427—a Scottish Parliament deemed it necessary to legislate on the subject of leprosy. The hospital of St. Mary Magdalene at Ripon was established in 1139 for the relief of all lepers in that district. In the time of Henry VIII. it contained only two priests and five poor people to pray for all ‘Christen sowlez.’

At Illeford in Essex a hospital was instituted in the reign of Henry II. for thirteen lepers, but a Commission in the time of Edward VI. reported that, though founded 'to find 13 pore men beyng Lepers, 2 pryests, and one clerke—thereof there is at this day but one pryest and 2 pore men.' By the same Commission most of the other lazar-houses were reported as having no leprous patients, although forty or fifty years afterwards the Edinburgh hospital at Greenside was established.

After leprosy had entirely disappeared from the mainland of Scotland it continued in Shetland, where it had been known for centuries. The session books of Walls, in the Shetland Islands, show the expenses incurred in keeping the lepers at the island of Papa from 1736 to 1740. Four of them died during these years, and two of the entries are for tobacco used at their funerals. In 1742 there is an entry in the session record of Walls enjoining a day of public thanksgiving for the total deliverance of the country from leprosy; although it appears that the last cases really died out about the end of the eighteenth century.

Benievini of Florence, who died in 1503, states that at that time leprosy was hardly ever seen in Italy; and Benedetti, who lived a few years later, does not mention that disease from his own experience, but makes some historical remarks regarding it. The affection began to disappear in France a little later than in Italy—according to Parè, in the end of the sixteenth century—most of the lepers in France being found on the south Mediterranean coast and towards the Pyrenees; although there were still so many in the beginning of the seventeenth century that it was thought necessary to isolate them. In the sixteenth century leprosy in Denmark had become so rare that leper-houses were abolished. Leprosy continued, however, to prevail in Sweden at the end of the eighteenth century. Although so common in the Faroe Islands in the seventeenth century that a leper-house was built, towards the end of the eighteenth century only a few patients were found. That the disease continued to exist in Norway, where there are still many lepers, is a matter of notoriety.

Of the continuity of leprosy in Asia Minor there can be no

doubt, although there are gaps in the historical notices. The writings of the Arabian physicians afford proof of its existence in Palestine and Persia in the ninth and tenth centuries, and the Crusaders found it prevalent in Palestine in the eleventh and twelfth centuries. In the fourteenth century Tamerlane caused lepers to be burnt in Asia Minor. We again find its existence in these countries noted by travellers in the seventeenth century. Prosper Alpin found it flourishing in Egypt in 1580, where Larrey also observed it at the end of last century.

To realise the completeness of the change which has taken place in Western Europe in regard to lepers and leprosy, it is only necessary to compare the almost entire ignorance of the subject now prevailing in these countries with the extent to which matters connected with this disease had entered into the common life of the people of the Middle Ages. Not only, as we have seen, were numerous leper-houses erected, but a special religious order was appointed to take charge of their interests. The leper order, or Order of St. Lazarus, is a very ancient one in the history of the Church, having been, according to Bellay, founded in Palestine about the year 366. When they began to take special care of lepers does not seem to be accurately known, but it is certain that St. Louis brought twelve knights of St. Lazarus to France, and intrusted them with the superintendence of the leper hospitals of his kingdom. The first notice of their having acquired a footing in Great Britain is in the time of King Stephen. They received lepers into their Order, superintended the inmates of the leper-houses, and, till a rule to the contrary was made by Pope Innocent IV., they were obliged to elect a leper to be their Grand Master. Under this organisation some of the leper hospitals became wealthy, till, as we have already seen, by the commencement of the fourteenth century they had excited the avarice of Philip V. of France.

When devotees wished to perform acts of the greatest conceivable abnegation, they could find no more striking means of showing self-sacrifice than by placing themselves in personal contact with lepers. Louis IX. of France visited the leper hospitals every three months, personally rendered the most abject services to their inmates, fed them, and bathed their sores with his own hands. Henry III. of England

annually, on Shrove Tuesday, did the same. Robert II., son of Hugh Capet, kissed the hands of lepers.

Matthew Paris relates an anecdote illustrative of penance and defiance of contagion, by the Scottish princess Matilda, the queen of Henry I. of England. Speaking of some transactions in 1135, he observes: 'At the same time David (King of Scotland), the brother of Matilda, Queen of the English, came to England to visit his sister, and when, on a certain evening, he came, by her invitation, to her chamber, he found the house filled with lepers (*domum invenit Leprosis plenam*); and the Queen standing in the midst, having laid aside her cloak, she with both hands girded herself with a towel, and water being placed in readiness, she began to wash their feet and wipe them with the towel, and embracing them with both hands, kissed them with the utmost devotion. Upon which her brother addressed her thus: "What is this which you are doing, my Lady? In truth, if the King knew this, he would never deign to kiss with his lips your mouth, contaminated by the pollution of the lepers' feet!" And she, smiling, replied, "Who knows not that the feet of an Eternal King are to be preferred to the lips of an earthly king? Behold it was for this that I invited you, dearest brother, that you might learn by my example to perform similar actions. Do, I beseech you, that which you see me doing." And when her brother had made answer that he would by no means do such things, as she persevered in her employment, David, with a smile, withdrew.'

About 1180 Christ was supposed to have appeared to St. Francis in the form of a leper, and to have insisted on his ministering to the sufferers. St. Francis washed them and dressed their sores, and once at least kissed them. The very fact that this was so carefully chronicled is an illustration of the fear and horror with which leprosy was regarded.

The fact that such acts were considered likely to reconcile an offended Deity shows only too plainly the dislike and disgust in which lepers were held by the general population, and is not inconsistent with the evidence which is preserved of the pains that were taken to exclude lepers from contact with the healthy portion of the people.

The sketch which we have given of the history of leprosy

establishes several important facts which have more than a mere historical interest. We have seen that, from the most ancient times, the disease prevailed in Egypt and India, where it has continued until this day.

There was a time when it was unknown in Greece, but before our era the disease had already obtained a footing in that country.

It is clearly established that leprosy was introduced into Italy about the time of Christ, and that from Italy it spread (following the Roman armies and the main routes) into countries in Northern and Western Europe. Within a few centuries of its first spreading into these countries it had multiplied to such an extent as to have inspired the whole of Christendom with horror and fear. The disgust and terror which it evoked roused the whole populations of these parts to drive the unfortunate lepers from their midst. The genius of Christianity, fortunately, was true to itself, and tempered this act by providing 'lazar-houses' for the reception of the unfortunate outcasts. The leper everywhere was met with the cry of 'unclean,' and to touch him was considered an act which only supernatural faith could inspire.

This was followed by another circumstance of enormous importance to us in the present day, who have to deal with countries in which leprosy is now as great a scourge as it was in Europe at that time.

With extraordinary rapidity, considering the nature of the infirmity, it began to disappear simultaneously with the adoption of the strict measures that were put in force, the disappearance being as rapid and complete as the onset of the disease amongst the populations had been swift and intense.

In the outline which we have given of the history of the malady, we have endeavoured to bring these facts into the relief which they deserve. Briefly summarised, they show that close contact with leper people spreads leprosy; when these are regarded with horror, and contact is avoided, the disease dies out.

CHAPTER II.

GEOGRAPHY

LEPROSY is known to exist at present, or in comparatively recent times, in the following parts of the world. We have purposely omitted references to cities such as London, Paris, and New York, in which there are always a certain number of lepers, because the disease is in no sense endemic in such cities. The lepers who are there have come from abroad for treatment, and a certain number of cases remain as paupers, on account of their homeless and friendless condition. In many of the parts named the number of lepers bears a very small proportion to the population, there being sometimes only a few isolated cases in a populous country.

In reference to some of these countries we shall add explanatory remarks.

The following is a list of the places in which leprosy occurs:—

EUROPE.

ITALY,	Piedmont, Varazze, Comachio, Venice, San Remo (1885), San Remolo, Ponente, Bologna.
RUSSIA, ¹	Kherson (10), Quralsokoi, Astrakan (94), Bolschwing, Struve, Esthonia (26), Livonia (276), Courland (79), Kuban (110), Don Cossacks (54), Terek (29), East Coast of Siberia (2), St. Petersburg (17),

¹ In the middle of the eighteenth century leprosy was very prevalent in South Russia; and the appearance of leprosy in the Cossack Brigade of the Volga, resident in the Caucasus (1792), coincides with the migration of several families coming from the regions of the Volga and Don.—*La Chronique des Archives de Moscou.*

RUSSIA,	Taurida (3), Caspian Territory (3), Kovno (3), Tver (3), Vitebsk (3), Kharkov (2), Saratov (2), Archangel (2), Finland (2), Cronstadt (1), Novgorod (1), Mogilev (1), Ekaterinoslav (1), Patigorsk, Caucasus, Crimea, Warsaw.
GREECE,	Acarnani, Etolia, Laconia, Messinia.
TURKEY,	Macedonia, Roumelia, Constantinople, Mouth of Danube (seldom), Thessaly.
SPAIN,	Carthagena, Catalonia, Valencia, Asturia, Galicia, Andalusia, Grenada, Malaga (Olavide estimates the number in Spain at 1000 to 1500).
PORTUGAL,	Lafoes, Babas-beira, Estramadura, Algarva, Lisbon.
FRANCE,	Belle Ile-en-Mer, Riviera, Delta of the Rhone, Provence, Nice.
SWITZERLAND,	Mont d'Or.
NORWAY,	About 1500 in 1884. Since 1885, isolation enforced by law.
SWEDEN,	Few.
HUNGARY.	
GALICIA,	Very few.
ICELAND,	About 100.
MALTA,	73.
SICILY,	About 100.
IONIAN ISLANDS,	Cephalonia, Corfu.
GRECIAN ARCHIPELAGO,	Cyprus, Rhodes, Scio, Mytelene, Samos, Crete.

ASIA.

CHINA,	Cochin China, Annam, Tonquin, Siam, Burmah.
INDIA,	British Burmah, Hindostan and neighbouring islands, Ceylon,

INDIA, Thibet, Kashmir, Malacca, Penang,
Prince of Wales Island, Singapore,
Java, Philippines, Sumatra, Bor-
neo, Islands of Sunda.

ARABIA.

ASIA MINOR.

PERSIA.

PALESTINE.

TURKESTAN, Bokhara, Samarkand.

SYRIA,

ALEUTIAN ISLANDS.

KAMTSCHATKA.

JAPAN.

AFRICA.

NORTH AFRICA, Morocco. (If it exists at Tunis and
Algiers, it is rare.)

SOUTH AFRICA, Cape of Good Hope, Natal, Trans-
vaal.

EAST AFRICA, Mozambique, Zanzibar.

WEST AFRICA, Senegambia, from Sierra Leone to
Congo Coast, Gold Coast, Benin;
Niger, and Gaboon lands.

CENTRAL AFRICA, Sesheke.

EGYPT, Cairo.

ABYSSINIA, (?).

NUBIA.

DARFUR.

SOUDAN.

MADAGASCAR, ST. MARIE, BOURBON, MAURITIUS, SEYCHELLES,
ST. HELENA, AZORES, MADEIRA.

NORTH AMERICA.

NEW BRUNSWICK, Nequac, Tracadie, Caraquet (since
1815).

UNITED STATES, Louisiana, South Carolina, Mary-
land, Minnesota (Norwegians),

UNITED STATES, . . .	California (Chinese, chiefly in San Francisco ¹), Wisconsin, Michigan, Oregon, Texas. (Chiefly Louisiana.)
CENTRAL AMERICA, . . .	Mexico, Guatemala, Costa Rica, Cartago, San Jose.
WEST INDIES, . . .	St. Lucia, Antigua, St. Kitts, Nevis, Montserrat, Virgin Island (Tortola), Jamaica, Cuba, St. Bartholomew, Guadeloupe, St. Vincent, Barbadoes, Trinidad, Porto Rico, Jungfernbago, Dominica, Martinique, Grenada, Tobago.
ISLANDS	Bermuda, Bahamas.

SOUTH AMERICA.

COLOMBIA,	Bogota, Socorro.
ECUADOR,	Quito.
BRAZIL,	Bahia.
DUTCH GUIANA,	Surinam.
BRITISH GUIANA.	
NEW GRANADA.	
VENEZUELA.	
PARANA and URUGUAY.	

AUSTRALIA.

VICTORIA,	Ballarat, Castlemaine, Melbourne (1888), Beechworth.
QUEENSLAND,	Cooktown.
NORTH AUSTRALIA,	Haugibauji.
NEW SOUTH WALES,	A Lazaretto, near Sydney.
NEW ZEALAND, SANDWICH ISLANDS, NEW CALEDONIA, SAMOA, FIJI ISLANDS.	

¹ In 1883 it was reported that in the leper hospital at San Francisco 52 cases had been admitted in 10 years, all of whom, with a single exception, were Chinese, and no case had been reported of a native citizen of California acquiring the disease.

INDIA.

It is a matter of notoriety that India is one of the great homes of leprosy, perhaps the greatest. Possibly China may rival her. Vague and widely differing estimates have been given regarding the number of lepers in our Indian Empire, but it is, we are satisfied, impossible even to approach accuracy in forming these estimates.

Mr. Macnamara, whose opinion, from his well-known experience of India, and accurate knowledge of the disease, and also from the fact that he has specially studied leprosy in its wider aspects, is entitled to the highest respect, replies as follows to our inquiry:—

‘I am convinced that it is impossible for any one to say approximately the number of lepers in India. All such information is obtained through the police, who have no better idea what leprosy is than our own police. You may safely assert that leprosy is common throughout the whole of Hindostan, and no part of India is free from the disease. In some districts it is much more common than in others, but all are affected. There is no restriction as to lepers associating with healthy people—that is, legal restriction, but the natives are more or less careful to avoid lepers. The native custom and law were much more strict in this respect before we took India, and altered the laws and much of the custom of the country. How far this has tended to produce the extension of the disease we cannot say, but those best acquainted with the matter are under the impression that it has spread slowly but surely of late years.’

An attempt has, however, been made to estimate the number of lepers in British India. In response to an official inquiry, Mr. Mackenzie, the Secretary to the Government of India, reported to the Minister of Foreign Affairs, Honolulu, in October 1885, that ‘leprosy prevails to a greater or less extent throughout British India, and that there seems to be three centres of comparatively intense prevalence, viz.:—

- (a) The Beerbhoom and Bancoora districts in the Lower Provinces of Bengal;

- (b) The Kumaun district in the North-Western Provinces;
 (c) The Deccan and Konkan in the Bombay and Madras Presidencies respectively.

He gives Tables showing the number of leprous persons, and the proportion in the three Presidencies, together with the total population on which the ratios have been calculated.

TABLE I.

	Total Population on which the Leper Ratios have been calculated.	Total Lepers.	Proportion of Lepers in every 10,000 of the Population.
Bengal Presidency, . . .	156,201,210	98,017	6·3
Madras do. . . .	31,170,631	14,525	4·7
Bombay do. . . .	23,395,663	12,382	5·3
Grand Total in British India,	210,767,504	124,924	5·9

‘These statistics cannot be accepted as absolutely correct, because the registration of lepers in general census operations is liable to error for the following amongst other reasons:—

- (a) That Leucoderma is apt to be classed with leprosy;
 (b) That the disease is not recognised by natives until it is at an advanced stage; and
 (c) That affected females of the house are carefully concealed, the disease being, in some parts of the country, regarded as one which entails disgrace.’

TABLE II.—SHOWING THE DISTRIBUTION OF LEPERS IN BRITISH INDIA.

DIVISIONS.		Total Number of Lepers.	Proportion of Lepers in every 10,000 (ten thousand) of the Population.
BENGAL AND ASSAM—			
Bengal Proper	Burdwan,	14,426	19·5
	Presidency,	5,633	6·9
	Rajshays,	7,170	9·3
	Dacca,	4,934	5·7
	Chittagong,	1,473	4·1
Total,		33,636	9·4
Behar	Patna,	8,343	5·5
	Bhaugulpore,	5,060	6·3
Total,		13,403	5·8
Orissa,		4,661	12·5
Chotta Nagpore,		2,274	5·4
Assam,		3,314	6·8
Feudatory States,		2,549	9·0
Total,		59,837	8·6
NORTH-WESTERN PROVINCES—			
Meerut,		1,692	3·3
Rohilkhund,		2,984	5·8
Agra,		843	1·7
Jhansi,		412	4·1
Allahabad,		2,199	3·8
Benares,		3,559	3·6
Kumaun, with Garhwal,		1,690	16·2
Feudatory States,		433	5·8
Total,		13,812	4·1
OUDH—			
Lucknow,		1,419	5·4
Rai Bareli,		1,107	4·0
Fyzabad,		1,032	3·2
Seetapur,		885	3·2
Total,		4,443	3·9
BERAR—			
Berar,		3,748	14·0
CENTRAL PROVINCES—			
Nagpur,		2,489	8·4
Jubbulpore,		624	2·8
Narbada,		930	5·2
Chattisgarh,		2,400	5·2
Total,		6,443	5·6

DIVISIONS.		Total Number of Lepers.	Proportion of Lepers in every 10,000 (ten thousand) of the Population.
PUNJAB—			
	Delhi,	666	3·5
	Hissar,	337	2·6
	Umballa,	819	4·7
	Jullundur,	1,844	7·6
	Amritsar,	1,081	4·0
	Lahore,	338	1·5
	Rawal Pindi,	1,158	4·6
	Mooltan,	215	1·3
	Derajat,	153	1·9
	Peshawar,	269	2·3
	Feudatory States,	2,854	7·4
	Total,	9,734	4·3
GRAND TOTAL in Bengal Presidency,		98,017	6·3
MADRAS PRESIDENCY—			
Sea-Coast Districts.	Ganjam,	963	5·5
	Vizagapatam,	856	3·4
	Godavari,	1,037	5·8
	Kistna,	626	4·0
	Nellore,	396	3·2
	Madras City,	435	10·7
	Chingleput,	984	10·0
	South Arcot,	1,208	6·7
	Tanjore,	1,072	5·0
	Madura,	812	3·7
	Tinnevelly,	802	4·7
	Malabar,	1,208	5·1
	South Canara,	909	9·5
	Total,	11,308	5·3
Inland Districts.	Kurnool,	246	3·5
	Cuddapah,	210	1·9
	Bellary,	356	2·7
	North Arcot,	1,161	6·4
	Salem,	363	2·3
	Coimbatore,	241	1·5
	Nilgiris,	58	6·4
	Trichinopoly,	495	4·1
	Puducottah Territory,	87	2·9
	Total,	3,217	3·3
GRAND TOTAL,		14,525	4·7

DIVISIONS.		Total Number of Lepers.	Proportion of Lepers in every 10,000 (ten thousand) of the Population.
BOMBAY PRESIDENCY (Collectorates)—			
Deccan.	Khandesh,	1,748	14·1
	Nasik,	593	7·6
	Ahmednagar,	765	10·2
	Poona,	1,088	12·1
	Satara,	1,179	11·1
	Sholapur,	401	6·9
	Belgaum,	289	3·3
	Dharwar,	162	1·8
	Kaladgi,	190	3·0
Total,		6,415	8·3
Konkan.	Kanara,	54	1·3
	Ratnagiri,	928	9·3
	Kolaba,	432	11·3
	Bombay,	430	5·6
	Tanna,	749	8·2
Total,		2,593	7·4
Gujerat.	Surat,	383	6·2
	Broach,	82	2·5
	Kaira,	199	2·5
	Panch Mahals,	70	2·7
	Ahmedabad,	72	·9
Total,		810	2·8
Sind.	Kurrachee,	88	1·8
	Haidarabad,	91	1·2
	Thar and Parkar,	12	·6
	Shikarpur,	69	·8
	Upper Sind Frontier	17	·14
Total,		277	1·1
Feudatory States,		2,287	3·3
GRAND TOTAL,		12,382	5·3

The above tables must, of course, be read in the light of Mr. Macnamara's letter, but they are nevertheless noteworthy

as an attempt, authoritatively and recently made, to deal statistically with a large and very important question.

To illustrate the extent to which leprosy prevails in some districts, we quote Vandyke Carter. The figures have unusual value, being the result of the personal inquiries of a highly skilled observer, equally qualified by his knowledge of the disease and of the country as well as of the habits of the people.

In a tour which he made in the Bhaonogar State, Bombay Presidency, in 1876, Dr. Vandyke Carter personally inspected 237 lepers in 77 villages, and on adding other localities and subjects, he found that he saw 271 lepers in 118 villages. In conformity with what is known of the general history of the disease all over the world, he states that from certain large towns it seems to have radiated along lines of intercourse, and not indiscriminately. He found that a third to one-half of all villages in a certain district were affected with leprosy; that altogether there were nearly two lepers to every 1000 inhabitants, including children (who are rarely lepers); and in infested villages the proportion was as high as 1 in 200 or 300 people, or 1 in 80, or even 1 in 50. As usual, the larger proportion were males, of whom there were, in 262 cases, 206 males and 56 females.

CHINA.

Whilst it is well known that leprosy has long existed, and still exists, in China, and that the Chinese are considered, with justice, to be a leprosy-infected race, there is comparatively little authentic information regarding the extent to which the disease prevails in the Celestial Empire. It is not infrequently stated that leprosy prevails over the whole of China, but this may be seriously doubted, and at all events is certainly not proved.

There are many parts of that enormous empire regarding which we have exceedingly little information of any kind, far less of the diseases which prevail in them. It is certain that leprosy does not prevail in the north of China to anything like the extent to which it prevails in the south-eastern parts, and it is very probable that it occurs in the neighbourhood of Canton, Amoy, and adjacent districts, to a much greater extent than it does in any other parts of the Empire.

In order to make, at all events, a beginning in endeavouring to get more information than we at present possess regarding the distribution of leprosy in China, we have applied to medical missionaries resident there, and we are able to present the valuable information received in the replies which were kindly sent to us by these gentlemen. Before, however, referring to these letters, it will be convenient to give an abstract of the information which we have been able to extract from the excellent *Epitome of the Reports of the Medical Officers of the China Imperial Maritime Customs Service, from 1871 to 1882*, compiled by Surgeon-General Dr. Gordon, C.B.

Peking.—Dr. Dudgeon of Peking, March 1875, reports that a case of tubercular leprosy occurred in a Chinaman aged thirty-five, the disease having begun three years previously.

Chefoo.—In the period to March 1872, ten or twelve cases of leprosy occurred, presenting the ordinary features of the disease.

Kiukiang.—In the report for the year ending March 31, 1881, among 1420 native patients, only three cases of leprosy were met with.

Hankow.—In 1871, of 57 cases recorded 55 were males, 2 females. The disease chiefly affected residents in the country. Leprosy had occurred in three native immigrants after residence of 10, 12, and 19 years, while their brothers and sisters, who remained in their own part of the country, continued healthy.

In the report for the six months to September 1872 particulars are given of eight cases of leprosy in its anæsthetic form and as elephantiasis (*Græcorum*). A few lepers are found in the cities, but not, as far as Dr. Reid is aware, among families who have resided in towns over two generations. Many of the offspring of lepers escape the disease, although all are alike exposed to contagion.

Shanghai.—It is stated that it is only since direct traffic by sea and land with the south has become constant and easy that syphilis and leprosy have spread in the Shanghai district.

Wenchow.—Dr. Macgowan gives a record of epidemics in China, in which leprosy is stated to have prevailed as an epidemic on four different occasions. Fukien, to the south, and yet more Canton, further south, are the seats of the malady.

Amoy.—Leprosy prevailed extensively in 1871. Of the patients who applied to the native hospital, seven per cent. suffered from leprosy in some form.

Taiwan Foo.—In the report to September 1871 it is stated that the disease is by no means uncommon.

Canton, 1871.—Leprosy in both forms is common among natives. No European has been known to be affected by it. Stated that only one European at all the Treaty ports has been heard of as being affected with leprosy. He was an old resident in the Canton district, and was much in contact with natives. He had in his house a native assistant, who was a leper. During five years master and assistant lived much together, and the former then became attacked with the disease in the feet, the Chinese attributing his attack to infection. The wife of another native assistant living in the same house became affected.

Hoihow.—During the six months ending March 31st, 1881, a large amount of leprosy was reported as existing in the neighbourhood. An instance is reported in which a young mother, observing symptoms of leprosy in herself, committed suicide by taking poison. Her child was allowed by her relatives to die of neglect.

The following information has been received from medical men resident in various parts of China, with whom we communicated in 1890:—

Dr. Cantlie, in his interesting book, *Leprosy in Hong-Kong*, states that lepers in China are driven from their relations and friends because they have the disease, and seek refuge in Hong-Kong in preference to entering one of the wretched villages on the mainland. There being no law against the importation of lepers, nor against begging in Hong-Kong, the streets of the city, with its rich inhabitants, are as an El Dorado to the leprous Chinamen. This immigration of lepers into Hong-Kong continues, in spite of regulations intended to keep the colony free from lepers. Up to 1876 leper families in communities settled on the hillsides above the town of Victoria, Hong-Kong, where they had maintained themselves from 1841 and upward. About 1876 the lepers were expelled to the mainland, and it is understood that whenever a leper is reported, the police shall

arrest him. He is examined by the Colonial surgeon, and, if expedient, sent to the mainland; notwithstanding which, within two years and a half, 125 lepers came to one hospital for treatment. The native guilds of Hong-Kong send lepers, as soon as they are discovered, to some one of the leper villages near Canton. Dr. Cantlie adds that the combined efforts of both British and Chinese authorities are not sufficient to prevent the import of lepers. Even monetary compensation is offered to induce them to leave, but not always successfully. This is only one illustration of the almost insuperable difficulties that any Government will meet with in countries where leprosy is common, when it attempts to enforce complete isolation.

Dr. Cantlie believes that leprosy is endemic in every district in China, and that the Chinese dread lepers and avoid them systematically, or expel them from their midst. Two Chinese doctors of the Tung Wa Native Hospital in Hong-Kong, in reply to questions submitted to them by Dr. Cantlie, stated that the Chinese consider leprosy 'both contagious, infectious, and hereditary,' that they would not permit a leper, even if the son of rich parents, to remain in the neighbourhood, and that the best method of dealing with lepers when they present themselves is to compel them to go to the leper village in Canton. They state (what we believe must be considered as the Chinese theory, but there is no proof that it is carried out in practice) that every district in China has its leper home, the inmates of which receive an allowance from the Government, and have land to till. To show the prevalence of leprosy over a wide area in South-east China, Mr. Cantlie supplies a table which shows that forty-one districts contributed to furnish 125 cases.

Mr. Jeremiassen, writing us from Hainan, states that leprosy is found throughout the whole Empire of China; that he himself has seen it in all the sea-coast provinces from north to south; that the disease is found among all classes, but naturally most among the poor. He states that leprosy is generally considered contagious among the Chinese, but that lepers are often found living amongst the family during the first stage.

Lepor villages are regularly established in different parts

of the country. Generally near cities one or more lepers will be found outside the city wall; still they are not excluded from visiting the city, where one daily finds them going from house to house begging.

Mr. Jeremiassen forwarded us an excellent photograph of two men and one woman, sitting outside the city of Kiung-Chow, on the main road, begging, showing the mutilations of nerve leprosy, the expression on their faces typifying the characteristic stoical *sans souci* of which the Chinese are pre-eminently capable.

Dr. Ker states that leprosy is very common in Canton, and in the whole province of Kwong-tung. During a residence in Canton of over thirty years, he has seen many cases of leprosy in well-to-do families. A millionaire in this city is said to have died of leprosy.

Leprosy is regarded as contagious, and the people avoid contact, but lepers are allowed to go about without restriction. As a rule, lepers are excluded from the family. But Dr. Ker has known cases where they were allowed to remain.

Dr. Bransmeren Taylor writes that during a stay of about eight years at Fuh Ning, Fuh Chow, he has only met three cases of leprosy, one of which was doubtful. 'Plenty of leprosy at Lo Nguong, a day and night's journey from here.' Leprosy also found at Fuh Ting and at Fuh Ang, at which latter place there is a leper hospital. Has been told (in regard to his inquiries as to the reason of the scarcity of lepers in one neighbourhood) that about sixty years ago a mandarin, having heard leprosy was infectious, determined to stamp it out. He invited all the lepers to a great feast in the hospital (in a small village about a mile outside the city of Fuh Ang), surrounded the place with soldiers, and then set a light to it. Since then the cases have been few. If a man is known to have leprosy, he is at once sent off to the hospital at Fuh Ang.

Dead lepers are considered very contagious. If a leper is about to die, he is removed, if possible, to some small out-house. Contact with lepers is avoided as much as possible.

Dr. Fahmy writes that leprosy is found in Ang-ki, Lai-na, Sin-ckhu, Chhoa-khin, Am-e, Zug-than, etc., all

belonging to the Chiangchin region, and from all which he had leprous patients. Dr. Fahmy names districts from which leper patients have come to him, all being in the Chiangchin region. Had only four cases amongst well-to-do Chinese. (In this region only about 1 per 1000 are well-to-do, and this may perhaps account for their paucity.)

The majority regard it as non-contagious, but hereditary; while some, for fear of contagion, try to avoid contact with *pronounced* lepers. A child, it is said, is never born with leprous symptoms, but at a certain age he may manifest the disease.

Only one case is known to him in which the wife is said to have got leprosy from the husband. It is almost universally affirmed that the wife escapes.

Dr. Cantlie writes that, as regards Amoy, Hong-Kong, and Pakhoi, he had not met with any cases amongst well-to-do people of these localities, but believes that the disease occurs in this class in Hong-Kong.

Leprosy is considered as contagious, and contact with lepers is avoided as much as possible.

Dr. M'Phun writes that leprosy is found in the Swatow district among the hills and on the plains; that cases of leprosy in these districts are found amongst well-to-do Chinese; and that leprosy is there regarded as contagious, and contact with lepers avoided. If a member of a family contracts it, he has to eat and sleep alone.

Contagion thought to be in the excretions, secretions, etc., of the body, or the saliva, fæces, urine, breath.

Dr. David Grant has seen cases of leprosy in Canton, Swatow, Amoy, and Foochow.

In the Amoy region he has observed cases of leprosy in all classes of society, and it is not more common amongst the very poor than among the well-to-do working class and farmers.

Leprosy is not regarded by the people as contagious, and contact with lepers is not avoided.

Dr. Gillison states that leprosy is found in the province of Hupeh, Central China, in which Hankow, his sphere of labour, is. He believes that it is also found in nearly all, if not all, the provinces of China.

He has met with the disease in people in comfortable circumstances, and also among the poorer classes; also among farmers, etc.

The idea of contagion does, he states, certainly exist. There is great carelessness in regard to contagion. This, however, is true in regard to other contagious diseases.

Dr. Anderson writes that leprosy is found throughout Formosa, except in the hill districts, where the aborigines reside. He has never seen or heard of a case among the latter.

Cases of leprosy are found but rarely amongst Chinese who are well-to-do. He has seen perhaps twenty such lepers in the course of ten years.

The disease is not considered contagious, and contact with lepers is not avoided. The only qualification is as regards the advanced stage of ulcerative leprosy. The individual often gets a wide berth in that case. Otherwise the Chinese are wonderfully apathetic as to lepers and leprosy, and most of them seem to regard it as an ordinary skin affection. Lepers are employed in the various occupations. He even knows some who are cooks.

Dr. Boone states that leprosy occurs amongst the natives of Shanghai, and he has seen a case of leprosy in a teacher, a man above actual want.

The natives do not regard it as contagious, and do not isolate lepers.

Dr. Roberts states that leprosy is found at Tientsin. All the cases he knows of were among the poor.

The people do not regard it as contagious, and contact with lepers is not avoided. (This, he believes, is due to the rarity of the disease in these parts, and the ignorance of the people concerning its nature.)

Dr. Douthwaite, of Chefoo, writes that he has no doubt the disease is contagious, but that contact with it is necessary for its production.

He states that leprosy is found in the provinces of Cheh-Kiang and Shan-tung. He has practised for eight years in each of these provinces, and has met with many cases, and from information gathered from friends in other parts he has reason to believe that it is found in all divisions of the country, but more in the southern than in the northern provinces.

All lepers who came under his notice have been of the poorer classes, chiefly farm-labourers and coolies; but his Chinese teacher assures him that it is by no means rare among the well-to-do people, who are not often seen among the patients at a mission hospital.

Leprosy is regarded by all intelligent people as contagious, and as soon as the disease is recognised, contact with the sufferers is avoided as much as possible. In some places a leper would be refused admission into inns and boarding-houses.

In Shan-tung, Dr. Hunter (*Chinese Times*) states that leprosy is seldom seen, and where it does exist it is mainly anæsthetic. But in the prefectures of Ti-chou Fu and Yen-chou Fu, leprosy is quite common. The majority of cases met with in missionary hospitals throughout the province come from these two prefectures, the one including the home of Confucius, and the other, Yi-chou, lying to the south of it. The cases exhibit all the characteristics of true leprosy, and often in the extreme stage. It is not uncommon for villages in Ti-chou prefecture to have several lepers.

Dr. Pritchard writes: 'My personal experience extends little beyond Peking and the surrounding country, within a radius of sixty English miles. Many people from various parts of China, visiting the capital, come to this hospital, also a few Mongols, Coreans, etc., but amongst them all, during four and a half years, I have not seen a single case of leprosy. We see about 20,000 patients in the course of the year.'

Dr. Cameron, writing from Chong-King, states that leprosy prevails in Canton, Sien-chow prefecture, Pakhoi, and about there. He travelled overland from Pakhoi to Canton, and saw a good many cases *en route*.

Shan-tong.—In Chefoo he saw a good many from the district, and from parts at some distance from the ports.

Hupeh.—In Wuchang-fu he saw one case. The patient was a native of An-heui.

Sze-chuan.—He has seen only a few cases in this province, —in (1) Chong King-fu; (2) Ho-chow; (3) Joh-chi; (4) Ghan-chu; (5) Ping-chow; and (6) Lanchuan: *i.e.* six districts, including Chong King-fu.

Pa-Hsien.—Most of the lepers seen in this province came from the above-named districts to him for medicine, etc.

He has only seen leprosy amongst small farmers and labourers. He has seen many lepers who were beggars, especially in the south of China.

He believes it is not regarded as contagious, and he has not seen lepers avoided in any way. He refers to the *China Medical Mission Journal*, September 1890, for further information. There is a Chinese proverb, 'With a leper you sleep in the same bed, but don't stay opposite the door of one who has the itch.'

Dr. Parry writes from Chentu that, so far as his own experience goes during three years in Chentu, he cannot recall any case of true leprosy.

For the following we are indebted to Sir Halliday Macartney, who made inquiries on our behalf from members of the Chinese Legation, his own experience of China being large and valuable.

He informs us that leprosy is essentially a disease of the poorest of the poor, and is not found amongst people in comfortable circumstances. The Chinese have a superstition that it is restricted to those parts of China where the 'lichi' grows; but Sir Halliday has seen a good deal of the disease both at Soochow and Nankin, where the 'lichi' does not grow.

He informs us that there is no law of any kind which forbids marriage of lepers to each other, or to healthy persons, and states that at Canton they are hunted out by their neighbours and compelled to take refuge in the leper villages, unless they are rich enough to pay their neighbours bribes for permission to remain at home.

The Chinese distinguish between white leprosy and tubercular leprosy. They profess to be able to tell when a man is suffering from 'white leprosy'—even when it is covered up—by examining his face. They have a certain kind of paper called 'the leper test paper,' *yen fung chi*, which they use for diagnosis. They burn this paper, and whilst it is burning hold it opposite to the face of the suspected person, professing to be able to tell by its effect on the face whether or not he is leprous.

The Chinese believe that leprosy is frequently communicated by sexual intercourse, and that it is otherwise contagious.

In the leper settlements children appear that are perfectly

healthy; but it is believed that they are capable of communicating the disease, and that they themselves will eventually have it in a milder form. The Chinese also believe that even the third generation will have it, but not in a communicable form.

Sir Halliday states that at Nanking lepers are not separated, and he was informed by a Pekingese that there were no lepers at Peking.

The venerable Dr. Lockhart, of Blackheath, who has had a long and useful career as a medical missionary in China, and to whose opinion on medical questions much value should be attached, states that there was no leprosy at Peking during the time of his residence there; the diseases which chiefly prevailed being goitre, typhoid fever, small-pox, congestion of the lungs, and phthisis.

By the kindness of correspondents with whom we were in communication in 1890, we are able to give the following information regarding the existence of leprosy in various parts of Asia, where, although leprosy is known to exist to a greater or less extent, recent exact information appeared to us to be not unwelcome.

Some of these letters—that of Mr. Paul in reference to Thibet, for example—contain information which we believe to be as important as it is new.

Mr. Paul writes on November 3, 1890, from Gantok, in Sikkim: “Mdze-nad” (pronounced “ze-ne”) is a generic term signifying “cancerous or corroding disease,” hence vulgarly “leprosy.” The word “nad” means “disease,” pure and simple, without specification. According to Tibetan medical works, there are eighteen different kinds of “corroding” diseases included in the generic term “mdze-nad.” (By “corroding” I mean any disease that eats away the flesh or tissues.) The most deadly is “Ikok-mdze” (pronounced “ko-ze”), or cancer of the throat. True leprosy is specifically styled “skam-mdze” (pronounced “kum-zé”), the “dry corroding” disease, and is marked by the gradual dropping off of joints, the disfiguration of the face, destruction of the cartilage of the nose, etc. As far as I can ascertain, it is not considered “contagious,” but most undoubtedly hereditary. This statement must, however, be qualified by an opinion of one of my informants that

formerly it was not contagious, but is so *now*. On the other hand, another person points out the case of a husband who has lived ten years with a badly leprous wife, and has not developed the disease. I am told that in Tibet there is less leprosy (*pro rata*) than in Sikkim, as the former country is much colder. In neither country is leprosy very prevalent. In the plains of India I have seen many hundred cases of leprosy, but never one amongst Tibetans or Sikkim Bhooteas. The disease, therefore, is not conspicuous amongst those of Tibetan origin. In Sikkim the disease is said to have greatly diminished, owing to the father of the present Raja, *i.e.* Naga Cho-phoe Namgyel, having ordered all lepers to live apart from their fellow-villagers, and, as respectable people of sound family will not intermarry with actual lepers, either in Sikkim or Tibet, the disease does not spread, and the leprous families gradually die out. The Tibetan medical treatise, "s-Man-r-Gyua," contains an account of the eighteen diseases. I would, however, refer you to an interesting account by Baboo Sarat Chandry. The Tibetans have a method (the Pon method) of curing leprosy by incantation. Among the eighteen kinds are also included elephantiasis (Lon-mdze), that is, the wet disease, but not goitre. Small-pox and venereal disease are however included. Lepers in Tibet are looked upon as "g-Dol-pa," or outcasts of the lowest and most despised class.'

KASHMIR.

Dr. Neve states: '(1) We hold that the different forms of leprosy are identical in origin. (2) Heredity may be regarded as predisposing. (3) All leprosy is derived from a specific element which cannot arise *de novo*, but only directly or indirectly from other leprous human beings. That the lepra bacillus is always present. That the incubation is so long, that a few positive instances of inoculation or contagion outweigh an immense amount of negative evidence. That inoculation might not be associated with any primary sore.'

Localities in Kashmir where leprosy is known to exist.—
'In fringes of mountains, separating Kashmir from the Punjab. Less among villages of the plateaux, still less in the alluvial plain. Scarcely at all in hilly districts to N.E. among

the Balti or Ladatch tribes (Tibetan). These districts are colder than those where leprosy is found.' Refers to article in *British Medical Journal*, vol. i. 1890, by Dr. Neve, and *Lancet*, 1889, vol. ii. pp. 900, 999.

'Has only known two lepers of good position; but the majority of the diseased are fairly well off, well-clad, and have plenty to eat.

'When purely anæsthetic, the disease is not recognised; nor when macular unless pigmented. When tubercular and mutilating there is certainly a prevalent fear of coming into close contact with it. Hence badly diseased lepers are sometimes cut off from their relatives.'

Dr. Karl Marx, Leh, Ludakh, writes that 'leprosy in the districts whence patients come to Leh is only found in Purig (district crossed by the Kashmir road between the Indus and the Zojila, about seven stages along the road. At the Zojihau-la, Kashmir is entered: the district commences at the fifth stage from Leh; it extends north and south of the road up and down the various valleys). Leprosy occurred in about ten cases within the last four years, all patients from Purig. As to nationality, only one was a Bot, three were Daws, the rest men of the Purig tribe proper. Leprosy is also known in Tibet. In Lhasa itself there are said to be about twenty-five to thirty living outside the city in separate hovels built of horns. In Ladakh the disease does not occur.

'The patients who came to Leh for treatment were poor, but not poorer than most people here. Poverty is universal, and well-to-do people, according to European and Chinese ideas, are almost unknown, or certainly very scarce, and even such as could afford to live comfortably frequently live like paupers.

'In Lhasa contact is avoided, though not really dreaded. There the disease is considered contagious. In Ladakh people are not sufficiently acquainted with the disease, and do not avoid contact.

'In Purig people are not particular about it, and probably do not consider it contagious.'

BILUCHISTAN.

Dr. Jukes writes that 'in ten years' medical practice west of the Indus, lat. 30 N. for a distance of 200 miles north and

south, and 100 miles east and west, I do not remember to have seen more than three or four cases of leprosy. I know of no locality in which it exists in Biluchistan. The cases seen were travellers or Faquirs. It is a rare complaint here. The number of patients seen in ten years is over 40,000, so that the proportion is about 1 in 10,000 patients.

‘I have seen no cases in well-to-do people.

‘Contact with lepers is certainly avoided, but not more so than syphilis, which is here recognised as contagious in the same sense as leprosy is at home.

‘I visited the leper asylum at Taran-taran, in the Amritsar district, and the native doctor in charge told me he did not consider it contagious, and gave instances where healthy women had married lepers, and had remained for years without showing any signs of it.’

JAPAN.

St. Francis Xavier is stated to have cured lepers in Japan in 1549, a few years after the discovery of these islands by the Portuguese.

Dr. Wallace Taylor writes that leprosy is found throughout all Japan to some extent, though more in some parts than in others: more in the southern and middle portions than in the northern. There are some villages around Kiyoto, on the west and south, where there are quite a number of lepers. There are more lepers in the Island of Shikoku than in any other part of the country. Along the western and southern portion of Shikoku, and the eastern portion of Kiushin, there are here and there small fishing villages that have a large number of lepers.

He has seen a few lepers of the middle Samurai families; not many, however. He has not known of any cases among the upper Samurai or Royal families, though there may be. Lepers are very largely of the lower classes—the farmers and coolies; a few amongst the merchant classes.

The disease is regarded as contagious, and contact with lepers is avoided. They are careful not to marry into a family where leprosy is known to exist, and careful not to employ a wet-nurse from such a family, or one whose relatives may

have had leprosy. A leper is considered a person to be shunned, although not kept separate.

Dr. Yamamoto, of the Imperial Japanese Navy, informs us that leprosy occurs everywhere in Japan, but is most common in the south. It occurs amongst rich and poor, most commonly amongst the latter.

It is regarded as not contagious, but strongly hereditary; lepers do not intermarry with healthy families. When leprosy occurs in a family, the family conceal it.

In the northern island of Japan there is, as is well known, the descendants of a remarkable race, the Ainos, who in physique, manners, and customs entirely differ from the Japanese. They are looked upon as the aboriginal inhabitants of the islands, and the few that remain in the extreme northern island are the remnants that have been left. They have white skins and long beards, and live by fishing and the chase, keeping themselves entirely distinct from the Japanese, no association taking place between the two races. It is therefore a noteworthy fact that these people, who have no intimate association with the Japanese, have escaped leprosy, whilst the Japanese suffer greatly from it. We have this fact from excellent authority.

The Rev. J. M. Batchelor, who has lived and laboured amongst these people, wrote to our friend, Mr. Consul Hall of Japan, that the Ainos informed him that their people do not become subject to leprosy. 'They have never known a case of leprosy amongst themselves, and only know of the existence of the disease through Japanese reports.'

[This is one more of the remarkable instances on record which show that leprosy is not a matter of climate or soil, but of association with those already affected.]

PHILIPPINE ISLANDS.

Dr. Donelan writes:—'I have myself examined cases in the islands of Luzon, Panay, Negros, and Gurmaras. There exists a leper hospital at Cebu, and I know from other sources that cases are to be found in every other island of the archipelago in which there is any considerable number of inhabitants.

'I have attended wealthy inhabitants, half-castes (China-

Malays), and have known cases in Spaniards of the very best class (a retired judge of the Supreme Court, a clergyman in good circumstances, and a lady of very good position).

'Leprosy is considered contagious. Lepers are driven from the "pueblos," and form in some places "pueblos" of their own, exclusively of lepers or children of lepers. I am inclined to think that the natives have taken this idea from the Spaniards, who consider leprosy contagious and hereditary, but I have known individuals decidedly leprous married or residing with their families.'

Dr. Donelan writes that he has treated a great many cases of leprosy both in Manila and at Iloilo, and states that he has notes of a case caused by inoculation, and another of a child born in the leper hospital, and living there for ten years, who, up to the present time, shows no sign of leprosy.

SIAM.

Dr. Willis writes that he cannot speak of his own knowledge outside of Bangkok, where leprosy is common, but is told that the disease is met with all over Siam. Cases are seen amongst the Siamese, Chinese, and Indians, who live in Bangkok. It would appear to be relatively most common amongst the Chinese, who form a large proportion of the whole population of that city.

Leprosy is met with amongst high and low, rich and poor—the polygamous character of the people, and the existence of slavery amongst them, favouring in very obvious ways the spread of the disease by inheritance. A man may be a prince on the father's side, and a gardener on the mother's.

There is great difference of opinion regarding the contagiousness of leprosy. Amongst the Indians residing in Bangkok great dread exists as to the contagious nature of the disease. Amongst the Siamese and Chinese, in a general way, very little regard appears to be paid to contagion. When questioned, all seem to fear more or less its contagious nature. After death, if a leper is being burnt, according to the custom of the country, care is taken to get to the windward of the pyre, as it is held to be dangerous to inhale the smoke from the burning corpse of the leper. The Chinese greatly dislike to eat with lepers, as the chopsticks which each man uses to convey

food to his mouth are not seldom freely dipped into the dish holding the company's common food supply, which may be easily contaminated with a leper's saliva, if such a one be in the company. Many speak of leprosy as the outcome of transgressions during an existence in the life before the present one. Persons holding such belief seem to have little practical dread of the contagiousness of the disease.

In *Leprosy in Foreign Countries* (Honolulu) Consul A. Kurtzhalss, of Bangkok, writes:—'The Government of Siam does not enforce segregation of lepers, but there exist certain temples here, the priests of which specially devote themselves to attending to paupers and lepers, by supplying them with food and allowing them to camp on the premises of the temple.'

Dr. Gowan, writing of Siam, states that the disease is found in Bangkok, Ratburi, Phetcharburi, Kanburi, Laonchasi, Aynthia, Chantaboon.

Cases in these localities occur amongst well-to-do Siamese.

Leprosy is not considered contagious; contact with lepers is not avoided.

BORNEO.

Dr. Haviland writes that leprosy occurs in Kuching and in Sarawak. The disease is not found amongst the well-to-do inhabitants, who are limited to Europeans and five or six Chinese. The Dyaks live up country, and are not known to suffer from leprosy; certainly it is very infrequent. The Malays are the great fishermen and sailors; leprosy is rare amongst them, but occurs occasionally. Practically, it is confined to Chinese. There are probably not more than 20 or 25 lepers in Sarawak territory. Mr. Kay Tye, the Dispenser in Sarawak for the last twenty-eight years, states, 'The disease is not properly understood or recognised, or considered contagious by Malays or Dyaks. Considered contagious by Chinese.' Contact with lepers is avoided by the better class of Chinese, but not by the poorer classes. The Chinese believe that leprosy was introduced into Borneo by them. Malays and Dyaks refer the spread of such diseases as small-pox and cholera to evil spirits rather than contagion.

Dr. Walker writes that from 1881 to 1890 he had seen

five cases of leprosy in Sandakan, in British North Borneo. Of these one came from Dutch Borneo, two from China, one from the Straits Settlements, and the fifth was developed in Sandakan, but was probably contracted in China. Nationalities: one native of Borneo, one an Eurasian, three Chinese. Classes affected: one shopkeeper, one clerk (Eurasian), three coolies. The disease is not considered contagious, and contact with lepers is not avoided. The disease is not recognised by true natives.

AUSTRALIA.

In the *New South Wales Medical Gazette*, 1873, p. 10, Dr. Cox published six cases of leprosy occurring in persons of European extraction. One was a native of Sydney; the second, a native of Windsor on the Hawkesbury river; the third, a native of Yorkshire in England, who had visited China and India, as a sailor, before coming to Australia; the fourth was a Dutchman; the fifth, a native of Campbelltown; and the sixth, a native of Germany.

In the *Australian Medical Gazette*, February 1890, a case of an American, who had resided in the northern territory of South Australia for upwards of three years, is reported.

The number of lepers under official cognisance in Australia at the close of 1889 was thirty—namely, in New South Wales, twelve Chinese, one Javanese, and two whites; in Victoria, four Chinese; in South Australia, two Chinese; in Queensland, four Chinese, one Malaccan, and one from the Straits; in West Australia, one Chinese; in Fiji, two Fijians, two in New Hebrides, and one Solomon Islander. There was reason to believe that there were several other cases of European parentage not under official cognisance. Of the two cases of European extraction, both being natives of New South Wales, and never out of the colony, there had been communication with the Chinese; but only in one case was there reason to believe that this communication was of an intimate nature.

Two additional cases of leprosy in the white natives of New South Wales were discovered in 1890. One, a man aged twenty-eight, in the Richmond river district, the other a boy of fourteen, who for some time previously had attended the

Balmaine public school. Both patients were sent to Sydney, and removed to the lepers' quarters at the Coast Hospital, where there are now four European lepers segregated.

NEW ZEALAND.

The existence of leprosy in New Zealand is a subject of unusual interest, as it has an important bearing on the etiology of the disease; and, strange as it may seem, its alleged presence in this island has been doubted on very plausible grounds.

If it is an established fact that leprosy has existed, and does exist, in New Zealand, the question arises, Can the disease take its origin spontaneously, and if it cannot, how did it become endemic in that country? It is very desirable, therefore, to consider the nature of the evidence on which the existence of the disease in New Zealand is based.

The only full account of the leprosy of the New Zealanders which we have been able to find is in a paper by Dr. Thomson, surgeon of the 58th Regiment, published in the *British and Foreign Medical Chirurgical Review* for April 1854. Dr. Thomson saw six cases of this disease, and states that Dr. Johnson, colonial surgeon at Auckland, had seen several cases, and thought the malady was a kind of dry gangrene. Dr. Thomson himself considers the affection to be a variety of leprosy, and called it 'lepra gangrenosa.' The New Zealanders themselves called it *ngerengere*. He states that the disease commences with a cutaneous eruption on the extremities, which extends over the trunk of the body. The eruption presents, in some parts, the oval patches and the copious exfoliation of a brown, scaly, morbid cuticle observed in lepra vulgaris (psoriasis), the irregular patches of psoriasis, and, occasionally, the innumerable fissures, the elongated and extensive cracks intersecting each other of ichthyosis. This is accompanied with a pricking and itching state of the skin, of which the sufferers complain much. The eruption goes on for months or years, increasing and decreasing, and disappearing partially or entirely. Imperceptibly, and without the knowledge of the sufferer, the hair on the eyebrows, the eyelashes, whiskers, and beard falls out; not the hair on the

head, the axillæ or the pubes. The tattoo marks are not affected. The skin over the whole body, but more particularly on the face, assumes a livid pale colour, the eyeballs become prominent, and a copious discharge of tears flows from them. The voice changes its tone, the face, nose, lips, forehead and eyebrows become swollen and shiny; but there are no tubercular deposits in them. The skin is dry and harsh to the touch, and at no time, when free from dead cuticle, is it destitute of sensation. The least pinch or puncture on the skin is immediately felt. Although the sufferer eats well and sleeps well, yet the New-Zealanders—sharp observers—soon perceive the horrid expression which their brother's face is assuming, and they at once detect the nature of the awful malady which afflicts him. In about a year, it may be more or less, from the appearance of the eruption, a small boil, blister, or dry crack appears in the direction of a flexure on the last joint of some of the fingers or toes. The soft parts ulcerate by a dry process, the phalanx falls away and the part heals. Each revolving year carries off by a similar process one or more of the joints of the fingers or toes. There is sometimes pain, or an uneasy feeling in the absorbents, which extends along the limb from the dying member; but generally there is little or no uneasiness. Nature, in this case, carries on her amputations without pain or loss of blood, as if she were anxious to avoid aggravating the mental torture which such a malady must produce. The healthy toes and fingers are dry, shining and scabby-like. They are as warm as the other parts of the body; but from being kept bent, the skin and tendons appear to contract, and the fingers are stiff. Dislocation at some of the joints takes place occasionally before the ulcer appears externally. On separation the bone is found dry and dead. The pulse beats at the wrist, and although the acute sense of touch in the fingers is injured, still feeling is not gone unless in the fingers about to drop off. Sometimes a paronychia of the hand occurs, and the limbs swell greatly, but generally there is no swelling of the legs or arms during these amputations. Three, four, or more years may elapse before the whole toes or the fingers are amputated. Nature appears to be satisfied with the phalanges, tarsal, metatarsal, and carpal and metacarpal bones. Death is generally hastened by an attack, or

by several attacks, of bronchial inflammation or diarrhœa. The pulse is generally between fifty and sixty, the tongue is moist and clean, and digestion goes on regularly; but the action of the skin is generally suspended. The health does not appear to be impaired, and the body keeps up its usual weight. In one fatal case, before the gangrenous stage had commenced, the urine was albuminous and low in specific gravity. Dr. Thomson refers to their 'satyr-like' faces, and to one person who had a foolish expression of face; but this facial idiocy did not extend to the mind. The loss of hair on the face, the swelling of the forehead and the other features, *make it difficult to determine the sex.* He describes a case which is illustrated by a coloured drawing. In this case, amongst other symptoms, there was a copious discharge of purulent matter from a spot in the palm of the right hand, over which there was a scab. The patient had enlargement of the glands of the neck. The first joint of the big toe of the right foot had been swollen. A thick piece of cuticle taken from the part where the toe rests on the ground disclosed *a round deep opening extending into the joint. There was no pain.* The other symptoms described are identical with those in his general description. The disease, he states, rarely or never attacks infants, the youngest person that he had heard suffered from it being a boy aged twelve or fourteen years. *Most of the cases occurred after puberty and under thirty years old.* Five of the six patients he saw were males. Several members of one family had died from it; and it is generally, but not always, fatal, the duration varying from one to five or eight years. When Dr. Thomson observed these cases, it was considered that the disease had become less frequent during the previous twenty years. An intelligent New-Zealander told him he had known ten persons ill with it in one village; but at the time he wrote, if a native were asked if he knew any one ill with 'ngerengere,' he would generally recollect one or two cases. The disease was not confined to any particular part of the country, but was most common among the tribes living in the interior. It was incurable.

Dr. Munro, who refers to Thomson's description, considers that 'ngerengere' may be a peculiar variety of leprosy; but does not consider that it is decidedly proved to be the actual disease.

We, however, feel compelled to admit that Dr. Thomson's description can only apply to leprosy. It must be remembered that he based his description on six cases, and that it does not seem that he had been able to follow, for a length of time, the course of the disease in any one patient. Symptoms of tubercular leprosy and nerve leprosy form part of the description, arising, evidently, either from Dr. Thomson having observed mixed cases, or from having in his description combined symptoms which he had observed in tubercular leprosy and in nerve leprosy. Thomson's statement that the patients were highly scrofulous is probably due to the fact that he did not give sufficient importance to the presence of enlarged glands in leprosy.

The existence of leprosy in New Zealand is a matter of great interest, as we must admit either that it arose there spontaneously, that it was conveyed to the island by immigration, or that the New-Zealanders brought the disease with them when they settled in the island.

It is impossible to discover any reliable data regarding the introduction of leprosy into New Zealand, but the fact that the Maories are of Malay descent, as is shown by their customs, their appearance, and character, affords a sufficient explanation of the existence of leprosy in these islands. That they have traditions regarding their arrival in New Zealand from distant islands would indicate that their settlement there does not go back to a very distant past. The prevalence of leprosy in India centuries before Christ, and the existence of leprosy amongst Malay races, explains the manner in which contamination probably took place from India, through the Malays, to New Zealand. The existence of a disease like leprosy—which there is no reason to believe ever arises *de novo*—in these distant islands of the Southern Ocean, is one of the most remarkable facts in connection with the history of disease.

Dr. Ginders, of Roturua, has been recently investigating the subject of leprosy among the Maories at Taupo and Rotorua. He has come to the conclusion that the disease known to the Taupo and east coast tribes as 'puhipuhi,' and to the Wanganui and western tribes as 'tuwhenua,' are, in fact, one and the same disease—namely, leprosy. The

opinion generally held by the Maories, that the disease first appeared on the North Island, at Hauraki, some time in the latter half of the seventeenth century, may, Dr. Ginders thinks, be regarded as true. It was probably introduced by the 'marooning' of a leper from a ship, possibly a whaler, near Hauraki. The term 'wero ngerengere' denotes the art of communicating the disease by puncture or inoculation.

SANDWICH ISLANDS.

Dr. Arning states that the first authentic case of leprosy in the Sandwich Islands occurred in 1830. The Chinese did not begin to emigrate to these islands till 1848, and it was some years after that before the disease appears to have been at all common.

Dr. Arning, taking advantage of the method practised by the islanders in the disposal of their dead, examined a large number of bones of persons who had died before that time, and did not discover the evidences that would have been left behind if they had been leprous before their death. This confirms the statements in the celebrated letter written to Mr. Macnamara by Dr. Hillebrand, in 1866. This gentleman states that he had been practising medicine in the Sandwich Islands since 1851, and to a great extent amongst the natives of the country. Leprosy was practically unknown before 1859, and after close scrutiny could not be traced further back than the year 1852, or, at most, 1848; yet, in the comparatively short time that elapsed till 1866, the number of lepers reported in a census was stated to be 230, out of a population of 67,000.

Soon after the character of the disease became known, the natives began to call it *maipake*, 'the Chinese disease.' So rapidly did it increase, that in the years 1881 to 1882 the number of lepers was estimated at about 4000. During a period of thirty-five years about one-twelfth of the whole living population was stricken, and in the interval, of course, many lepers must have died.

Dr. Hillebrand was able to trace the development of the disease in certain centres from individual cases—an observation that was possible before the cases had become too

numerous. During this period, the food and physical well-being of the people were better than they were before.

An asylum for the lepers has been established in the island of Molokai, where, on April 1st, 1888, there were 942 people, of whom 749 were lepers. It was in this asylum that the late Father Damien met his death, having become infected during his stay amongst the sufferers.

Of 652 lepers at Molokai, Dr. Mourity reported, in March 1886, that there were 19 Chinese, 4 Germans, 2 British, 1 Pole, and 1 Belgian.

We extract the following from a paper by Dr. Arning, translated from the *Archiv für Derm. und Syph.*, Jan. 1891, for the *Journ. of the Leprosy Invest. Com.*, Jan. 1891:—

‘I have made,’ Dr. Arning remarks, ‘the following calculation as regards Hawaii. According to the census of 1884, the native and half-caste Hawaiian population numbered 44,232. The foreigners, not counting Chinese or Japanese, numbered 17,935. If the number of Hawaiian lepers is calculated at 1500, which is a low figure, we reach the terrible average of 1 leper to every 30 healthy people.

‘Amongst the white population, numbering 17,935, I knew of 35 leprosy cases. Of course I only count those who were ill at the time the census was taken, or very shortly afterwards, and not those white men who had died previously from leprosy. The half-castes are equally excluded from this list. We, therefore, reach the average of 1 leper to every 514 healthy people, who belong to a class in which heredity is hardly in question.’

In a sermon preached by the Bishop of Honolulu, it is stated that on March 31st, 1890, there were at the settlement on Molokai 1159 lepers!

SAMOA.

The following is extracted from the *Sydney Morning Herald*, Dec. 15, 1890:—

‘From Samoa, by the R.M.S. *Zealandia*, news was received yesterday that a bad case of leprosy had been discovered there, and reports are about of other cases on the island. Recently a warship which arrived here reported

several cases in the Fiji group, and it would seem that the disease is gaining a hold amongst the natives.'

NEW BRUNSWICK.

In *Leprosy in Foreign Countries* (Honolulu, 1886, p. 139) it is stated that 'by far the greatest number of lepers in New Brunswick is counted among the French and people of mixed origin, and for many years past the malady was, and is, exclusively limited to these two categories. The disease has become endemic only in five localities—namely, Tracadie, Niguac, Pokmouche, Chipagan, and Caraquette, in which the French population is to all other origins as nine is to one. There never was any case of leprosy among the Indians, although one of their principal villages is located in the endemic section, being contiguous to the parish of Niguac.'

The origin and spread of leprosy in New Brunswick will be again referred to in another part of this book. The number of lepers there never seems to have exceeded, at any one time, some twenty-five to thirty.

The *Journal of the Leprosy Investigation Committee*, No. 2, states it has been reported that several cases of leprosy have come to light at Englishtown, Cape Breton Island.

LOUISIANA.

Dr. H. W. Blanc, in his letter to the *Journal of the Leprosy Investigation Committee*, January 1891, on leprosy in Louisiana, remarks that leprosy is undoubtedly increasing in New Orleans—slowly, but steadily; and the author is not aware that any Louisiana physician has ever before reported half as many cases in that city. He estimates that there are not less than seventy-five cases of leprosy in Louisiana at the present time.

At the end of 1886 four lepers (all males) were known to be living in Minnesota, but it was considered that there might be, and probably were, cases not known or reported, because milder and less conspicuous. Between 1876 and 1886 ten lepers had died in Minnesota.

MEXICO.

Dr. Gornez, in charge of the lazar department of the Jaurez Hospital, Mexico, April 27, 1885, states that leprosy exists in the western regions of Mexico, and that it appears to have existed in Mexico since the time of the Conquest, as Hernan Cortes founded a hospital especially for lepers. It is believed by the Superior Council of Health in Mexico, that the disease is decreasing there.

COLOMBIA.

Mr. Hicks, M.R.C.S., of Bogota, writes in the *British Medical Journal*, Nov. 8, 1890, that leprosy is spreading in this Republic in an alarming manner. It is impossible, he states, to obtain reliable figures, but, putting the entire population at six millions of inhabitants, the lowest estimate gives 18,000 lepers.

BRITISH GUIANA.

It is estimated that in 1890 the number of lepers in British Guiana was 1000, or 1 to every 250 of the population.

Dr. Castor, the Superintendent of the Mahaica Asylum, is of opinion (1889) that leprosy is increasing in the colony. In 1869 there were 218 in the Asylum; in 1879, 245; and in 1889, 338.

One inmate informed him that when he left the east coast village, twenty-two years ago, there was only one leper in all the village, while now they are numerous.

TRINIDAD.

Extract from the *Journal of the Leprosy Investigation Committee*, January 1891, in reference to the number of lepers in Trinidad:—

Lepers in Trinidad.—Dr. Rake criticises the figures given in Père Etienne's book (860 lepers in 1878) as well as the number (480) cited by Archdeacon Wright. He has not been able to ascertain that any regular statistics had ever been taken of the lepers in Trinidad before 1889. A circular was then sent round from the Surgeon-General's office, the replies

to which have so far revealed only 348 lepers in the island, 210 of whom are in the asylum. Of course, one cannot rely absolutely on these figures, for there are doubtless many unreported cases; but one would have to allow a considerable margin to arrive at 480, and a very wide one to get 860, the number recorded for 1878. Either, then, the number of lepers has rapidly decreased, or one or other set of figures is very far wrong. It would be an excellent thing if a leper census could be taken next year, when the general census is taken in Trinidad. Of the total number of 216 lepers treated in the asylum last year, seventy-four, or rather more than one-third, were coolies. Dr. Rake is of opinion that, in many of them, the disease is already incubating when they arrive from India.

RUSSIA.

Dr. Oscar V. Petersen, in a letter to the *Journal of the Leprosy Investigation Committee*, January 1891, on 'The Leprosy Question in Russia,' states that in 1887 the number of lepers in the Baltic provinces was 378. It may be presumed, however, he remarks, that the number is now greater, for the spread of leprosy is decidedly on the increase. This can be proved by the following fact:—During a trip to the Island of Oesel this summer, Dr. Petersen found in a house in the country, where Dr. Hellatt in 1857 discovered only one old leprous woman, besides her, the husband (who has been ill for one year), and the daughter (ill for four months)—all certainly leprous. The son with his wife and child are still healthy, because they keep apart from the others.

He further states that 'among the people of the leprous districts, in the north as well as in the south, the conviction of the contagion of leprosy is universal.'

In the same letter Dr. Petersen remarks that this year three cases are announced from Moscow, in the heart of Russia. He adds that leprosy has been observed in different parts of Russia, in the north as well as in the south, also in the far east on the Russian coasts of the Pacific Ocean, as well as in Siberia. According to approximate calculations, he says there must be 1500 to 2000 cases at present in Russia.

Dr. Petersen also states that an asylum is to be erected on the island of Filsand, near Oesel, for sixteen patients, at the cost of the Government. Another is to be built near Rigi for sixty patients, at the cost of the town, with the assistance of the Government, and one for thirty patients is to be erected in Lirland.

MALTA.

STATEMENT showing the Number of Persons suffering from Leprosy in each locality in Malta and Gozo. (Communicated by Dr. Pisani, Valetta, through Dr. Messer, R.N.)

Malta.

Valetta,	2
Hamrun,	2
Shema and St. Julian's,	1
Zabbar,	4
Tarseen,	1
Melleha,	4
C. Curmi,	16
C. Zebbug,	3
C. Zurrico,	2
Naxaro,	6
Murta,	11
Hospital of Incurables,	10
Central Hospital,	1
	—
Total,	<u>63</u>

Gozo.

Sannat,	3
Nadur,	6
Ghainsielem,	1
	—
Total,	10
Total for Malta,	63
	—
GRAND TOTAL,	<u>73</u>

RIVIERA.

Leprosy appears to be diminishing in the Riviera. Professor Bo inspected the Western Riviera (Carter) about 1846, and found 150 cases of leprosy, the disease not prevailing east of Genoa. Under the influence of segregation leprosy began to diminish. In Varazze Boeck found 15 cases of leprosy in 1841. In 1876 Carter was told that the disease was not to be seen in the town, and that it had almost, if not quite, ceased. There seemed the usual indisposition on the part of the people to acknowledge its existence. The diminution of the disease is evident from the fact that, so recently as 1858, a lazaretto was established by the Italian Government on the heights above San Remo, in which as many as forty lepers were accommodated. In 1876 Carter found twelve lepers at San Remo.

JERUSALEM.

Dr. Wheeler (*Journal of the Leprosy Investigation Committee*, January 1891) remarks that, in Jerusalem, there are about from forty-five to fifty lepers, and that at present there are twenty-two lepers in the Asylum Jesus Hilfe.

EGYPT.

Mr. A. R. Greene, in his letter on 'Leprosy in Egypt' (*Journal of the Leprosy Investigation Committee*, January 1891), states that the total number of cases reported in Egypt is 2058, but this does not by any means represent the whole of the lepers in Egypt, for many districts, where he had reason to suppose some exist, sent in blank returns.

EAST AFRICA.

The following is extracted from the *Journal of the Leprosy Investigation Committee*, No. 2:—

'It appears that leprosy is common in East Africa, in the neighbourhood of the large lakes, as well as near the coast, and steps are being taken in the German East African country with a view to its arrest. The Berlin correspondent of the *Standard* has recently written—

“About two miles from Bagamoyo a village is being built

specially for lepers, who are rather numerous in East Africa. The Hindoo traders there have contributed four thousand rupees towards the expenses, while the French Catholic Missionaries, who will tend the lepers, have given the site, and are already having huts built on it. The village is to be called St. Lazaire, and is to be completely isolated, the only entrance or means of egress being by a single gate. The doctors of the German force will undertake the medical duties.”

On the West Coast of Africa leprosy is unknown for some distance south of Cape Lopez.

The following note regarding the existence of leprosy in Central Africa is extracted from *David Livingstone* (by Thomas Hughes), p. 98:—

‘They found a sad state of things at Sesheke, where they met Sekeletu. He had been struck by leprosy and was isolated. He believed himself bewitched, and had put several chief men to death, had altered Sebituane’s policy of conciliating the tribes he had subdued or attracted, and advanced none but pure Makololo. Moreover, there had been a long drought, which had scattered the people in search of food; the inferior chiefs were setting up for themselves, and Sebituane’s empire was fast crumbling to pieces. However, Sekeletu received them most hospitably, was pleased with the presents they brought, and insisted on their treating him for his leprosy. They did not entirely cure him, but left him in better spirits and health.’

MAURITIUS.

In a letter to the *Journal of the Leprosy Investigation Committee*, January 1891, Mr. F. Lovell, writing on ‘Leprosy in Mauritius,’ says:—

‘The average number of deaths from leprosy declared before the Registrar-General’s officers for the six years, 1874-9 was 80·6; the corresponding number for the years 1880-5 was 85·6. In the Registrar-General’s annual report for 1889 I find that the average number of deaths registered from leprosy, from 1886-9, was 67·3. Although not very reliable evidence, this fact tends to show that the disease is not on the increase since 1885, and that it is probably diminishing.’

CHAPTER III.

TYPES OF LEPROSY

CLINICALLY, two types of leprosy have long been recognised: tubercular leprosy, in which the disease manifests itself chiefly in the skin; and nerve leprosy (often called anæsthetic leprosy), in which the disease consists of changes caused by destruction of the nerves, the chief of these being loss of sensation in parts of the skin, and tropho-neurotic symptoms which manifest themselves specially in the hands and feet, and in a peculiar kind of facial paralysis.

These forms are now known to depend on the idiosyncrasies of individuals, as regards the bacillus of leprosy. If this organism can find its habitat and development in the corium, we have tubercular leprosy as the result. If it cannot obtain a footing in that structure, but can live in the nerves of the extremities and face, we have nerve leprosy as the result. There are cases in which both of these forms are combined—cases of so-called ‘mixed leprosy,’ and one form may, after a time, pass into the other.

SYMPTOMS OF TUBERCULAR LEPROSY.

The symptoms of this form of the disease may be artificially divided into four distinct classes.

When the parasite has established itself in the skin, the first effect—before there are any changes observable to the eye—is to set free a poison, which produces more or less marked results in different individuals, causing the so-called *prodromata*, or premonitory symptoms of leprosy. After a time the multiplication of the parasite causes a vasor-motor paralysis of the parts in which it grows, producing the *exanthem* of tubercular leprosy. The further development of the bacillus leads to direct changes in the corium itself, causing swelling,

thickening, infiltration, and discoloration, which vary according to the extent and rapidity with which it grows. This forms the so-called *tubercular* stage. The breaking down of connective tissue, and the destruction of blood-vessels, produced by this excessive growth of bacilli, lead to ulceration—the *ulcerative stage* of tubercular leprosy. Finally comes a time when, in most cases, the bacillus leads to leprous deposits in the liver and spleen, and the patient becomes exhausted by the constant discharge from ulcers, and by visceral complications, to which he eventually succumbs; unless, in the meanwhile, he has been suffocated by the leprous growth in the larynx, or has died of some acute intercurrent malady.

Although these sets of symptoms may, more or less, run into each other, they deserve separate mention.

PRODROMATA.

The chief early symptoms are malaise and debility. The patient is liable to shivering, with fugitive pains in the limbs, and suffers from lassitude and stiffness of the extremities, particularly noticeable when he moves after being in repose. Vertigo and excessive drowsiness oppress him, accompanied by a sensation of heaviness and disinclination to exertion, and general depression. There are well-marked dyspeptic symptoms, with bad appetite and occasional nausea, sometimes followed by vomiting. An intermittent febrile condition associated with excessive sweating, a sensation of dryness of the nose sometimes followed by epistaxis, and a feeling of cold in the extremities, further characterise this stage. These symptoms might naturally excite apprehension in parts where leprosy was common, but it is scarcely necessary to remark that, in countries where the disease is rare, they would not suggest to a medical man that he might be dealing with a case of leprosy.

In a patient from India who consulted us on account of an outbreak of leprous erythema, which she herself, without a suspicion of the nature of her malady, attributed to the action of the sun whilst bathing, we found that some symptoms of indisposition from which she had been suffering for several months had been attributed to derangement of the uterus. Unfortunately, the symptoms of tubercular leprosy

soon became only too well marked to permit of any doubt regarding the cause of her previous indisposition.

ERYTHEMA OF TUBERCULAR LEPROSY.

Dr. Hillis has found, in British Guiana, that excessive sweating and presence of vertigo are constant symptoms foretelling the early appearance of the leprous erythema. After these symptoms have lasted for a greater or less time, a rash is observed in the skin, consisting of spots varying in size from a lentil, or less, to that of the hand. They have the characteristic symptom of an erythema, as the colour disappears under pressure. They are sometimes well defined, sometimes not very distinct, and are best seen during change of temperature. The skin feels thickened, and sometimes looks swollen. The spots disappear at the end of some days, or weeks, or months, without leaving a trace, and then reappear with greater intensity than the first time. The colour of the eruption is modified by race. Hillis describes it in the negro as a perfectly red or brownish spot, situated on the face or either of the extremities, but more frequently the face, of a deeper colour in the centre than at the circumference, and abruptly terminated by sound skin, which causes it to stand out from the black background with a greasy, shining appearance. In the white races the crimson or reddish mahogany colour of the spots becomes gradually darker, until they assume a deep brownish black shade. With the appearance of the spots the general condition improves, and the patient feels comparatively well.

The development of the erythema may be so slight that it may pass unobserved, if it appears on the covered parts of the body. Occasionally the spots are the seat of itching and pricking sensations. Their surface is usually smooth and shining, the smaller ones having more distinct borders than the larger patches, which may indeed appear under the form of diffused redness. They may disappear without leaving any trace, or they may leave a slight pigmentation. When the eruption has come and gone during a period more or less long, the intervals between the outbreaks extending over a month, the spots finally become stationary, of a brownish colour, and no longer disappear under pressure. At this

time the patient generally feels relieved; but this relief only lasts for a time. With fresh accesses of fever the stage of permanent (tubercular) infiltration sets in only too surely.

FORMATION OF LEPROUS TUBERCLES.

The description of the nodules or lepromes in tubercular leprosy, as they appear in white races, has been drawn magisterially by Danielssen and Boeck. In their classic treatise the tubercles are described as varying from the size of a pea to that of a small nut. They may be flat or prominent, oblong or round, isolated or confluent, and in colour varying from a pale violet to a dark brown. On parts subjected to pressure—as the chest, back, and posterior surface of the thighs—they are flattened; whilst on the face, arms, and backs of the hands they are more prominent. The consistence and colour also somewhat depend on their position. On the trunk they are generally soft, and of a brownish-yellow colour, whilst on the extremities and the face they are particularly hard, and somewhat livid. They are found on every part of the body, with the exception of the scalp, which, all authors agree, possesses a remarkable immunity from the leprous deposit.

They are exceedingly rare on the palms and soles; where however, they have in rare cases been observed, for Leloir states that he has seen the palmar and plantar regions affected, although Danielssen and Boeck had never seen them on these parts. In the palms, Leloir remarks, the lepromes are flat, coppery or violet coloured, sometimes circinated, sometimes diffuse. The epidermis desquamates over the centre, and the appearance of the leprome becomes shiny, varnished, cracked, and very like a palmar or plantar syphilide.

If the tubercles develop on the face the eyelids may become œdematous and cover the eye. According to Leloir, the parts of the face which are affected correspond to the 'mask,' with often a healthy border of one to two centimetres round it.

The tubercles usually develop slowly, irregularly, and without pain; but during the intercurrent attacks of fever, which are not uncommon, the tubercles and the skin surrounding

them become very tender, swell, and are of a deep red colour. When the fever ceases, the swelling subsides, the epidermis desquamates, and the tubercles are flatter, but more consistent than before, remaining quiescent until a fresh febrile outbreak takes place. During the congestion of the tubercles, attended by constitutional disturbance, their appearance is similar to that of erythema nodosum, with which they have been sometimes confounded.

The tubercles develop in spots which have become stationary, and the parts first affected are usually the forehead, the supra-orbital region, the backs of the hands, the anterior aspect of forearms, and outside of thighs. Gradually they become more and more prominent, of firmer consistence, and more livid in colour. Usually tubercles soon form on the trunk and on the limbs, the hairs falling off at the parts invaded; this is particularly noticeable in the eyebrows, the loss of which constitutes a symptom of tubercular leprosy generally recognised in countries where the disease is common. Leloir says they often accumulate at the root of the thighs, in Scarpa's triangle. The genital organs may be affected—the glans itself even, although not commonly; Neisser says never.

If the tubercles appear in successive crops, each fresh deposit is preceded by some degree of fever, which may be severe. Hillis states that this fever occasionally proves fatal, and is especially characterised by determination of blood to the head, which may be relieved by bleeding from the nose. Leloir states that the temperature in the axilla may reach 38°, 39°, 40°, and 41° Centigrade, and the pulse 120 to 130.

As the deposits acquire volume and consistence, isolated dark brown tubercles are formed; sometimes, however, they are confluent, and constitute large *plaques* which may embrace a thigh or an arm or a leg, or may cover the greater part, according to Hillis, of the front of the chest, or even the abdomen. In old cases, Hillis states that these may be arranged as dark brown rings, with sound skin in the centre, and having a degree of anæsthesia. (He considers this a milder form of leprosy, and has only observed it in white or fair persons.) They may end in resolution, or subside and reappear. Raised above, and darker in colour than the

neighbouring sound skin, the dilated sebaceous follicles, with their greasy look, cause an appearance compared by Hillis to the rind of an orange when it is squeezed between the fingers.

Although leprous tubercles may form on any part of the body except the hairy scalp, they have their special sites of predilection. The face, ears, nasal mucous membrane, extremities, nipple, mammary glands, scrotum, prepuce, around the anus or the vagina, and the armpits, are, according to Hillis, their most frequent sites. They are rare on the back of the neck, soles of the feet, or palms of the hands. Their relative frequency in different parts of the body is a point, however, on which authors are not in strict accordance.

Hillis has never seen the glans affected, but Leloir states that he has seen examples of it, and quotes Greisenger as having also observed a case. Leloir denies that the satyriasis in men, or nymphomania in women, described by authors, is at all common. It must indeed be excessively rare, but he grants that it might be caused by tubercles on the glans in the very rare cases in which they occur.

After attaining a certain development the tubercles may remain stationary, and becoming gradually absorbed, leave a cicatrix; but whilst absorption is taking place at one part of the body, fresh tubercles may be developing at another. The disappearance of the tubercles may be caused by a drain on the system, by large suppurating surfaces, or from the patient being attacked by an acute disease. In this stage the development of nerve leprosy, or tubercular infiltration of the abdominal organs, may be coincident with the disappearance of tubercles in the skin—usually, however, to be followed by the development of new ones.

With the full development of the tubercular stage the characteristic appearance of the leper is established. The thickened skin of the forehead, studded with unequal tubercular masses, and marked horizontal furrows; the tumid greasy cheeks, uneven with tubercles; the everted lips; the nose, thickened, widened, flattened, and crushed like a negro's; and the projecting nodular ears, present an appearance which distinguishes leprosy from all other diseases, and which requires only to be seen once to be always recognised.

The development of tubercles is caused by an increase in

number of the bacillus lepræ, and the changes to which that increase gives rise is the explanation of the premonitory febrile attacks. Renewed activity in the development of the parasite means the setting free of a fresh poison through the system, and, although tolerance has to some extent been set up, there is still reaction produced, indicated by pain in the limbs, bleeding from the nose, and fever.

The effects of the poison show themselves in other ways. If the disease occurs before puberty, development is retarded, the beard does not grow, the testes atrophy, or menstruation is delayed, the natural development of the body receiving a powerful check.

When there is no ulceration the epidermis remains normal, notwithstanding slight desquamation, and the excessive secretion of sebum. The infiltration deprives the skin of its elasticity, so that it shows for a time the impression of the finger.

In the fully developed stage lepers suffer from severe lancing pains in the legs, particularly at night, and exhale a peculiar fœtid odour from the skin and the lungs. Perspiration is checked over the tubercles, and in the infiltrated parts the sensibility is dulled; but during attacks of fever the tubercles may become sensitive, red, swollen, and tender.

We have already referred to the occurrence of the tubercular infiltration in large *plaques* (*lepromes en nappe*, Leloir). Their appearance is the sign, according to Danielssen and Boeck, of an unusually chronic case. A large erythematous patch of variable size, and irregular in form, becomes the seat of true tubercular infiltration. The plaques are dark in colour, sometimes almost black, and desquamate very slightly on the surface. They may last for years without much change. Gradually they project from the level of the surrounding skin, become darker in colour, harder, more unequal, itch, and the hairs fall. Sensation becomes dull, perspiration ceases over the surface, and they are often the seat of ulceration, which heals with extreme difficulty. Their usual position is on the limbs, seldom on the trunk, and, according to Danielssen and Boeck, never on the face; but Leloir states that he has seen them on the face. They vary in size from a florin to the palm of the hand and more.

To Campana belongs the credit of having been the first to show that, when the tubercles are developing, there is an increase of temperature in the part, as much as from a quarter to two degrees Centigrade; and he has subsequently been confirmed by Leloir and Zambaco.

Leloir has given a careful and minute description of the colour of the tubercles. At the beginning, he states, they are often a pale rose or pale red, slightly coppery or violet tint. Later the colour becomes red, brown-red, coppery-red, verging sometimes on violet, sometimes sooty. On the trunk the tubercles are often browner than on the extremities, where they have a more livid tint. They have frequently the colour of sienna earth or bronze. In Italians, and the inhabitants of warm countries, they have a tint which he compares to skin which has been painted with tincture of iodine.

Hillis describes a peculiar mottling on the skin of the abdomen, and between the shoulders, accompanying advanced tubercular lepra in the black races, seen chiefly in young persons, and those with the darkest skins. It appears on the belly as numerous light and dark shadings, and on the back as if mapping out the spinal cord. It remains without alteration, is not attended with loss of sensation, and there is no change in the true skin.

In regard to the extent to which tuberculation may develop, Hillis states that he has seen men with hardly a hand's-breadth of sound skin on their bodies, if the head, face, and palms of the hands were excepted.¹

When the tubercle undergoes fibrous induration it becomes firmer and smaller and the epidermis sometimes desquamates, the skin often becoming atrophic, paler, and sometimes a little white in the centre. Induration may last a long time, even indefinitely, without further modifications. Sometimes these sclerosed tubercles become keloidal. Leloir has observed this fibrous transformation both in diffused lepromes and in nodular lepromes.

¹ On an occasion in which we were examining the blood of a tubercular leper from the East Indies, it was with difficulty, and only after examining the whole trunk of the body, that we could find a part sufficiently clear from tubercles and livid infiltrations to be sure that we were drawing the drop of blood from a part free from leprous infiltration.

ULCERATIVE STAGE OF TUBERCULAR LEPROSY.

The tendency of leprosy tubercles is to soften, becoming of a yellowish-grey or brown colour; and eventually, the epidermis giving way, a thick dirty pus is discharged. The ulcers which are formed secrete a yellowish-brown viscid fluid, which sometimes hardens into thick crusts. Whilst some of these ulcers heal, others form. The general state of the patient at this time is, however, usually fairly satisfactory.

Ulcers, which may heal quickly when properly treated, may in some cases take on gangrenous action, and lay bare the bones, and the tendons, ligaments, and joints being destroyed, a falling off of the parts ensues, particularly of the fingers and toes. At this advanced stage there are usually also symptoms of nerve leprosy. The cicatrices which follow ulceration differ from those which follow absorption, being more irregular, harder, and more consistent: they are also whiter, surrounded with a brownish border, and often somewhat firm and projecting. They may become keloidal.

Sometimes, with symptoms of fever and malaise, a great number of tubercles soften at once, and discharge a yellowish white mass, forming thick, dirty brown crusts which come off periodically, on account of the discharge secreted beneath them. So long as the system is being depleted by this free secretion from the ulcers, the other tubercles cease to increase, or may even become smaller. The continued formation of new ulcers gives a most repulsive appearance to the patient, nearly his whole body being covered with disfiguring crusts or open sores.¹

Ulceration may take place in tubercular leprosy in a somewhat different manner. Usually in the legs, and more rarely on the arms, the skin becomes much infiltrated and thickened. In this infiltrated skin soft painful points form, which, after several days, open and discharge a viscid acrid matter. Under the influence of this discharge the

¹ Danielssen and Boeck had seen three cases in which, after suppurating successively several times, the tubercles disappeared for ever. The cicatrices which formed in this way were white, unequal, firm, slightly prominent, whilst those which are formed by the absorption of the tubercles are round, depressed, and thinner, and of a dirty greyish-yellow colour.

neighbouring parts break down until the ulceration may extend round the whole limb, or involve the dorsal surface of a foot. The ulcer thus formed is irregular, with a callous, elevated, abrupt border. It extends deeply, and secretes a considerable quantity of yellowish-white matter, the surrounding skin being hard, uneven, livid, and even painful. The inguinal glands become greatly swollen, and there are severe pains in the legs, with exacerbations at night.

Under the influence of the discharge from these ulcers there is a tendency in the tubercles either to retrograde or to become stationary, or to develop with exceeding slowness.¹

Danielssen and Boeck describe a rare form of tubercular leprosy in which, under the influence of the itch acarus, the crusts may project to a prominence of two inches on the face or the external surfaces of the extremities, attended with intense itching.

The condition of the large inguinal glands has a direct relation to the development of the disease. During the prodromata they are only slightly swollen, but as the tubercles develop they become larger and harder, and sometimes painful. In the groin, axilla, or neck, glandular tumours may form as large as a goose's egg, and when they have their seat in the neck they usually produce great difficulty in breathing or swallowing. They eventually soften, and extensive fistulous tracts often form in them, from which a large quantity of thick matter discharges. In acute conditions Leloir describes a ribbon-like lymphangitis in the skin, extending towards the glands.

Intercurrent acute diseases produce a temporary subsidence of the tubercles. Danielssen and Boeck have observed them disappear after severe attacks of small-pox. Beaven Rake has noted, first swelling, and then disappearance of tubercles at the Trinidad Asylum, in patients whom he has vaccinated. Hardy makes the same statement regarding pleurisy and pneumonia. Leloir and Rake have observed

¹ Danielssen and Boeck state that if these ulcers heal rapidly, the constitutional condition becomes much aggravated, the patient suffering from intense fever, followed by death, unless the ulcer re-opens. Neither Hillis nor Leloir has observed any danger follow from the healing of leprous ulcerations.

the retarding effect of erysipelas. Leloir also mentions the disappearance of cutaneous tubercles when the patient is attacked by phthisis, which has also been observed by Rake. It is only possible to explain this effect of these diseases by assuming that they alter the blood-supply of the part, whilst at the same time they probably favour absorption. Campana inoculated lepers with erysipelas, but without any effect on the disease.

LEPROSY OF THE MUCOUS MEMBRANES.

Sooner or later the disease attacks the mucous membranes. The voice then becomes hoarse, breathing is interfered with, and the patient has a cyanotic appearance. On the tongue, the mucous membrane of the cheeks, the hard and soft palate, the uvula, and the tonsils, pale red, soft, flat tubercles are seen, which are very liable to destructive ulceration. The hoarseness increases till the voice becomes sibilant. Bronchial catarrh develops, and the sufferer is threatened with suffocation. On the mucous membrane of the nose—particularly over the part which covers the septum—tubercles are formed which soften and cause ulceration, leading to obstruction of the nostrils with thick hard crusts, destruction of the septum, and sinking in of the nose.

For a detailed account of the changes in the throat, we refer to a paper which Dr. Hillis has written in the *Dublin Journal of Medical Science*, March 1890, on the lesions of the throat in leprosy, from which we extract the following paragraphs:—

Dr. Hillis remarks that 'in tubercular leprosy the first throat symptoms occur during the febrile attack. The fauces, uvula, and back of the throat become uniformly red and congested, or glazed-looking, and the patches seen at the back of the pharynx and roof of the mouth have raised crescentic edges. Such patches are pathognomic of leprosy and, when combined with the thickened condition of the mucous membrane of the nose, explain the epistaxis. After a varying interval of some months the interior of the mouth is found to present a dull white, pallid appearance, extending not only to the larynx, but even to the bifurcation of the trachea.

'The next stage is the formation of tubercles in the air-passages, appearing first as small red papules, not larger than a pin's head, but rapidly increasing in size; the rapidity of growth depending on the extent of blood contamination going on.

'Externally, the leper will probably be covered with tubercular masses on the face, extremities, and parts of the trunk. In the mouth, tubercles first appear on the dorsum of the tongue, or the tip is studded with small wart-like growths. Next they are found on the pillars of the fauces, uvula, inside the cheeks, and on the roof of the mouth. Tubercles also form in the nasal fossæ.

'The uvula is almost always attacked. A tubercle will form at the tip, giving a bulbous appearance, or one may form at its junction at the velum, giving rise to œdema and hypertrophy. Ulceration may set in and extend, till the entire uvula is destroyed. Ulcers with ill-defined edges and a greyish slough are found on the side of the tongue, inside the cheeks, or further back in the pharynx.

'The epiglottis becomes enlarged in every direction, from infiltration or hypertrophy of the submucous connective tissue, and may be plainly seen whenever the patient opens his mouth. There seems to be no inconvenience in swallowing from this cause. There are tubercles of all shapes on its free edge, and varicose veins on the under surface. The arytenoids and inter-arytenoid space become enlarged and distorted. The vocal cords are seen in a state of ulceration, or they are discoloured a dirty yellow, and in the more advanced cases the structures of the larynx are changed into a shapeless mass.'

Leloir's description of the tubercles in the mucous membrane is to the effect that they are usually soft, rose-tinted, pale red, livid, but sometimes, on the contrary, dull greyish and opaline. Generally smooth, they sometimes vegetate—much resembling syphilides of the mouth, and being sometimes like lupus. They may begin by white or opaline spots, as if the part had been touched with nitrate of silver, and they often lead to the shedding of the teeth, particularly the incisors.

Leloir gives a graphic description of the leprous tongue,

which he describes as sometimes resembling the syphilitic tongue. The disease may appear as isolated tubercles, or simply as opaline spots. The lingual papillæ are prominent. When the dorsal aspect is covered with tubercles, the surface is raspberry-like, or like a torn fig, and more or less lobulated. The epithelium is altered, often thickened, and comes away in rags, leaving the subjacent parts a little red or pale. The tongue becomes thick, sometimes double its normal size, and can be moved with difficulty; mastication becoming more difficult and painful when the furrows between the tubercles crack.

The mouth of these patients emits a fœtid, and sometimes, on the other hand, a sweetish odour. From this cause, amongst others, most of the leper-houses of Norway exhale a distinctive smell 'between that of small-pox patients and a warm corpse.'

In old tubercular leprosy which has become associated with nerve leprosy, the skin, subcutaneous tissue, and muscles of the face acquire a gelatinous appearance; and a trembling, due to a kind of colloid degeneration, may be observed.—(Leloir.)

The hairs and nails are affected secondarily in tubercular leprosy. The hairs over the tubercle become short, split, and eventually fall off. The normal development of hairs does not take place on the tubercles.

These facts are easily understood by any one who has studied a vertical section through the border of a leprome, and observed the disintegration of the hair papillæ caused by the leprous cell infiltration. The nail formation, being less directly dependent on the condition of the corium, is not so often affected, although during the progress of the disease the nails occasionally fall off, leaving unhealthy ulcers, which may heal. When the nails are replaced, the fresh ones are of necessity badly developed, and soon break.

Apart from disorders of sensibility caused in leprosy by special disease of the nerves, sensation is more or less altered in the leprome. According to Leloir, sensation or pain may completely disappear in the tubercles, whilst tactile sensibility is preserved. The leper may feel the knife penetrate the

skin of the tubercle, but experience no pain. Sometimes sensation for heat is preserved, whilst sensibility to pain disappears; and in very rare cases thermic sensibility may have disappeared, whilst the other sensations (tactile and pain) are preserved. Often the tubercular tissue is itself absolutely anæsthetic.

Hansen (*Archiv f. Derm., etc.* Vienna, 1870-72, p. 199) examined successively 141 tubercular lepers, and found that in nine, cutaneous sensibility in the tubercles was entirely normal. The older the tubercle deposit the more pronounced was the anæsthesia; hence he concluded that in tubercular leprosy the nerves are also affected. This constitutes a pathognomonic sign.

Tubercular lepers are not necessarily bald.

Danielssen and Boeck describe an exceedingly rare acute form of tubercular leprosy, of which they have observed four examples. In these cases, after uninterrupted fever for twelve days, there suddenly appear an eruption of shining, bluish spots over nearly the whole body, raised above the level of the skin, and rapidly increasing in volume and hardness. Frequently confluent, they give rise to considerable tubercular infiltration, the affection making as much progress in a few weeks as it does in chronic cases in several years. With the appearance of the eruption constitutional disturbance ceases to be intense, and after the tubercles have softened, the affection becomes chronic. If the cutaneous affection does not declare itself the patient dies of pneumonia, pleurisy, or meningitis, in a few days. Leloir has not seen this acute leprosy of Danielssen and Boeck, but has seen acute leprosy supervene as a termination of tubercular leprosy, after eight to fifteen days of intense continued fever with nocturnal exacerbations, an eruption of nodular lepromes and plaques appearing on the skin and mucous membrane. These developed rapidly, and soon ulcerated. There is a distinct analogy between this acute leprosy and acute tuberculosis, which, as is well known, may develop suddenly in a previously healthy person, or may supervene on the chronic ailment.

LEPROUS DISEASE OF THE EYE.

The manner in which leprosy causes destruction of the eye is described by Danielssen and Boeck in the following words:—‘The white of the eye assumes a muddy appearance, and the vessels of the conjunctiva are seen to be periodically injected. This change of colour increases little by little, and usually produces upon the sclerotic, towards the extreme border of the cornea, a greyish-yellow thickening. It forms a rampart around the cornea of more or less elevation. The thickening progresses simultaneously with an increase of vascular congestion, until the whole conjunctiva becomes the seat of the specific infiltration. The eyelids, which until then have been spared, become the seat of an erythematous swelling: the eyelashes fall. Permanent induration may remain along the tarsal cartilages, or the eyelids may be completely invaded by leprosy tubercles. Eventually the disease extends from the sclerotic to the cornea, which at this point becomes dull, and from this time the patient occasionally complains of pain in the eye. The original spot which, on account of its increased volume, may be now called a tubercle, acquires a brownish colour. It is somewhat firm to the touch, and extends through the thickness of the cornea. The sight is weakened, and above the tubercle are seen engorged conjunctival veins, and the lachrymal secretion is increased. After having completely traversed the thickness of the cornea, the tubercle reaches the iris, which then assumes a dirty yellowish-grey colour; the growth eventually penetrating into its substance. The pupil becomes angular; and the anterior chamber is gradually filled with tubercular matter. The patient feels lancinating pains in the eye, and the sight is extinguished. The disease continues to attack the organ until the complete occupation of this chamber, and the invasion of the entire cornea by the yellowish-white matter. The eye is then a shapeless mass. The tumour increases to such an extent that the eyelids can no longer cover it. The pain continues, and the lachrymal secretion is increased. Tears flow down the cheeks, and erode them by their acidity. The affection seems then to have reached its highest point of development. The tuber-

cular mass softens, the tumour contracts, the eye can again be closed, the secretion of tears becomes less, and the pains cease.'

Danielssen and Boeck describe a more chronic process in the eye, in which, after the spot has been formed on the sclerotic, the disease appears to be arrested for a time, although the patient remains subject to severe periodic pains. After six months or more the pupil is found to be deformed, and exudation is observed in the anterior chamber in which a yellowish-white point develops that may become as large as a pea, and which extends to the iris. The growth of the tubercle then becomes arrested, but the pains persist. This tubercle softens only very rarely.

A concise summary of the affections of the eye in leprosy has been given recently in his book, *Leprosy as a Cause of Blindness*, by Dr. C. F. Pollock (1889). He remarks that 'the processes in leprosy, which lead to blindness, are commonly symmetrical. Thus, the history of the one eye is usually prophetic regarding the other, which has suffered less; and the state of this second eye affords a retrospect of what occurred in the first. The disease of the eyeball is largely ciliary in origin. Infiltration of the cornea starts from the tissues at the corneo-scleral junction, and spreads from the periphery forwards towards the centre in the superficial layers; tubers may do the same. Tubers arise in the deeper parts of the corneo-scleral junction, and destroy the posterior layers of the cornea, into which they extend; the anterior chamber may be invaded from the angle between the cornea and the iris; the iris is attacked from its periphery, and the ciliary body is often involved; and from this region also, the disease passes to the neighbouring portion of the choroid and the ora serrata of the retina. Slow and intermittent in its progress, it is disastrous in its results. An eye once seriously involved, may be looked upon as doomed. There is no tendency to recovery, and thus the arrival of blindness is prevented only by the more speedy approach of death. The perception of light may linger long; it is almost sure to be ultimately quenched. Of the forty-one patients whose eyes he had described, eight claimed the power of distinguishing between light and darkness; but in only five of them was even this certainly present.

One of these had tubers on the corneæ with ulceration, and both eyes retained this amount of vision; of the others, the corneæ were destroyed by leprous infiltration, and in each case one eye was totally blind.

‘Recalling at times many other affections of the eyes, leprosy has at other times manifestations which are peculiar to itself. For instance, corneal affections are the most frequent local diseases which blind the eye of a leper; and these may be such as are seen in non-leprous patients, or they may be quite characteristic of leprosy. Paralytic ectropion (nerve leprosy) is not confined to this disease, although no other complaint yields so many victims of this distressing paralysis; and the blinding hazards which ectropion implies are familiarly known to those who have never seen a leper, but who have seen many eyes exposed to the risks of irritating and noxious influences from the want of the natural covering. On the other hand, the invasion of the cornea by leprosy, whether in the flat variety of infiltration or in the form of tubers varying in their degree of prominence, is essentially characteristic of the disease, with its special appearances, its intermittent advances, its augmenting disturbances, and its final hopeless destructiveness. All of these, with the resulting conditions of softening, shrinking, bulging, and hardening, have been passed in brief review. The inclusion of the internal structures of the eyeball is frequent, and the share which these take in determining the ultimate state of the blind eye prevents rigid classification of individual cases.’

The extent to which the sexual instinct and procreative power are affected in tubercular leprosy varies in individuals, and has given rise to much difference of opinion. Bidentkap regards it as a well-established fact that sexual desire in leprosy is sometimes much increased:—‘It is not rare, at least in Norway,’ he remarks, ‘for patients suffering from an advanced form of tubercular leprosy of many years’ standing, to beget children; this applies both to men and women. I have seen quite remarkable cases of this kind which were, moreover, interesting in that women, suffering from far advanced tuberous leprosy, brought forth children who were

healthy in appearance, and who continued for many years, and probably all their lives, free from leprous symptoms. On the other hand, it is a fact that the function sometimes ceases, and that in women menstruation is arrested, or does not appear at all. As a rule, however, lepers retain the generative faculty for a very long time.'

Most modern observers do not, however, share Bidenkap's opinion, the general belief being that under the depressing influence of the leprous poison the sexual instincts become gradually weakened; and this weakening has been given as a reason for the comparatively few instances in which husbands and wives infect each other, in many cases the instinct being destroyed before the disease has reached the stage in which it is most apt to be communicated. Although there is no doubt that leprosy in one or both parents is not incompatible with the birth of children, the number of children born to lepers is comparatively very small, and it may be taken for granted that in this disease, as in others, the diminution of the procreative power is associated with the annulling of the instinct on which it is based.

A remarkable example came under our cognisance several years ago, in which a man, the subject of tubercular leprosy, which had not reached the ulcerative stage, but whose face was in the condition of fully developed leontiasis, and whose skin was all over largely infiltrated with nodules and diffused leprous infiltration, was with difficulty prevented from marrying a young healthy English woman, whose affections, strange to say, had been gained by the unfortunate leper.

We believe Dr. Arning to state the fact correctly when he remarks that the *potentia virilis* is always lower, and frequently—within a few years after the development of the disease—extinguished.

Dr. Munro (p. 75) found that among eighteen male lepers over twenty-one years of age nine were married, and six had families, all of whom, however, with the exception of two children born to one man, were born before the parents became lepers, except in one case, in which the last child was born one month after the father's attack. In only one case did he see children born to a man after he became a confirmed leper; these were three and eight years old, and perfectly healthy.

'As to females,' remarks Dr. Munro (p. 76), 'I found in St. Kitts, among twenty-six women (over twenty-one years), nine had had children, seven having had them *before* the disease appeared. I saw only one woman who had had *two* children *after* she was attacked—one eleven days, the other three and a half years old, both healthy; and one other case, attacked at thirty-four years of age, who had children and grandchildren, all healthy. I am not quite certain whether any children were born after her attack, but believe not. Wortabet appears to be right in saying that males lose the power of reproduction earliest.'

Holmnsen (Munro, p. 75) only found one case among twelve in which parent and child were affected in which the parent was affected before the birth of the child.

This phase of the question possesses a more than merely theoretical interest, as the permission or prevention of marriage between lepers in asylums, and the rules to which in such institutions the relations of the sexes should be subjected, are matters of much practical importance.

After years of suffering, the unfortunate victim of tubercular leprosy reaches a stage to which no other disease affords a parallel, and it is difficult to say which of the two distinctive features of the affection are the most terrible—the extraordinary chronicity, or the disgusting mutilations and deformities to which the malady gives rise. We cannot wonder that in past times, when human life was considered of little value, and when the infliction of suffering on our fellow-creatures excited no surprise, ruthless conquerors like Tamerlane, or savages like Fiji chiefs, should have removed from the earth persons whose appearance was so revolting.

Leloir has given the following vivid and correct picture of this terrible state:—

'If the patient,' he remarks, 'does not die of some intermittent disorder or special complication, the unhappy leper becomes a terrible object to look on. The deformed leonine face is covered with tubercles, ulcers, cicatrices, and crusts. His sunken, disfigured nose is reduced to a stump. His respiration is wheezing and difficult; a sanious, stinking fluid, which thickens into crusts, pours from his nostrils. The nasal

mucous membrane is completely covered with ulcerations. A part of the cartilaginous and bony framework is carious. The mouth, throat, and larynx are mutilated, deformed, and covered with ulcerated tubercles. The patient breathes with the greatest difficulty. He is threatened with frequent fits of suffocation, which interrupt his sleep. He has lost his voice, his eyes are destroyed, and not only his sight, but his sense of smell and taste have completely gone. Of the five senses hearing alone is usually preserved. In consequence of the great alterations in the skin of the limbs, which are covered with ulcerating tubercles, crusts, and cicatrices, the pachydermic state of the skin which gives to the limbs the appearance of elephantiasis, and of the lesions of the peripheral nerves which are present at this time, and by which occasionally the symptoms of nerve leprosy are combined with those of tubercular leprosy, the sense of touch is abolished. The patient suffers excruciating pains in the limbs, and even in the face, whilst the ravages of the disease in his legs render walking difficult, and even impossible. From the hypertrophied inguinal and cervical glands pus flows abundantly from fistulous openings. In certain cases the abdomen is increased in size on account of the liver, spleen, and mesenteric glands being involved. With these visceral lesions the appetite is irregular or lost. There are pains in the stomach, diarrhœa, bronchial pulmonary lesions, intermittent febrile attacks, and a hectic state. The peculiar smell, recalling that of the dissecting-room, mixed with the odour of goose's feathers or of a fresh corpse, is indicated, but badly described, by the authors of the Middle Ages, who compared it to that of a male goat.

'This is the horrible appearance which the patient presents, unless some fatal complication has come to his relief. One can understand how, in the ancient poem of Job, leprosy was called "the eldest daughter of death." Nevertheless, in spite of his terrible condition, the unhappy leper, although in great prostration, preserves his intelligence unaffected to the end. I have been struck,' continues Leloir, 'with the calm stoicism with which the Norwegian lepers supported their misfortune, and even the gaiety or indifference of the lepers in Italy and other countries, and with the care which they gave to their toilet. I

have never seen a leper ask for death, and I do not know an instance of suicide amongst these patients, who observe with the greatest resignation the slow and progressive decomposition of their bodies.'

Danielssen and Boeck have stated that a patient may be carried off quickly by acute leprosy, and that the disease may last for even twenty or more years, but the usual period of duration is some eight to twelve years.

The usual immediate causes of death are pulmonary phthisis; colliquative diarrhoea; suffocation from œdema of the glottis, or obstruction of the larynx, trachea, or bronchi by mucus or particles of food; or by an intercurrent malady.

The following statistics by Hillis illustrate the relative proportion of the usual causes of death in British Guiana:—

Exhaustion from leprosy (either from the ulcerations, gangrene, atrophy, marasmus, or general debility),	42 per cent.
Muco-enteritis,	36 "
Dropsy,	11 "
Lung affections, including phthisis,	3 "
Peritonitis,	2 "
Remittent fever, hemiplegia, jaundice, dysentery, valvular disease of the heart, epilepsy, each one per cent.,	6 "

CHAPTER IV.

NERVE LEPROSY.

WHEN the bacillus of leprosy develops in the nerves the disease acquires a physiognomy of its own, which not only differs, but in some respects almost forms a contrast to that of tubercular leprosy. As might be expected, destruction of the nerve tubes leads to defects of sensation and nutrition, anæsthesia and absorption of tissue eventually forming the most prominent symptoms. As in tubercular leprosy, so in this form also, the first development of the poison produces constitutional disturbance; but the prodromata, although the same in nature as those which precede tubercular leprosy, are more insidious and last longer. The patient seems to be suffering from a smaller dose of the poison. There is the same feeling of chilliness and shivering, pallid complexion, and depressed appearance. In many instances, however, the prodromata must be very slight in degree, as they are often entirely overlooked by the patient.

The cardinal symptoms of nerve leprosy are the appearance of spots, bullæ, anæsthesia, and certain motor paralyses and absorption of tissue, attended by mutilation. Although the spots and bullæ are usually amongst the earlier symptoms, there is absolutely no fixed rule as to the order or time when these various phenomena present themselves. Sometimes the spots appear early in the disease, or they may be absent during even its whole course; whilst the bullæ may appear early, or may not show themselves until the system has been affected for several years. Sometimes neuralgic pains are amongst the earliest symptoms; sometimes the first thing noticed by the patient is a marked loss of power, which interferes with his work. Frequently, indeed, the first symptom which leads him to consider that there is anything

wrong is the difficulty which he finds in readily grasping objects. Hillis mentions that amongst the negroes of British Guiana the field labourer has his attention first directed to his condition by the difficulty he finds in holding his cutlass. The man at present suffering from nerve leprosy in the White-chapel Infirmary informed us that the first symptom he observed in himself was the strange loss of power and grip he experienced when cutting meat in the market.

As the various symptoms may or may not occur simultaneously, and the order in which they appear is not regular, it will be convenient, for the purposes of description, to consider them separately.

Often the appearance of spots, of a reddish colour at first, and slightly raised, is the first symptom observed. Somewhat resembling the polymorphous erythema of Hebra, but generally larger and more irregular, these spots may be the seat of slight pruritus, or may not itch at all, or they may be the seat of a burning or stinging sensation. As they become more tender the surrounding parts sympathise, as is evidenced by œdematous swelling, particularly under the eyes when the spot is situated on the face. The spots vary in size from a florin to the palm of the hand, or even more. Generally small at first, they slowly increase in size, and their contour is gradually lost in the colour of the surrounding skin. Their tint changing as they grow older, frequently acquires in course of time a somewhat yellowish shade, deepening to dark brown and even black. The redness at first disappears under pressure by the finger, reappearing, however, immediately. They remain for long periods, and may be unchanged for years; but as they become darker, their tendency also is to become slightly raised above the level of the surrounding skin. At this time they may be the seat of a slight desquamation, and in cases of a more acute eruption this desquamation may be somewhat pronounced.

After reaching a certain size they may remain stationary; but if they continue to increase, they form, by coalescing, irregular surfaces with curved contours which often contain islands of unaffected skin. Frequently they become discoloured in the centre, which becomes pale or livid and pigmentless, the margin retaining its colour longest.

The borders of the spots are nearly always raised, and may be observed to be studded with small vesicles which appear above the skin. Hillis states that in black races they are almost invariably of a bright yellow, and remarks, in agreement with other observers, that their most frequent sites are the back, shoulders, backs of arms, nates, around the knees, elbows, and on the face. He also states that he has been struck with the frequency with which the course of the musculo-spiral nerve has apparently been taken by the eruption. The serpiginous tendency of the spots is best seen on the extremities.

Sometimes the spots develop rapidly, preceded by an attack of fever, sometimes gradually, and without any febrile symptoms.

Hillis and Leloir have given minute descriptions of the varying hues of the leprous spots. The former, whose description is based on long experience and observation in British Guiana, states that whereas in Europeans, Creoles and Mulattoes, and fair-skinned people, the spots when first seen are of a light copperish tint, in black races they are of a dirty yellow; that later on the hue becomes lighter, and the margins appear as if washed or brushed out; that these hyperæmic spots do not pale on pressure; and, in conformity with other observers, he found that they did not correspond to any defined nerve distribution. Leloir, who has made a special study of the colour they present, divides them into three classes—those which are erythematous at first, those which begin by excess of pigment, and those in which there is either a diminution of pigment at the outset, or a diminution following excess.

Whilst Norwegian writers call special attention to the erythematous nature of the spots, the chief feature in coloured races and hot climates appears to be the excess or absence of pigment. The most general tendency, however, of all these spots is to become pigmentless in the centre, and hyperæsthetic in the peripheral hyperchromic margin, the centre eventually becoming anæsthetic. The explanation of this is that whilst the peripheral nerves are irritated by the leprous poison, there is accompanying hyperæmia or hyperchromia; but when the terminal branches of the nerves have been destroyed, the part becomes colourless, and sensation is lost.

The spots are never present on the scalp, and very rarely on the palms and soles. They are generally roughly symmetrical. In some instances in which large extents of surfaces are affected, the symmetry is very marked and striking. They appear to affect the mucous membrane with great rarity.

During the permanent stage of the disease, the eruption in some cases may take place over large portions of the body. Hillis states that he has seen almost the entire body darkened by one huge discoloration occasioned by the blending together of the patches. In a European boy, who acquired his leprosy in the West Indies, and regarding whom we were consulted some years ago, when in the fully developed stage of nerve leprosy, the spots on his thighs had coalesced until they had embraced the whole limbs, and sweeping upwards met over the tops of the hips in a large well-defined curve.

After the spots are fully developed the disease may appear to be arrested for a considerable time—months or years—and the general health may be fairly good. The mottled appearance of the limb, or a large part of the trunk; the complete suppression of sweat from the anæsthetic portions, and sometimes from the skin surrounding the spots;¹ and the whitening of the hairs in the affected parts, are the leading features of the eruption; whilst the only symptom in connection with the general health may be neuralgic pains of more or less intensity, or hyperæsthesia of parts of the skin.

Whilst the hairs in tubercular leprosy fall, in the anæsthetic spots of nerve leprosy they become colourless, but do not always fall. Usually the lymphatic glands enlarge and are sometimes painful. Danielssen states that he has seen the spots remain unchanged for eighteen to twenty years, the patient in the meantime suffering so little that he took no medical advice. He informed Leloir, in 1884, that in very rare cases he had seen anæsthetic spots in the mucous membranes; and that he had observed an eruption of anæsthetic

¹ The complete suppression of sweat from the surface of the spots is a striking symptom, and important as a diagnostic point. Dr. Manson informs us that the Chinese in Amoy consider this symptom as pathognomonic of leprosy. By hypodermic injections of pilocarpine he has, in doubtful cases, been enabled by this peculiarity of the leper spot to make a positive diagnosis in cases the nature of which would have otherwise been doubtful.

spots, accompanied by redness and thickening of the pharynx, which disappeared without ulceration.

In a case of nerve leprosy observed by Leloir at Trondhjem, he found on the middle of the palate and uvula an ulcer, as large as a two-franc piece, with a greyish base, which had been superficially formed from four separate points. Slightly diphtheritic in appearance, with rose-tinted edges half a millimetre in depth, and invading the whole uvula, this ulceration was completely indolent and entirely anæsthetic; very similar, apparently, to the ulcerations which sometimes form in certain varieties of herpes of the throat. The patient was not aware of its existence.

Cæsar Boeck (quoted by Leloir) believes, on account of the symmetry of these nerve lesions in leprosy, that their first development is due to hyperæmic congestion produced by the action of the poison on the central nervous system, and that it is only later that it perceptibly attacks the peripheral nerves. Danielssen once found considerable redness of a nerve leading to a spot. The same author told Leloir, in 1884, that he had seen the spots of nerve leprosy disposed in the form of a double zone, following in rare cases the intercostal nerves; there was no pain present. This form is stated to be more serious than when the first spots are situated on the limbs.

The spots may, however, be absent at the beginning, and may never appear at all in nerve leprosy (although generally present); the first distinctive symptom in such cases is decreased sensibility, which shows itself in circumscribed parts, particularly the hands, forearms, feet, and legs.

A characteristic symptom of the disorganisation of the nerves is the appearance of the leprous bullæ. Months or years after the premonitory symptoms associated with the action of the bacillar poison have been present, bullæ may appear suddenly, and without any preceding local symptom. The patient, however, may not be aware of their appearance until they have burst, which they do after they have existed some hours. They vary from the size of a nut to that of a hen's egg, are semi-transparent, and filled with a viscous yellowish-green fluid, which is sometimes milky. Very soon after they have burst the epidermis loosens and falls, leaving a slightly red ulcerated surface. The ulcer may remain for a

long time, and secrete a viscous yellowish white fluid; this frequently hardens, forming brownish crusts that fall off and give place to fresh ones. As soon as these ulcers are healed other bullæ appear which follow the same course, and have the same character as ordinary pemphigus. Leloir states that, within ten to eight days, the red margins may gradually enlarge till they have doubled in size.

This state of liability to bulla formation may last for years. Danielssen and Boeck have seen it last for five years, there being very short intervals free from the appearance of bullæ, the patient remaining fairly well.

The cicatrices which are left are of the same size as the bullæ. Slightly depressed, with a shining whiteness, and often less sensible than the surrounding skin, they are frequently outlined by a light brownish border. In general they are free from hairs, and where hairs are found they are very fine and colourless.

Sometimes several bullæ come at once—two or three round the knees, for example, and many on the arms; but usually there is only one at a time.

Danielssen and Boeck have only seen a leprous bulla once on the face, where Campana has also seen it, though they occur very frequently on the palms and soles: possibly connected with the liability of these parts to mechanical or thermic traumatism. They may come on any part of the body except the scalp. Leloir has three times seen them on the mucous membrane. The ulcer which is left after the bulla has burst may heal in a few days without a scar; but usually months elapse before this process takes place.

These bullæ, which are as characteristic of nerve leprosy as the fall of the eyebrows is of tubercular leprosy, may continue to form for weeks, sometimes for months, and in very rare cases for years, before the other characteristic symptoms of nerve leprosy are developed. Danielssen and Boeck have observed the formation of bullæ twice in an advanced period of the malady. As a rule, the early bullæ are small and numerous, and are hyperæsthetic, or have normal sensation; whilst the later ones are large, solitary, and may be anæsthetic, in which case the bullæ come at longer intervals, and the secondary ulceration is more persistent.

Eventually the symptoms of neuritis set up by the localisation of the bacilli in the nerve trunks become painfully manifest. Danielssen and Boeck have given the following graphic description of these symptoms:—

After the pemphigus stage has fully developed, the patient usually feels fairly well; but this favourable condition only lasts for a short time, for excessive hyperæsthesia soon appears, accompanied by periodic shiverings. The hyperæsthesia may be limited to certain parts of the skin, or may extend over the extremities, or a large part of the face. Often manifesting itself first on the extensor surfaces, it soon attacks other parts of the body, and increases until the slightest contact produces a sensation like that of an electric shock. Movement causes violent pains, which are likened to the pricking of pins, and the patient can only attain peace by remaining in bed. He becomes sleepless, loses his appetite and flesh, and his skin being disagreeably dry, he perspires little. When the hyperæsthesia is limited to small portions of the skin, the general health is less affected.

This hyperæsthesia, which may last a long time, even years, is succeeded by anæsthesia, which occurs usually at first in the parts supplied with cutaneous branches from the ulnar and peroneal nerves—the little finger, for example, which is often early affected. The skin becomes pale at places, parchment-like, and inelastic; the secretion of sweat is entirely arrested, as is also the sebaceous secretion. The anæsthetic area extends, and as the patient does not readily perceive when his feet touch the ground, his manner of walking becomes uncertain. He grows thin and cadaverous-looking, his countenance assuming a pale yellowish, slightly violet tint. He suffers from severe pains in the head, radiating from the part above the root of the nose, and complains of dryness in the eyes. The conjunctivæ are injected, and the expression is dull. The region of the orbicularis muscle becomes loose and full. The lower eyelid falls to some extent from the eyeball, this being particularly noticeable at the canthus. The lower opening of the lachrymal duct is prominent and patent, and the few tears which it secretes flow over the cheek. Small vesicles form on the cornea, rupture, and heal. Eventually there is complete ectropion. The eyelashes fall, and the palpebral

conjunctiva no longer has any secretion, but becomes dry and resembles the skin. In the cornea, opacities and dry thick crusts of a greenish-yellow tint form. These remain a long time, then fall and give place to new ones. In this way the vision is gradually destroyed, and the eye eventually becomes dry and without a trace of secretion. Destructive penetrating ulcers rarely form in the cornea, and iritis is exceptional. In the meanwhile the face becomes disfigured and deformed from the feeble action of the muscles. The lower lip drops, allowing the teeth to be seen, and exposing a large part of the pale and swollen gums. The patient cannot shut his mouth without supporting his lower lip, and the flow of saliva sometimes corrodes the skin. In the nasal cavity, which remains long dry, causing a disagreeable sensation, perforating ulcers frequently form without destroying it; sinking in of the nose is much rarer than in the tubercular form.

So complete is the anæsthesia that one can touch, and often make incisions in, the bulb of the eye, cheeks, lips, gums, and nasal cavity, without causing the patient any pain or apparent sensibility to touch. The taste is gradually impaired, but the hearing is not usually altered.

As might be expected from a neuritis, however caused, a prominent symptom may be pain—in the limbs chiefly, but occurring also in the face, where it is sometimes localised round the eyes, cheeks, mouth, or root of the nose, and sometimes on one side. We have already alluded to the severe pains which are experienced in the head. It is to this grievous suffering, aggravated at night, that the anæmia, so characteristic of the victims of nerve leprosy, is attributed. After months, or even years, of this torture (which happily is not a constant symptom), the patient complains of weight and dulness in the limbs; the hyperæsthesia diminishes; the pains abate; and there is a consequent apparent improvement of the general health. This indicates the stage when the symptoms caused by *degeneration* of the nerve become marked; afterwards, when the *destruction* is complete, and sensation no longer exists, anæsthesia, atrophy and absorption, and mutilation, are the prominent symptoms.

Dr. Hillis states that the throat does not become affected in nerve leprosy till late in the progress of the malady, and 'when

it has been in existence for more than five years, the average duration of the disease being fifteen years. The lesion, when it occurs, consists of complete loss of sensibility about the soft palate, uvula, and back of the pharynx, not amounting to paralysis, but seriously interfering with the proper functions of the muscles of the throat affected by it; permitting regurgitation through the nostrils, and causing difficulty in swallowing. The anæsthesia is so great in the parts mentioned, that patients do not wince when a sharp instrument is plunged deeply into them.'

Dr. Castor found that out of 231 cases where the mucous membrane was examined in the mouth and pharynx, anæsthesia existed in ten per cent. on both sides, in two cases on the right side, and in five on the left side.

When the bacilli have fairly attacked the large nerve trunks, the neuritis which they produce leads to a regular fusiform thickening (more rarely nodular or moniliform) of certain nerves, particularly the ulnar and tibial, sometimes the peroneal, more rarely the median, radial, brachial, and cervical. The thickening of the ulnar nerve behind the olecranon process at the elbow constitutes a characteristic and well-known symptom of confirmed nerve leprosy. Leloir states that he has seen it sometimes as large as the finger, or even larger. Not only do the larger nerves become thick, but their branches can be sometimes felt as fine cords, of which Danielssen, Boeck, Lamblin, and Leloir have seen examples. The thickened nerves are perhaps painful to the touch, and when compressed severe pains may radiate towards the fingers and toes. During this stage the nerves are larger than when they have become degenerated entirely.

Wherever there is anæsthesia, nutrition is affected, and as loss of sensibility often begins in the hands, these early become thin. Danielssen and Boeck consider that the shrinking of the muscle over the metacarpal bone, between the fore-finger and the thumb, is a characteristic sign. After the thenar and hypothenar muscles have begun to waste, the muscles of the hand, then the forearm, and, finally, even some of the upper arm atrophy. The corresponding muscles of the lower extremities likewise atrophy, but in a less degree. The anæsthesia extends deeply, and the patient

can burn himself till the flesh is charred, or undergo considerable amputations, without feeling pain. The fingers become difficult to move, and are flexed; the backs of the hands flatten, and the first phalanges become extended, whilst the others curving produce the characteristic clawing appearance (the *main-en-griffe*). After the flexure has lasted some time, it is impossible to straighten the fingers. The same changes occur in the toes. This condition is not produced by anæsthesia, which, it is said, may occur after the deformity alluded to.

During the course of the disease a point of a slightly bluish colour may present itself at any part of the sole, after several days' headache, thirst, and oppression.

Soon there is discharged from the place a great quantity of thick ichorous pus, and the general symptoms are relieved. The skin involved becomes gangrenous, and a large irregular ulcer is formed, which may invade a great part of the sole, and, penetrating deeply, destroy the soft parts until it has laid bare the bone. These ulcers are exceedingly difficult to cure, and usually persist indefinitely—their condition varying with the general condition of the patient, which Danielssen and Boeck state is better when the ulcers discharge freely. The ulcers are, according to Hillis, found in almost every case, occurring amongst people who go barefooted.

Bidenkap considers that this perforating ulcer, so common in the sole, is due to a process similar to that which proceeds from the bulla in other parts; the thicker epidermis in this part preventing the bulla from being observed, and allowing much ulceration to take place before the epidermis breaks.

When the anæsthesia has reached its full development, the characteristic necrosis begins, generally in the fingers or toes, which one by one become affected. After lancinating pains, which are felt in the bone, a swelling forms that encircles the whole finger. This swelling, which is of a deep violet colour, is not painful to the touch, and soon fluctuates. The pains, which become exacerbated, extend over the whole limb, and are accompanied by swelling of the glands and usually by violent fever, with increased fluctuation. The skin soon gives way, a large quantity of pus is discharged,

and the general symptoms rapidly improve, the pain diminishing gradually. By this process the phalanx has not only been laid bare, but has been loosened and discharged, and the ulcer is cured, the finger being shortened. If the second phalanx is first attacked and falls, the third is drawn towards the first, the finger then appearing as if it had only two joints. The thickening of the tissue after the fingers have fallen produces great deformity in the hand. A similar process takes place in the foot, where not only the toes, but the bones of the metatarsus and tarsus fall. The dorsum of the foot becomes flat, and the sole flattens out, producing a deformity which Danielssen and Boeck compare to the paw of a seal. The foot or the whole hand may fall in this manner. Usually, when the foot is united to the leg simply by a portion of skin and some tendons, it is cut off; the skin which remains adhering to the bare surface of the joint and protecting the bone.

The bones disappear in two ways—by caries and interstitial absorption. The ulcers left after bullæ may deepen, and destroy the connective tissue, muscles, and fasciæ—forming deep, smooth, and punched-out holes. Where the bone is near the skin—for example, in the ankles, wrists, or hands and feet—or where there is much pressure, as in the sole, the destructive process finally reaches the periosteum, and the bone is laid bare, and becomes carious. On account of the anæsthesia, these wounds may be neglected, and a large portion of bone destroyed.

The effect of the loss of nerve supply in leading to interstitial absorption of bone without inflammation is a peculiar feature of this form of leprosy.

During the course of nerve leprosy, the patient—who usually has a fairly good appetite—is troubled with heartburn and pyrosis, with sour eructations and constipation. He suffers from persistent dryness of the mouth, extending to the œsophagus, and great thirst. He complains of a sensation of cold, and craves for warmth in his room, getting near to the fire or stove. Long before the days of the clinical thermometer, Danielssen and Boeck, taking the temperature of the skin in anæsthetic leprosy, found that of the hands rarely above 32.5° , sometimes as low as 20° , whilst in the axilla and

in the groin they never found it below 36.2° , and rarely above 40° , Centigrade.

But the loss of nerve influence may lead to simple atrophy, apart from ulceration. The skin becomes less elastic and mobile, the fat gradually disappears, and the mobility of the hands and feet becomes restricted. In this condition, Bidentkap states that the skin on section is thin, and the connective tissue transformed into a lardaceous mass.

The state of the skin causes it to crack under forced movement, and deep rhagades appear, which are difficult to heal. It is strange, however, to learn that patients can often use their crippled and partly insensible hands for mechanical work for a long time; when dry mummification sets in, which is arrested at a joint, lepers may be seen lopping off the parts with a knife or chisel.

During the course of the symptoms which have been described, and especially those which result from the implication of the nerve trunks, the general health of the patient gradually fails. Hillis states that, in the later stages of the disease, the temperature is several degrees below normal. Emaciation and anæmia increase, and there is liability to complications of visceral disease. The brain and spinal cord, apparently, are less subject to implication than some of the visceral organs. The kidneys are liable to amyloid degeneration, which is one of the causes of death. The patients frequently succumb to colliquative diarrhoea, accompanied by cramps; or they may die of violent exacerbations of the eruptive fever. They may, however, live a very long time, the mean duration being stated by Bidentkap to be eighteen or nineteen years.

If the disease has begun before puberty, menstruation never occurs; if it begins in adult life, the function is usually irregular, and in some cases ceases. The growth of the hairs, in this form of leprosy, undergoes no special change; but when the disease has begun in childhood, and anæsthesia has shown itself at the time of puberty, the hairs are fewer and finer, and more delicate than usual. The nails are not specially affected. Sterility is not a necessary accompaniment of the disease.

After having reached a certain degree of development,

nerve leprosy may become arrested, and the symptoms may even abate. The spots nearly always disappear when the disease has lasted long, without any visible marks being left on the skin, and Bidekap states that even sensibility may be re-established.

With the disappearance of the spots, cessation of bullæ, and marked improvement in the general health, the patient may be said to be cured; atrophic and paralysed muscles, and anæsthetic portions of skin being the only remnants of the disease. This arrest may take place early, or after the disease has lasted a long time, and many of the patients may therefore attain a relatively great age.

It is difficult to get exact data for a large number of cases, but it would appear that in all tropical countries cases of nerve leprosy greatly outnumber those of tubercular leprosy, whilst in European countries the reverse holds good (Hansen).

MIXED LEPROSY

The most experienced observers in connection with leprosy describe tubercular and nerve leprosy as types which may run a distinct course to the end; but there are many instances in which a case which was tubercular at the beginning becomes complicated with the typical symptoms of nerve leprosy; and there are cases in which, after a period during which the symptoms were solely those of nerve leprosy, the symptoms of the tubercular type developed. Or the symptoms peculiar to tubercular and to nerve leprosy may develop in the patient at the same time. These cases are described by authors as examples of Mixed Leprosy.

The cause of these varieties depends upon the peculiarities connected with the development of the bacillus in each case. The organism may establish itself both in the connective tissue and nerves, or it may specially select the connective tissue, sparing the nerve trunks, or, as we have seen, it may develop in the nerves, entirely sparing the connective tissue.

The symptoms of Mixed Leprosy combine those of tuber-

cular and nerve leprosy, in proportion as the respective tissues are involved.

The proportion of these varieties to each other appears to vary in different climates. In Norway, Danielssen and Boeck give the following figures:—

Nerve Leprosy,	33·3 per cent.
Nerve Leprosy, with Tubercles (Mixed Leprosy),	15·1 „
Tubercular Leprosy,	51·6 „
In British Guiana, in 188 cases, Hillis found there were—	
Cases of Tubercular Leprosy,	34
„ Mixed Tubercular Leprosy,	51
„ Nerve Leprosy,	103
	<hr/>
	188

The figures given by Vandyke Carter show that, in India, cases of nerve leprosy are greatly in excess of tubercular cases.

These figures appear to indicate unmistakably, that nerve leprosy is more common than tubercular leprosy in hot countries, and that the disease is apt to be more severe when it attacks persons who live in cold countries.

CHAPTER V.

PATHOLOGY OF LEPROSY.

THE changes produced in the human body by a parasite depend on the organs which it selects for its special habitat, and on its capacity to cause destruction of blood-vessels and tissues; and as no two parasites appear to have in these respects identical capacities, it happens that the changes which are produced by them are always special in their nature. The bacilli of leprosy form no exception to this rule. The pathology of leprosy simply expresses the kind and amount of destruction produced by the direct action of the bacilli in certain parts of the body, more particularly in the cutis and in the mucous membranes, and on the tropho-neurotic changes consequent on the destruction of nerves by the special elective affinity of this organism for nerve trunks. To these changes may probably be added, in the second rank, certain secondary processes of degeneration produced by the wasting effects of the disease in its later stages, and certain erythemas, probably produced by the action on blood-vessels of a poison set free by the growth of the bacillus. Although such a poison has not been isolated, it is certain that the bacillus, like all other organisms that live in the tissues, cannot grow without setting free new substances which are foreign to the body, and which in most cases act as poisons.

PATHOLOGY OF TUBERCULAR LEPROSY.

A very complete account of the naked-eye changes in leprosy has been given by Danielssen and Boeck. In a section of a tubercle which has not softened, the epidermis is found normal, and from the slightly firm corium a little viscous fluid can be expressed. When the tubercles are com-

pletely developed and softening, the cut surface is granular, yellowish-white, and a substance having this colour can be squeezed out of it. The subcutaneous tissue is infiltrated and thick, and a lardaceous mass, which is often gelatinous, adheres to the corium. The skin becomes gradually thickened, the tubercle very rarely extending to the subcutaneous layers, and, when it does so, it is only at certain points—it being always easy to distinguish the limit which separates the corium and the subcutaneous tissue, which does not soften with the rest of the tubercle, but becomes firmer. The vessels and nerves which extend through the diseased part become affected, the walls of the large subcutaneous veins being thickened, a resistant lardaceous mass, which is deposited on their outer surface, binding them to the infiltrated subcutaneous tissue. The thickened veins resume their normal condition as soon as they have left this infiltrated area. The external surface of the cutaneous nerves becomes hypertrophied by the same deposit, and the neuritis may cause the nerve to be double its usual thickness. The deeper layers of the connective tissue and muscles are found normal, and the bones are never directly attacked. In the early stages of the disease coagula are found in the vessels; and in cases in which death had occurred with great rapidity considerable effusion of a thick, dark, bloody fluid was found between the muscles, and all the organs looked as if they had been soaked in blood.

The condition of the spots and tubercles in the mucous membranes is analogous to those in the skin. In the larynx, which is sometimes early affected, spots or tubercles are found. They may commence on the edge of the epiglottis, which becomes thickened, and the seat of extensive tubercular infiltration. The ligaments and cartilages also become infiltrated and thickened, causing extensive narrowing of the glottis, which is sometimes almost entirely closed by the progressive thickening of the mucous membrane of the thyro-aretenoid ligaments. When these infiltrations soften, considerable ulcers form, not only in the epiglottis, but in the cavity of the larynx. The cartilaginous substance is thin, but never entirely destroyed. The glands of the neck, both superficial and deep, are swollen, and sometimes found as

large as a hen's egg, the infiltrated mass being yellowish-white, and sometimes black. These glandular changes are found only when the disease has been of long duration, or when its course has been acute.

Considerable difference of opinion exists regarding the deposits of visceral leprosy, between Danielssen and Boeck and recent observers.

The former authors describe leprosy changes in the bronchi, pleuræ, uterus, and intestines, but their views have not been confirmed.

The bacilli can develop both in the liver and spleen, producing in these organs infiltration of tubercular leprosy. In both organs the bacilli are found in cells, indistinguishable from ordinary lymph cells, and grouped and surrounded by a moderate degree of fibrous change.

Bacilli are also found in the affected lymphatic glands and in the seminiferous tubes of the testicle. Arning, in one case of premature death from leprosy, found inflammatory infiltration with bacilli in the ovary. They do not appear to have been found in the lung, bronchi, bones, or muscles, and there seems to be some doubt as to whether certain lesions in the intestinal canal are due to specific leprosy deposits or are of the nature of true tuberculosis.¹

In some cases an immense number of acari have been found in the hair follicles.

Danielssen and Boeck injected the blood-vessels in lepers, and in the early spots they found the capillary vessels greatly increased in number, but in the development of the tubercle the capillary network had disappeared. In tubercles which were beginning to soften no trace could be found of blood-vessels; so much so, that an injected face showed the colour of a bright red poppy, whilst on it the tubercles were almost of a straw colour.

If a vertical section is made from a leprome of the skin,

¹ A case is described by Goldschmit, of Madeira, in which the œsophagus was invaded by a leprome. Cornil and Babes state that bacilli were found in one case in all the tissues, even in those which appeared healthy; that they exist in the endothelium cells of the vessels of the lung, and in the walls of the endothelium of the vessels of the kidney, particularly in the glomeruli. Leloir states that neither himself nor Hansen nor Neisser had found bacilli in the lungs or kidneys of lepers.—(Leloir.)

and examined under the microscope, the chief morbid change found is that large clusters of cells have taken the place of bundles of connective tissue, which are broken down. Very often, if the leprose is not advanced towards the ulcerative stage, a thin band of sound, unbroken connective tissue is observed between the rete mucosum and the affected part of the corium, which may be found the seat of a dense infiltration of cells. The cells are very similar to the so-called 'granulation cells' observed in lupus and in syphilis. In the centre of a group of such cells in a lupus tissue one or more sections of enlarged blood-vessels filled with granular material may be discovered—the so-called 'giant cells' of authors. 'Giant cells' are referred to by several authors in connection with leprosy, but in a very large number of sections which have been examined by us we have not observed the characteristic appearances described by ourselves and others in lupus vulgaris.¹

The cells in leprosy vary in size from that of an ordinary white blood corpuscle to double, and even four times, that size and more. If specially stained for the purpose, it is seen that these cells contain leprosy bacilli, the smallest of them containing a few, the largest of them masses of bacilli matted together. Groups of bacilli (Damsch) are found in the walls of blood-vessels, evidently corresponding to leprose cells which have found their way into the adventitia. The bacilli, once lodged in the cells, produce a poison which leads to breaking down of the connective tissue and to the accumulation of white blood corpuscles, which in their turn become infected with the leprosy bacillus. Under the influence of the multiplication of the bacilli, the cells expand, the nucleus breaks into fragments, which first enlarge, and finally become more or less disintegrated, and the cell substance is altered, until, at length, the enlarged cell—the large yellow cell of Virchow—is represented by a globular mass of bacilli and detritus. When the cutaneous leprose undergoes fibrous transformation, the bacilli become less abundant.

Syphilis, lupus, and leprosy in the skin have in common destruction of connective tissue, and the accumulation of masses of cells which are, under the microscope, not very

¹ *Med. Chir. Trans.*, vol. lxii.

dissimilar. As compared with syphilis and lupus, the connective tissue round the cell infiltration in leprosy appears to have a less tendency to break down, and is less sharply limited. The surrounding unaffected connective tissue seems, in leprosy, to tolerate longer the presence of the morbid elements in the diseased parts which it surrounds.

The bacillus of leprosy was discovered by Hansen in 1874, and was within a short period found to be present in leprosy tubercles brought to Europe from all parts of the world. It is now known to be invariably present in leprosy tissue. The organism is a delicate slender rod, stated by Leloir to be in length equal from a half to three-quarters, and in breadth from an eighth to a fifteenth, of the diameter of a red blood corpuscle.

In size and staining characteristics it presents such a close analogy to the tubercle bacillus as to render it necessary to refer specially to alleged points of difference.

Leloir gives the following summary of these points:¹—

‘The bacilli of leprosy are specially distinguishable from those of tuberculosis, because in the coloured sections lepromas always contain an immense quantity of bacilli, whilst tuberculomas always contain much fewer, and most usually they are very few in number. The tubercle bacillus must be patiently sought for in stained sections. The bacilli of leprosy, on the contrary, are present in immense numbers. The size of the lepra bacillus is more uniform and more rectangular than the tubercle bacillus.—(Cornil.) They are shorter, thinner, and less pointed than those of tuberculosis.—(Hansen.) The bacilli of leprosy are also more easily coloured than those of tuberculosis. Thus, for example, they colour with Poirier’s fuchsine, which, in simple solution, does not tint the tubercle bacillus. A much longer period, also, is required to decolorise them by nitric acid.—(Babes.) The tubercle bacillus colours only in alkaline colouring liquids, that of leprosy also takes colour in neutral or acid colouring liquids: gentian, fuchsine.—(Neisser.) For the purpose of distinguishing, for example, the bacilli of leprosy from those of tuberculosis, if they occur together in an organ, the sections are coloured with simple fuchsine for half an hour, and, decolorised with

¹ *Traité*, p. 231.

an acid. By this proceeding the lepra bacilli alone remain coloured.—(Cornil and Babes.)'

A comparison of this summary with the autotype plate representing Mr. Pringle's photographs, shows the advantages of photography as compared with simple unaided microscopical observation. Without desiring to prejudice in the smallest degree the observations regarding the different effects of stains referred to in the above note, it is necessary to state that they do not accord with the results of some experiments made by ourselves.

Notwithstanding these points, the resemblance—as ordinarily seen under the microscope—is so great that we were long in satisfying ourselves that they could be distinguished simply from their microscopical aspects; and experienced and patient observers have expressed themselves to us in the same sense.

For this reason we have availed ourselves of the kind offer of Mr. Andrew Pringle—whose competence in such a matter is recognised—to endeavour to bring out by photography such points of difference as actually exist in the size and shape of the organisms. Mr. Pringle's admirable photographs have been reproduced in autotype, and may be studied in the plate which is prefixed to this volume.

It will be seen by examining the plate that the leprosy bacilli are more unequal in breadth than the tubercle bacilli, and that they have a special and characteristic tendency to become club-shaped at one end and tapering at the other. The tubercle bacillus, on the contrary, have a fairly uniform thickness throughout. This point of difference was perhaps more apparent in the photograph than in the autotype reproduction, as the original bears examination under a magnifying-glass.

In addition to the individual differences between the rods, there is a characteristic difference in the tendency which the leprosy bacilli have to become agglutinated into masses, the *glia*, or juice which they secrete, causing more intimate cohesion than is the case with the tubercle bacilli. A morphological difference is, we believe, established between these bacilli, and any doubt that may have existed after examining the preparations is, we believe, inadmissible after studying Mr. Pringle's photographs.

The position of the bacilli has given rise to some discussion. The earlier observers—Hansen, Neisser, and others—described the bacilli as being in cells, apparently without considering that the fact could be doubted; and in our own studies on this subject, extending over a considerable period, with an ample supply of leprous tissue, we considered the fact to be perfectly established. After some time, Dr. Unna of Hamburg, who devoted himself to the subject with characteristic energy and ingenuity, by practising a special mode of preparation, arrived at the conclusion that the leprosy bacilli were not in the cells, but that the cell appearance was produced by the bacilli grouping themselves so as to form spheres, and exuding a glia in which they were embedded. If a section through a leprome is dried, then moistened and stained, an immense number of bacilli can be brought to view. Nothing is seen of the cells, and the appearance is exactly that which is described by Dr. Unna. It is possible, however, to obtain preparations which, it seems to us, put the matter beyond the possibility of doubt.

Mr. E. E. Henderson, of St. John's College, Cambridge, has produced for us preparations in which the bacilli, the nucleus, and the cell substance can all be distinctly seen in the same cell. The discharge from a leprous ulcer in a patient at present in London was smeared on cover-glasses, which we placed first in diluted, and after a few minutes in undiluted, absolute alcohol, in which they were allowed to remain twenty-four hours. The effect of the alcohol was to permit the nucleus to take on a beautiful hæmatoxylin stain, and, at the same time, the bacilli could be clearly stained by the ordinary methods. By another stain the protoplasm of the cell enclosing the nucleus and bacilli can be distinctly and unmistakably made out. We believe it is in the power of any one possessed of ordinary technical skill in bacteriology, who has access to the discharge from a leprous ulcer, to obtain preparations which show the cell substance enclosing the nucleus and the bacilli. Discharge from an ulcer is recommended instead of a section, because there can be no doubt regarding the identity of the leper cell, which is found free in the fluid.

The Figures 3 and 4 in the autotype plate (Plate III.) at

the beginning of this volume show these points as well as they can be shown in a photograph.

When the stained cover-glass preparations are examined under the microscope, the demonstration is of course more striking; but it is also possible to obtain sections which show clearly enough, in our opinion, that the nuclei are contained in cells. This point established, the question arises as to whether the bacilli are not only contained in cells, but also lie free in the tissues. This is a matter on which it is extremely difficult to come to a definite conclusion. In the cover-glass preparations from an ulcer, not only are bacilli found in cells, but a number are found lying free, as, for example, in Figures 3 and 4 of the autotype plate; but it must be remembered that these preparations have been made by one cover-glass being rubbed against another; and, of course, many cells must have been entirely disintegrated in the process, and more or less of this disintegration would take place by whatever method the cover-glasses were smeared. In the preparation of sections there is the same source of fallacy. It is impossible to prepare a section without subjecting the tissue to considerable violence, which must result in the disintegration of a number of cells, and in the production of apparently free bacilli. Probably, also, the natural course after a leper cell has become swollen and distended is for the protoplasm to undergo disintegration first and then to disappear; and where we previously had clusters of cells containing bacilli, we would find no evidence of cells, but a globular mass of apparently free bacilli. We have ourselves repeatedly observed such masses apparently occupying the position of blood-vessels, and we have explained them in this way.

After long study of many sections of leprous tissue, and after having read much that has been written on this subject by competent observers, we cannot satisfy ourselves that there is any evidence that the bacilli can live and multiply outside the cells.

The matter is not one of simple technical interest. The fact that the bacillus lepræ specially selects white blood corpuscles for its habitat, and refuses to live unhoused amongst the other elements of the body, probably accounts for the

extraordinary chronicity of the disease and the comparative rarity of contagion. Whilst studying this bacillus, we found it in cells in the corium, sparsely but distinctly present in the unbroken rete mucosum, in the epiglottis and larynx, and in the liver and spleen; but in all these instances they were contained in cells of nearly similar size and form. The cells were to us undistinguishable from leucocytes when small, and there were transitions in all gradations to those of the larger size.

The tendency of the bacilli is to the formation of spores, and, if proper illumination is used, it is possible to detect these spores in what, under ordinary examination, appear to be simple straight rods. Occasionally groups of these bacilli and spores may be found massed together, producing in a section the appearance of a canal or tube which had been filled with them.

The peculiarity of this organism is the enormous extent to which it may be developed in the skin compatible with the preservation of life, and even with a fair amount of strength. The surface of a leprous ulcer, either in the skin or the mucous membrane, is rich with what is almost a pure cultivation of them. If a fold of the infected skin is pinched up and pricked with a needle, the clear fluid that exudes contains them in numbers; whilst in well-developed cases the corium may be rightly considered as being almost composed of masses of bacilli. When we consider the extent to which the integument is sometimes involved in tubercular leprosy, it is almost appalling to think how much of the actual specific weight of the individual must be due to the parasites he carries about with him. This condition is hardly paralleled by the swarms of embryo filariæ found in the blood of the persons who harbour that parasite.

Although the bacillus lives and multiplies in the corium, its special place of predilection is the nerves. In the leprose of the cutis, the nerves are invariably affected; but there are individuals, victims of nerve leprosy, in whom the nerves alone are involved. In such persons the parasite is incapable of living and developing in any part of the body other than the nerves, and it would appear that, if not in all, certainly in many cases (and exceptions have not yet been demonstrated), in the peripheral nerves only, even in cases of nerve leprosy

lasting many years. It is impossible to believe that the localisation of the disease, and the limitation of the bacilli to the nerve trunks and the extremities—and perhaps also to the nerves of the face—can be due to any other cause than the fact that in such persons these parts of the body alone tolerate the development of the organism.

In tubercular leprosy, after a time, changes take place which enable the leucocytes carrying the organism to settle finally in the liver and spleen; but in all cases, and up to the very end, there are many structures of the body in which the organism cannot live. In these respects there is an analogy to the tubercle bacillus, which also selects special structures for its habitat and development. Possibly, also, the same may hold good for an organism which causes syphilis, when such an organism is finally discovered.

The relations of the leprosy to the tubercle bacillus, observed in their behaviour in common as regards certain dyes, indicates that, chemically, they have something in common which distinguishes them from all other bacilli yet known.¹ As regards size, several observers have called attention to points of difference. We are, however, obliged to confess that, after considerable observation, we find ourselves compelled to state that, under the microscope, we could detect no difference in size between the tubercle and leprosy bacillus. But whilst it is difficult to establish a difference in size, successful photography, as we have already shown, is conclusive as to a difference in form. Wesener has stated that dead leprosy bacilli inoculated into the anterior chamber of a rabbit retained their form and capacity for colouring, whilst if dead tubercle bacilli are inoculated, they soon lose both their form and their capacity for colour.

Whether the bacillus lepræ can be transferred to animals is still doubtful. Dr. Kaurin, like several other experimenters, has not been able to confirm Dr. Ortmann's inoculation of the bacillus lepræ on rabbits.² Transplantation on man

¹ Leprosy and tubercle bacilli, when stained with fuchsine, can be subjected to the action of nitric acid for a short time without being decolorised. All other bacilli yet known to us immediately lose the stain when in contact with nitric acid.

² *Journal of the Leprosy Investigation Committee*, Jan. 1891.

has, up to the present time, given no results that are beyond criticism.

It has been suggested that the leprosy and the tubercle bacillus are probably identical, a suggestion that could not be entertained by any bacteriologist of experience. The tubercle bacillus can be cultivated with certainty outside the body. The leprosy bacillus has not yet been cultivated outside the body. The tubercle bacillus can be inoculated in certain animals with the certainty of growing—in the guinea-pig and rabbit, for example. Numerous experiments of this kind with the leprosy bacilli have failed. These experiments have been now performed so frequently, and by so many competent observers, that it may be considered as proved that the leprosy and tubercle bacilli are not identical, even if we leave out of account the different clinical conditions with which they are associated.

The important facts to bear in mind are that the leprosy bacillus exists in cells; that wherever it is found it leads to disorganisation of tissue, and to multiplication of bacilli-holding cells; and that, whilst multiplying freely in the connective tissue of the corium and in the mucous membrane of the mouth and the larynx, it has special elective capacity for developing in the interior of nerves, where it leads to destruction of function, abolishing the power of sensation, and causing atrophy of the tissues supplied by the affected nerves.

Considered more in detail, there are certain facts and statements worthy of notice.

Leloir states that Hansen, Cornil, and himself have observed slight movements in bacilli obtained by pricking a tubercle, and that in a leprose which has undergone fibrous transformation the bacilli are less numerous than in the early stages. In the liver they are found in cells in the interlobular spaces, and in the spleen scattered in the lymph cells. They have been found in the seminal ducts, and Arning found bacilli in the stroma of an unfecundated ovary, and in small cells between the follicles. They have not been found in the bones. In nerve leprosy they are found in cutaneous and peripheral nerves, and perhaps in the lymphatic glands. In tubercular leprosy they are found in the

skin, mucous membrane of the mouth, throat, nose, and larynx, lymphatic glands, liver, spleen, and eye; whilst they have hitherto only in a few cases been observed in the testicle, ovary, and cartilages. Hansen does not believe that the bacilli lie free in the lymph channels, and considers that it is because they are contained in cells that diseases like leprosy and syphilis are chronic; he believes that in leprosy, more than in any other disease, the peripheral lymphatic glands act as a filter for the specific poison. He states that the bacilli are not found circulating freely in the lymphatic glands, or acting as emboli in the interior, but are found in the ampulla, firmly enclosed in the cell membrane, and that the nearer to the centre of the gland the less is the infection. In regard to their presence in the blood and blood-vessels, varying opinions have been expressed. Neisser never found them in blood-vessels; but in sections from a leper larynx which we examined in great detail, we satisfied ourselves that capillary blood-vessels were sometimes blocked with white blood corpuscles, within which bacilli could be distinctly seen. Neisser did not find them in blood; and Beaven Rake, with his large experience, states that he has always failed to find bacilli in the blood of lepers at any stage of the disease. In repeated examinations of the blood of a fairly advanced case of tubercular leprosy, which came under our notice some years ago, we did not once discover bacilli in freshly-drawn drops of blood. Hansen also (quoted by Leloir) states that he had not found them in the blood. Leloir states that, in very exceptional instances, he has found bacilli in the interior of blood-vessels, and that he found three bacilli in twenty preparations of blood, and that only in one case out of five patients.

We found cells containing bacilli in the rete mucosum, in tissue very carefully examined;¹ and in a preparation made by the dry method, kindly sent us by Dr. Unna, bacilli were distinctly to be seen in the hair follicle.

The presence of bacilli in the epidermis and hair follicles of course affords a means by which bacilli may leave the body of lepers, even if there is no ulceration present.

The following scheme from Leloir appears, so far as we at

¹ *Med. Chir. Trans.*, vol. 66.

present know, to represent the organs in which the bacilli are generally, if not exclusively, found:—

Cutaneous and peripheral nerves, and perhaps lym- phatic glands,	} Nerve leprosy.	} Complete or mixed leprosy.
Skin; mucous membranes of the mouth, throat, nose, and larynx; connective tissue; cartilage; lymphatic glands. The eyes. The testicle. The liver and the spleen. Ovary (Arning),		
	} Tubercular leprosy.	

Dr. Beaven Rake examined, microscopically, kidneys from forty-nine lepers, and found bacilli in only two cases.

In the liver, spleen, mesenteric glands, intestines, and kidneys, amyloid degeneration is sometimes very marked. In nerve leprosy the kidneys are nearly always affected with nephritis and amyloid degeneration.

Beaven Rake states that in seventy-eight autopsies of lepers at the Trinidad Leper Asylum twenty-three showed some form of nephritis.

In the muscles secondary changes are found under the form of interstitial myositis, with atrophy of the muscular fibres.

The characteristic changes in nerve leprosy are found in the nerves (which are much swollen at parts), but the parts that have been altered by the loss of nerve supply also show certain specific changes. Danielssen and Boeck described the skin in cicatrices left by bullæ as being thinner but not altered in structure, and state that in the fully-developed malady the skin becomes thin. The subcutaneous and inter-muscular fat almost entirely disappears. The muscles are atrophied. On the face and hands a thin layer of gelatinous substance is found, containing the remains of atrophied muscles. The nerves in the infiltrated tissues around the ulcers are much swollen, as well as the deeper nerves. The axillary and inguinal glands are swollen, both superficially and deeply; but the hypertrophied glandular tissue rarely

suppurates. It is only when the flexures are recent that they yield on cutting the tendons. The skin is firmly adherent to the articulations after the fingers have disappeared. In the eye, when the changes which have been described have taken place, the anterior chamber is found diminished, and the iris is sometimes adherent to the lens. The lachrymal glands are constantly atrophied to a great extent, and sometimes disappear. These authors have described injection of the posterior surface of the spinal cord and exudation in the serous tissue of the arachnoid, extending usually at one or more parts of the cord a little over the posterior roots of the nerves, and state that it seldom covers the anterior surface of the cord. They also state that the spinal cord is altered in consistence, becoming harder. The grey substance, they assert, acquires a dirty yellow colour. In some cases they found the axillary and ischiatic plexuses, and the branches of the nerves which proceed from them, visibly atrophied, such changes being more pronounced in the cervical and lumbar regions. They describe having found in the brain a sero-albuminous exudation in the subserous tissue of the arachnoid, which was marked round the region of the fifth, sixth, seventh, and eighth pair of nerves. They also describe the cerebral substance as harder than usual, and when there has been anæsthesia of the face they state that they found the Gasserian ganglion infiltrated with thick, opaque, albuminous exudation; the cerebellum being generally found normal. Small circumscribed ulcerations were sometimes found on the cartilaginous septum of the nose. They consider that the changes they found in the ganglion, and at the region of the common facial nerve, explain the paralysis of the orbicularis and the want of power in the cheeks and lips.

The result of Danielssen and Boeck's investigations on these points have not been sufficiently confirmed by subsequent observers; and Danielssen has latterly modified his first statement, by giving it as his opinion that the peripheral nerves are first attacked, but that the leprous affection extends thence to the brain and spinal cord. Tschiriew, Breuer, and Steudener have reported specific pathological changes in the spinal cord. There can be no doubt, however, that nerve leprosy, in the words of Bidentkap, starts and generally ends

as a peripheral nerve disease—a perineuritis leprosa. Whether leprous processes may occur in the spinal cord in the later stages of leprosy may be regarded as still an unsettled question.

Hansen informed Leloir that he had examined the spinal cord and brain in more than twenty cases of leprosy, and found them healthy in every case. Once only had he seen a leper ataxic, or affected with any kind of myelitis.

Hillis and Neisser have examined a certain number of medullæ of lepers, and always found them healthy.

Hansen and Neisser, quoted by Leloir, have never found bacilli in the spinal cord, and so far the bacillus has not yet been found in this organ. Leloir, in one case with Dr. Dejerine, and in two cases alone, found the recurrent laryngeal nerve affected with parenchymatous and interstitial neuritis, which he considers may have something to do, in certain cases, with the aphonia so often present.

Danielssen and Vandyke Carter have described with great fulness the lesions of the nerves in anæsthetic leprosy, and have shown that the symptoms in the extremities are in direct relation with the neuritis of the nerves which supply the parts. Danielssen states that the cutaneous palmar nerve is usually the first attacked, and some of its branches may be much changed, whilst others remain unattacked, in which case the colourless and anæsthetic spots are found in the part of the skin that is supplied with the diseased branches. As the anæsthesia develops, the nerve is found attacked in its whole tract. The cutaneous nerves of the lower limbs are affected in the same manner.

One of the first large nerves to be affected is the ulnar, which is generally attacked immediately above the internal condyle of the humerus, the lesion beginning by a red spot in the sheath of the nerve, which penetrates more or less into its substance.

The increased thickness of the affected nerves corresponds to the amount of congestion and inflammation. The swelling may be partial, or extend continuously to the ultimate ramifications of the nerve. According to Danielssen, the change begins chiefly three or four inches below the axilla, the upper part remaining quite healthy. In the legs similar thickenings

most frequently begin in the peroneal nerve, and the external posterior and cutaneous nerve which springs from it. The lower part of the tibial nerve is frequently affected. The nerves of the face are also included, as Danielssen has several times found the ramifications of the fifth and seventh pair affected.

This neuritis is strictly dependent on the development of the leprosy bacilli in the sheaths of the nerves, as well as between the nerve tubes. On this point we can confirm previous observers.

In preparations of diseased nerves from cases of anæsthetic leprosy, we have found the leprosy bacilli in groups, corresponding to an arrangement of cells, not only within the sheaths, but between the individual nerve tubes.

Not only does the poison set free by the bacillus destroy the nerve tissue proper, but it seems to have an especial influence on the fibrous tissue which takes its place. The walls of the arteries and veins are thickened, and bands of fibrous tissue of considerable consistence are formed, producing an appearance which in some of our preparations were histologically very similar to that of sections of tendon.

The more complete the investigation into the condition of the nerves, the more certain it becomes that the pathology of anæsthetic leprosy has to do with a special morbid process in the nerves, that this process is characterised by inflammation and consequent destruction, and that the cause of the morbid change is to be found solely and simply in the presence and growth of the bacillus lepræ.

AGE.

The examination of a large number of statistics shows that the most frequent age at which leprosy develops is during the interval from puberty to thirty, but it is by no means limited to that period of life. Lewis and Cunningham found that the age of attack in 79 cases varied from three to sixty-three years, the average being 23·73. Profeta, in Sicily, found that of 114 persons affected, 9 suffered at ages from seven to ten, 26 at eleven to twenty, 39 at twenty-one to thirty, 22 at thirty-one to forty, 11 at forty-one to fifty,

and in 7 cases the disease manifested itself at ages ranging from fifty-one to sixty-five years.

Dr. Cantlie saw a case of leprosy in Hong Kong which developed in a man over seventy years of age, and very aptly remarks that it is difficult to conceive an 'hereditary disease' occurring at that age for the first time.

Leloir saw a case in which the disease began at seventy-one.

Dr. Abraham saw at Trondhjem a husband and wife, each seventy-four years of age, the woman having been diseased four or five years, and the man three years. A man aged eighty-seven had been leprosy for two years.

Two cases at Trondhjem are instanced as having been leprosy at or shortly after birth.

Dr. Castor, of British Guiana (Surgeon-General's Report, 1887), has seen no case of congenital leprosy, the youngest child affected being eight years old.

Bidenkap has only twice seen obvious symptoms of leprosy in children of two and three. They were both born of leprosy parents, and he states that in 2000 lepers only a little more than one per cent. were found to be under ten years of age.

Danielssen and Boeck state that they have seen children who showed signs of tubercular leprosy in their first year. Bidenkap remarks that this is certainly exceptional, as symptoms of leprosy rarely appear before the second year of life is passed, and even at the age of five years they are very uncommon.

In a letter to the *Journal of the Leprosy Investigation Committee*, January 1891, Mr. W. Hoad, writing on 'Leprosy in the Seychelles,' says he has seen an infant of a few months old developing tubercular leprosy. The mother was a young woman of about twenty, suffering from tubercular leprosy.

The following is extracted from the *British Medical Journal*, September 27, 1890:—

'In the *Revista Medica de Bogotá*, November 1st, 1890, Dr. R. Navarro, who has practised for more than forty years in the province of Vélez, in the United States of Colombia, reports two cases of congenital leprosy which came under his own notice. In 1847 he delivered a woman, at Chiquinquirá, of a male child of a remarkably weakly and wasted appear-

ance, and covered with leprosy spots over the whole surface of the skin. In two months leprosy tubercles became developed on the face, elbows, and knees. Soon afterwards the mother showed symptoms of leprosy, and a daughter, aged eight years, who had up till then been in perfect health, contracted the disease. All three died of leprosy within two years. In 1848 Dr. Navarro attended another woman at Pangote, in the province of Garcia Rovira. She was suffering from elephantiasis in its last stage, and gave birth to a well-formed female child, the whole of whose skin was covered with leprosy spots. There was also a well-developed tubercle on the upper part of the concha of the left ear.'

Leprosy may therefore exist in childhood, and may for the first time develop in old age. The most common age for lepers is thirty to thirty-five, and the age at which the disease most frequently begins is from twenty to thirty.

SEX.

Leprosy appears to occur more frequently in men than in women. A century's statistics at the Funchal Hospital, Madeira, showed 526 men to 363 women. On the other hand, Danielssen and Boeck state that in the years 1841 to 1848, in the St. George Hospital there were 461 male lepers and 445 females, a difference of only sixteen.

Dr. Cantlie found that in Hong Kong, out of 125 lepers, 10·4 per cent. only were females, whereas the proportion of females to males in all cases in 18,000 cases of disease was 16·6 per cent.

In India, in 262 lepers, Carter found only 56 females.

Bidenkap states that in Norway the difference is not great. It seems probable that the apparent excess of males over females may be due to the habits of the people in the particular countries, which would bring male lepers more before the notice of the medical profession, and in which, from the different habits of life, men would be more exposed to contagion than women. There is no reason to believe that women are less liable to the disease than men, from the point of view of sex.

DURATION.

Danielssen and Boeck give the average duration of the disease as nine and a half years for the tubercular form, and eighteen and a half years for the anæsthetic. They consider the age at which it begins has no influence on its development, but that when it develops in adolescence it causes premature death.

Leloir states that tubercular leprosy may run an acute course and terminate fatally in a year, whilst cases of nerve-leprosy may last thirty-five or forty years and more. In certain cases tubercular leprosy may last many years, and eventually pass into the chronic form of nerve-leprosy.

Dr. Kaurin, Medical Superintendent of the Molde Asylum,¹ states that in Norway the tuberous form is the more frequent (70 per cent.), and that the mean duration of this form is from nine to ten years, and of the nervous form from fifteen to sixteen years.

Hillis gives the mean duration of thirty-eight fatal cases of tubercular leprosy in British Guiana at eight and three-eighth years. He refers to the mean duration in India as being put at twelve years, and states that in Ceylon it proves fatal within eight to ten years.

These figures show a remarkable unanimity in the average for the different countries. The same author estimates the average duration of nerve leprosy in the West Indies at fifteen years. It usually attains a very full development in ten years, and proves fatal generally between forty and fifty years of age.

In regard to nerve-leprosy, it is to be remarked that it is often difficult to decide positively when the first symptoms appear.

INCUBATION PERIOD OF LEPROSY.

There is no certain period of incubation in leprosy. It seems to extend from a period of months to many years. Dr. Arning reports that a young lady arrived in the Sandwich Islands from a state in North America which is free from leprosy. Three months after her arrival she developed

¹ *Journal of the Leprosy Investigation Committee*, Jan. 1891.

leprosy on the skin of the arms, with anæsthesia, bacilli being found in the nodules.¹

In the south of France a girl aged twelve left her parents' house, in which there were lepers, and had no further relations with them. At the age of twenty-seven she first manifested symptoms of leprosy.

Dr. Höegh² has reported the case of a man, born in Norway, who had leprous relatives. In 1848 he emigrated to a part in the States where leprosy has never existed. He first manifested symptoms of leprosy in 1875, twenty-seven years after the time he left the place where he could possibly have been affected.

Some years ago (we quote from memory) we had occasion to observe a leper with the following history. A young man emigrated from England to Australia. From Australia he went to India, whence, after remaining one year, he returned to England. Twenty years after his return to England he developed symptoms of tubercular leprosy.

Danielssen and Boeck noted a case in which the period of incubation was ten years. Leloir observed cases in which it seemed to be two, three, or five years, and one in which it was even forty years.

It is unnecessary to multiply the evidence regarding long periods of incubation by giving other instances.

Bidenkap gives a case where the incubation can only have been a few weeks. He states that, in a case in which there was no family history of leprosy, and in which both the patient and his relatives come from a part of the country where the disease was unknown, the patient showed evident signs of leprosy after staying a few weeks in a part in which it was endemic.

¹ *Viertelj. f. Derm. u. Syph.*, 1887, Heft i. p. 207.

² *Archives of Dermatology*, 1881, vii. p. 175.

CHAPTER VI.

IS LEPROSY CONTAGIOUS ?

THERE can be no question that leprosy is not infectious in the same sense as small-pox and measles are infectious, but there are very strong grounds for believing that it is contagious in the same sense in which syphilis and tuberculosis are contagious. It is a matter of common experience that a person who has never been affected with syphilis or tuberculosis may come into intimate personal contact with patients affected with these diseases and remain free. Yet that does not lead us to doubt that these diseases are contagious in their nature. We know that they are inoculable on previously healthy persons. The fact that the great majority of medical men and nurses who attend syphilitic patients remain unaffected does not invalidate the well-known fact that, occasionally through misadventure, both medical attendants and nurses acquire the disease. In regard to tuberculosis, it is a matter of notoriety that healthy persons may remain healthy although in the most intimate association with sufferers from the various forms of the disease; but this does not in any way invalidate the fact so firmly established, in recent years, that tuberculosis may be conveyed from an affected to a healthy person by personal communication and contact. The great number of instances in which healthy persons may associate for years with lepers and yet remain unaffected cannot invalidate the evidence of contagion if, in a certain number of cases, it is clear that leprosy has been conveyed from one person to another. And as the contagious nature of tuberculosis has been explained and confirmed by the discovery of the tubercle bacillus, so the contagious nature of leprosy has become more intelligible, and must, to those who are capable of weighing the evidence, have become more

credible, since the discovery of the bacillus lepræ. Although the existence of a specific bacillus at once suggests that leprosy is a contagious disease, it perhaps does not of itself indisputably prove that it is so. If the bacillus were to bear the burden of this proof entirely, it would be necessary to show that the conveyance of the bacillus from a leper to a healthy person carried the disease with it. To what extent evidence in this direction has accumulated will be considered when we deal with the alleged instances of inoculation and contagion by vaccination. But apart from the bacillus, a very considerable amount of evidence has now been accumulated in favour of the conveyance of leprosy by contagion. Before considering these facts in detail, it is advisable to inquire whether the history and geographical distribution of the disease teach us anything regarding its alleged contagious nature.

It is certain that leprosy is not exclusively a disease of any climate, of any race, or of any country. But although the human organism is capable of developing leprosy in all parts of the world, and to whatever race it belongs, yet there are many parts of the world in which leprosy has never existed, and others from which it has disappeared. It is clear, from what we have stated in the historical part of this work, that leprosy, when it has spread, has always done so in continuity with previously existing foci. It was unknown in Greece until brought there from Egypt; unknown in Italy until brought there from Greece and the East; unknown in Western Europe until brought there from Italy; and unknown in the American Continent until brought there by the negroes. Wherever lepers have gone, there leprosy has developed—showing that the absence of development was not due to any peculiarity of climate, food, soil, or habits. A consideration of the history of the disease, alone, affords therefore strong presumption of contagion. We shall now proceed to examine what detailed evidence there is regarding its contagiousness in individual cases.

There are two circumstances which render it difficult to prove that leprosy is contagious, the one being the fact that many people escape leprosy, even in countries where it is most prevalent; the other that the incubation period of the

disease is of uncertain, and often of long duration. The analogy of other diseases, which are acknowledged to be contagious, shows that the fact of many persons escaping contagion does not prove that the disease is not contagious. But the uncertain period of incubation of a disease, where there is no demonstrable primary lesion, renders it extremely difficult to bring home, in any given case, the certainty that the disease had been conveyed from an affected to another unaffected person. If we were to suppose, by way of illustration, that measles is a disease from which the majority of persons entirely escape, and in which the period of incubation varies over an uncertain number of years how extremely difficult it would be under such circumstances to trace the exact mode and time of infection in any given case. All that we should be able to say under these circumstances would be, that in any part where there were a certain number of persons suffering from measles, a small proportion of the healthy persons living in that part would, as shown by experience, be certain to become affected with measles; and if any ingenious person were to bring forward the hypothesis that measles is caused by 'telluric' influence, or by some article of food in common use, it would be impossible to prove that this hypothesis was wrong unless evidence could be procured that the disease was conveyed in some other way. But if it were found that amongst healthy persons *associating* with those suffering from the disease a considerably larger proportion became affected with measles than amongst those who had very little association with them, the conviction would become more and more certain (in proportion to the number of such cases) that measles was acquired by the contact of an unaffected with an affected person. This is precisely the kind of evidence that can be brought forward to show that leprosy is contagious.

To obtain satisfactory irrefragable evidence of the contagiousness of a disease, it is necessary to find a case in which, in some country where the disease does not exist, a person who has acquired it in a country where it does exist comes to the virgin soil and communicates the disease to a healthy person. Such is clearly a case of contagion, and a case of this kind is available in regard to leprosy. The often cited

case of Dr. Hawtrey Benson's patient ought to satisfy every person of ordinarily constituted mind that a person became leprous in Dublin from close association with a leper who had acquired the disease in the West Indies, and that in this case, at all events, leprosy was shown to be contagious. The facts of this unique case are as follows:—

Dr. Hawtrey Benson published in June 1877, in the *Dublin Journal of Medical Sciences*, the following case:—In 1872 he had shown to the Medical Society of Dublin a man who was affected with leprosy, which he had contracted in the West Indies, where he had resided twenty-two years. After a certain time spent in hospital he returned to his own house, and died after about a year and a half. During this latter period his brother slept in the same bed with him, and wore his clothes. This brother, who had never left Ireland, except forty-six years before, when he had passed some time in England, became a leper, and was shown, May 2nd, 1877, to the Medical Society of Dublin. There had been no other cases of leprosy known in the family.

The above case demonstrates that leprosy may be contagious; and if it may be contagious, every leper is a possible source of contagion under given circumstances. The fact thus shown, that the disease can be conveyed from one person to another, weakens the objections that may be taken to a large number of other cases in which the probability of contagion appears very great. Instances in which the evidence of contagion is much strengthened by Dr. Hawtrey Benson's case are to be found in considerable number in various reports dealing with leprosy in countries in which it prevails, and we shall now give brief summaries of some of these, extracted from several sources. The following cases are taken from the *Reports to the Government of India* (1875-77):—

1. A girl, in whose family there was no trace of leprosy, married a leper, and after some years became leprous.
2. A sweeper, who belonged to a family in which there was no leprosy, married a leper woman, and himself became a leper.
3. A weaver, whose father and elder sister were lepers, became leprous at thirty. His wife continued to live with him, and eventually became a leper.

4. A weaver became a leper at forty-five. His wife continued to live with him, and became leprosy.

5. A cultivator became leprosy at forty-eight. His wife became affected with leprosy a year later.

6. A man became a leper at thirty-two, his brother being a leper. His wife lived with him for two years afterwards, and became leprosy.

7. A woman, whose grandfather and father were lepers, became a leper at twenty-eight. Her husband, who lived with her a year afterwards, became affected.

8. A sweeper became a leper at eighteen, and his wife was afterwards affected.

9. A woman, whose father died of leprosy, became affected, and her husband developed leprosy the following year.

10. Deputy Surgeon-General Cockburn (Hoogly, October 30, 1877) states that he had seen a wife with her two children contract the disease by remaining with her husband who was affected by it, while three other children who left him remained free.

11. The same observer had seen two healthy strong men, in whose family there was no leprosy taint, become leprosy whilst in attendance on lepers at the leper asylum.

12. Dr. Greene, March 16, 1877, states that he has seen several instances at Sehampore hospital, in which the disease was acquired by sexual intercourse.

13. Dr. Ghose, 1877, relates a case of a woman who became leprosy after her husband. When he died she went to live with her brother, and within a year the brother acquired leprosy. In the course of six years three other individuals in neighbouring houses got the disease. Dr. Ghose was assured that before this woman returned home after her husband's death there had not been a leper in that village.

Other cases of a similar nature are related in the *Reports*.

14. Dr. Duncan, Civil Surgeon, Julpaiguri district, states that a healthy woman, aged twenty-eight, sustained a gunshot wound in the middle third of the thigh. Her skin was healthy. She had no leprosy relations, but her husband was a leper, with ulcerations on the hands. He and two children, aged seven and three, accompanied her into the hospital. The woman recovered and began to move about, only a small

fistulous opening remaining, which, however, began to ulcerate. The skin around cracked, and both feet became affected with rapidly spreading leprous ulcerations. At the same period both the children became affected, the disease exhibiting itself in the hands. In all the four members of the family the disease was in rapid progress when they were lost sight of.

The following cases are extracted from the well-known Report of the College of Physicians:—

15. At Grenada, a girl, aged about twelve to fourteen, slept in the same bed with a young woman who had symptoms of leprosy. Within twelve months the girl had a leprous rash, and was a confirmed leper seven or eight years afterwards. The mother of this girl contracted the disease; the father escaped.

16. (a) Dr. Pollard (*ib.*), states that the children of a white family in Guiana, who were permitted to play with a leprous negro boy, all became affected with leprosy. (b) Dr. van Holst (*ib.*) relates the case of an officer in Dutch Guiana who contracted leprosy from cohabiting with a woman whose family were affected with the disease.

17. Two instances (*ib.*) at Corfu are related in which the wives became leprous some years after the husbands.

18. At Mauritius (*ib.*), a case is related in which a wife became affected after her husband; and another in which, after a man became a leper, the child of his wife by a former husband became affected.

19. An Englishman in British Guiana (*ib.*) cohabited with a coloured woman and became leprous. The woman had not been suspected of leprosy, although afterwards it was found that she had had the spots on her body previously. One of her sisters was leprous, and the woman's child, when five years old, exhibited signs of the disease.

20. A white man (*ib.*), aged twenty-five, became a leper after sleeping in the same bed and using the same pipe with a leper.

21. A healthy girl (*ib.*), aged seven, slept in the same bed with a boy aged nine who was leprous, and became affected with leprosy.

22. Dr. Davy (*ib.*) cites the case, on the authority of the

medical officer of Trinidad Hospital, of a man who became a leper after two children had been born to him. Afterwards these children became leprosy.

23. A man (*ib.*), soon after the birth of his first child, discovered that his wife was a leper, and shortly afterwards became one himself. His children remained free.

24. A Brahmin (*ib.*), aged thirty, believed his leprosy was caught from his leprous master, who had suffered twelve years.

25. A woman (*ib.*) lived with her husband, who had suffered many years from leprosy, but herself remained free from the disease. All the children are lepers. (Unless heredity is admitted, the cause must have been contagion.)

As examples of the many instances in which Europeans have become affected with leprosy after living in countries where the disease prevails, the following three cases from the same Report may be given.

26. A boy aged nine, the son of healthy parents (Europeans), developed leprosy on a voyage to England, and died of diarrhoea three days after the appearance of the disease. No other members of the family have shown any taint.

27. A merchant, aged forty-three, became a leper, and died of hæmorrhage from the bowels within eighteen months of the first appearance of the disease.

28. A European officer became leprous when he was forty-five, and within two years had developed the full stage of tubercular leprosy. His large family and many relations, as well as his parents, were perfectly healthy.

29. A boy (*ib.*) lived with an apothecary who was a leper, and became leprous. A convict, acting as orderly to the same gentleman (the apothecary), became affected with the disease, and died within a year of the first appearance of the affection.

30. A European (*ib.*), who was a leper, stated that he had contracted the disease from a favourite servant who was constantly about his person.

It is stated that amongst the employés of the Lazaretto in the Sandwich Islands nine per cent. yearly become lepers.¹

The following cases are extracted from a remarkable paper by Dr. Forné (*La Contagiosité de la lèpre, Archives de médecine navale et coloniale*, 1890, No. 9):—

¹ *La lèpre aux Iles Hawaii*, par H. Varigny, *Revue scientifique*, 16 juillet, 1887.

31. A child whose parents, grandparents, and four brothers and sisters were healthy was the favourite of a leper, the brother of his grandfather, and frequently slept in the same bed with him. He became affected with leprosy.

32. A woman (*ib.*) in whose family it was known that for three generations there was no leprosy, was sent when a child to Èze, county of Nice, to be wet-nursed by a woman who appeared to be healthy, but in whose family there had been cases of leprosy. On the woman herself, immediately after the child was weaned, leprous manifestations were observed. The child grew up, and became leprous in mature years. She married, and had four children. Her husband and two daughters, who died young, had no leprosy. The other two children (sons) have since died lepers. Of these sons there is the following history: One developed symptoms of leprosy when doing his military service, after having left Èze. He died, aged twenty-eight, of leprosy. His brother died of leprosy at fifty. His wife still lives, and is well. He had been long in intimate relations with a woman who came from the north of France, and who belonged to a family in which there was no leprosy. This woman, and one of her sons who had been much associated with the man, became leprous three years after he showed symptoms of the disease.

33. A family (*ib.*) named Quin, consisting of a father, mother, and five children, all in good health and free from leprous taint, left Nice for St. Laurent d'Èze. There they associated daily with a family of lepers. They had meals in common, and *slept on straw in the same granary*. After six years of this intimacy leprosy appeared in the family of Quin. The mother and five children successively died of leprosy, and the father has just died of leprosy in the hospital at Nice.

34. A girl (*ib.*) belonging to a leprous family of Laghet, left her home when twelve years of age, and became a servant at Nice. When she was twenty-two, and in perfect health, she married a healthy, strong young man, from the north of France. She was nineteen years old when her father first showed signs of leprosy. When she was twenty-seven years old she had leprous tubercles below the left breast, and died at the age of thirty, at the hospital at Nice. Two years after the death of his wife the husband showed leprous

development in the face, and died of the disease three years later.

35. The village of Tourette (*ib.*), situated on the right bank of the Paillon, river of Nice, was free from leprosy until 1815. At that time a family Mas—— took a servant who was a leper. From this patient leprosy was conveyed gradually to nine persons. The household Mas——, husband and wife, were attacked first; then a family Gar——, who had frequent relations with the Mas——. A cousin of the Gar—— family who lived with them was also affected, as well as his wife. His three children still live at Tourette, and are lepers. One of the latter, having long lived in a shepherd's hut, made a present of the cabin in which he slept to a shepherd belonging to a healthy family. This shepherd lived in the cabin for a long time. He is now a leper.

36. On the 1st January 1890 (*ib.*) there were six Europeans who had been transported from Europe to New Caledonia, and had acquired leprosy there. The first of these was a Belgian, aged 31, who was transported in 1874. He was liberated in 1875, but never left the colony. From February 1881 he remained for six consecutive years at Moindow, where there were cases of leprosy. In 1885 he developed symptoms of nerve leprosy, and when seen by Dr. Forné in 1889 mixed leprosy was diagnosed.

37. A *canaque* (*ib.*), belonging to a family in which there was no leprosy, came from a place in which the disease had not yet appeared. When in Government service at Noumea he took his meals with a comrade who developed and died of the disease, using the same pipe, and the same table utensils. He became a leper after the insurrection of 1878, in New Caledonia.

Canaque prisoners, numbering 750, were, by order of the French Government, quartered at the Isle of Pines; and Ouatchia was fixed as their place of residence. They arrived there in 1879, and formed a large village. Before this emigration leprosy was unknown in the Isle of Pines. It showed itself at first exclusively at Ouatchia, amongst the exiles from the New Caledonian mainland. Eight years afterwards, in 1887, leprosy had established itself amongst the aborigines of the Isle of Pines.

38. According to Dr. Simond (*La lèpre et ses modes de propagation à la Guiane*, Thèse de Bordeaux, 1888), quoted by Dr. Forné (*ib.*), fourteen convicts, transported to Guiana, thirteen of whom were born in France, and one in Algiers, became leprous after they were set free.

Dr. Simond confirms other observers, who state that while the negro race in that country is much infected with leprosy, the Indian race, wherever it has preserved its autonomy and kept apart from the other races, has remained free from the disease; and the Indians have no word for it in their language.

39. A Sister of Mercy (*ib.*), born in France of healthy parents, and who had excellent health until she was forty-six years of age, came to French Guiana in 1862. Five years after her arrival there she became attached to the service of the lazaretto of Acarouany, where she was occupied in attending to lepers in various ways. In 1878, at the age of forty-six, after having been eleven years in the lazaretto, she experienced the first symptoms of leprosy; and in 1883 was in the last stage of the disease. She believed she had been infected by washing linen belonging to leper women; but Dr. Hulin de Godon stated that the Sister became leprous after having pricked her fingers with a needle, which she used in sewing lepers' clothes.

40. A European Sister of Mercy (*ib.*), free from hereditary taint, who was occupied in the linen room of the hospital at Tahiti, inoculated herself with a sewing-needle under the same condition as the Sister at Guiana. She was sent home to France in 1885, a leper.

41. Dr. Woods, quoted by Dr. Hann (*De la lèpre*, Thèse de Nancy, 1882, p. 57), states that Dr. Robertson, the superintendent of the lazaretto of the Seychelles Islands, became a leper during his period of service in the hospital.

42. The frequently quoted case of Dr. Hildebrand, given on the authority of a medical man in Batavia (*Leprosy: a Communicable Disease*, by C. N. Macnamara, p. 65), is as follows:—A European child nine years old, free from taint, associated with a leprous coloured child. During their play the leprous child took a pin or penknife and thrust it into the anæsthetic skin of his leg, without experiencing pain.

The astonished white child repeated the experiment on himself, causing himself severe pain. He was afterwards sent to Holland to be educated, and returned, when nineteen years old, to Java, a confirmed leper, the disease having appeared two years before his return. The gentleman was well known in Batavia, and the case was clearly either one of contagion or inoculation.

43. Sir William Moore¹ relates that when he was stationed in India he had the patients (some of whom suffered from leprosy) who were affected with itch rubbed with sulphur ointment at the dispensary. One of the persons employed to do this injured her hand and afterwards developed leprosy, her family being quite free from the malady, and no history of other association with lepers being obtainable. Sir William Moore remarks that reasonable conclusions were that leprosy had been contracted, and that sulphur ointment had no protective influence.²

44. Professor Cayley (*ib.*) relates that a strong healthy European consulted him in India for symptoms of anæsthetic leprosy. The patient told him that he had noticed several years previously that his bearer or native valet was suffering in the same way.

45. The same writer relates that, in 1886, the leper ward at Burdwan Jail contained about thirty lepers. During the twelve months that he was in charge of the jail two persons who had been there four or five years, and who were selected as healthy men, were put in charge of the leper ward, and were attacked with leprosy.

46. Surgeon-General Francis (*ib.*) refers to a case of leprosy which occurred in an Eurasian, who had been nursed, it was said, by a foster-mother, in whom the disease was developed.

In 1874 the Governor of British Guiana appointed a commission, consisting of three medical men, to inquire into the subject of the contagiousness of leprosy in that country. In their report they referred to the following cases adduced by Dr. Cameron, Acting Colonial Surgeon-General.

¹ *Journal of the Leprosy Investigation Committee*, No. 1.

² We have remarked in another chapter on the possible conveyance of the bacillus by *acarus scabiei*.

47. An Englishman, whose parents never left Europe, lived with a woman who some time afterwards showed symptoms of leprosy. The man became a leper, and was seen by the Commission.

48. A white girl, aged fifteen, of good family, without leprosy taint, accepted an invitation from a young friend, members of whose family were lepers, the fact being concealed. The girls slept in the same bed, and lived intimately together. After three months the girl belonging to the leprous family left her friends, and some time afterwards the disease made its appearance. The girl who was invited grew up to womanhood, married, and had children; but after a few years the disease attacked her, and she died a leper.

49. A white man, of clean healthy family, without hereditary taint, lived with a black woman, by whom he had two children—the woman's mother being a leper. The man and his two children got the disease. (A second similar case is given.)

50. A boy belonging to a clean family used to play and sleep with a boy who belonged to a family in which there was leprosy. The tainted boy soon became a leper, and three years afterwards his playfellow, in whose family there was no taint, became leprous.

51. A white man, aged twenty-five, was on intimate terms, and slept with a young man who had leprous spots. After intercourse of about a year, the previously clean man found spots on his person, and died in a short time of leprosy. His family was, and remained, free from all taint.

52. A white man, aged thirty-five, born in England, cohabited with a coloured woman, who was leprous, without the fact being known. He became a leper, and died of the disease in Europe.

53. A young coloured boy, of clean family, whilst suffering from an eruption, played with a boy who was a leper, and had a suppurating ulcer in the foot. The previously healthy boy became a leper about a year afterwards, his family remaining untainted.

54. A young Scotsman, whose parents had never left Europe, was contaminated by a leper woman. Within ten months he developed leprous spots and died a leper. (This

case, which it is stated can be relied on as perfectly correct, is followed by another one very similar in its features, regarding which it is said the evidence is not so strictly reliable.)

55. A coloured man, a leper of Kaoo Island, stated that he attributed his disease to the fact that his mother washed the clothes of several lepers, and used to wash his along with them. He stated that his parents and relations, as far as he knew, were free from leprosy.

In analysing 188 cases in connection with the place from which they came, Dr. Hillis found that the 'group' cases considerably outnumbered the single ones, without the particular localities affording any clue to the fact. The largest number from any one place came from the district of Mahaica, where a large leper asylum had been established in 1858, the inmates having free ingress and egress. Sixty cases were contracted in the immediate vicinity of this institution, although Mahaica is one of the healthiest parts of the country.

In 92 out of 139, or 67·17 per cent., contact, more or less prolonged, of the unhealthy with the healthy, was the most probable factor in the propagation of the disease.

Dr. Hillis states that during slave-time the cases of leprosy in British Guiana were not only few, but the disease was stationary. On account of the value of the slaves, their owners isolated any one who became a leper by giving him a hut, called the 'Yaws house,' for his sole use at the furthest boundary of the estate, and all contact with him was avoided. When these isolated lepers handed over money for provisions sold, they counted and delivered it by the point of the cutlass, and it is a fact, Dr. Hillis states, that leprosy did not spread during this time.

It was not until after the emancipation in 1838 that the disease began to spread throughout the colony.

From a return, dated October 1831, there was a total of 431 lepers, all negroes, in the colony. There are no records of any other race having been affected at that time.

In 1832 the lepers were removed to the mouth of the Pomeroon river, and eventually they were settled in the immediate neighbourhood of an Indian post. The lepers were established a few roods from the Indians, who were

under charge of a post-holder. The Indians were dissatisfied, and only one tribe consented to remain—the Warroos,—who constantly associated with the lepers. Leprosy afterwards broke out among the Warroos, and prevails amongst their descendants to this day.

It is stated in a report—1842—that amongst the whole Indian population the cases of leprosy were found solely amongst the Indians of the Warroo nation.

56. The smaller the number of lepers in any district, the more value must be attached to the development of the disease in an individual after contact with a leper: a remark that applies to the Riviera, where Professor Bow informed Vandyke Carter (1876) that he had known a guard who occasionally nursed a leper child, and who himself became a leper.¹

Dr. Vandyke Carter states that in Bombay there were usually three or four European lepers under treatment in the hospital ward for incurables, and refers to three well-marked instances of leprosy in Europeans—one a boy at school, a young man, and an adult military man.

The sanitary commissioner at Madras mentioned to him the cases of three European lepers in good social position, whom he had seen in private practice.

Dr. Hildebrand states that the first leper seen by him in the Sandwich Islands was in 1853, the case being that of a man who lived in the island of Oahu, about twenty miles from Honolulu. In 1861 this man was in an advanced stage of leprosy, and in his immediate neighbourhood six other persons had become affected.

In the village of Haslua the tax-collector was for several years the only leper in the district; but towards the end of 1864 about seven cases became known which were reported to have contracted the disease in this village.

57. On the authority of Dr. Stewart, of Calcutta, it is stated that two dressers in the leper asylum contracted the disease there.

58. On the authority of Dr. Greiner, the statement is made that, at a leper hospital in Java, a dresser, who was of

¹ *Reports on Leprosy*, second series. Dr. Brunelli (*ib.*) mentioned to him the case of a young man who apparently caught the disease from sleeping in a cave, and lying on the same bed, where a leper had lived and died.

a clean family, contracted the disease and died of it after having in his turn communicated it to a relative.

59. Dr. Liveing relates that a soldier, who had served in India, died in Guernsey, and that in his last illness he had sores on his fingers and toes, an enlargement of the nose, and discoloration on the skin of the face. One of this man's sons, when fifteen years old, developed leprosy. Several brothers and sisters, older than himself, were perfectly healthy. For those who believe that leprosy is not an hereditary disease, this is a clear case of contagion, as clear as that of Dr. Hawtrey Benson's.

The only case, except that of Dr. Hawtrey Benson's, that we have found recorded, in which the disease must have been communicated in England in this century, is that published in Guy's Hospital reports for 1868, and referred to by Dr. Munro. Johanna Crawley, an Irish woman, aged thirty-four, had lived thirty years at Stepney. In 1866 she had lost part of the first finger of the right hand. On her body and limbs were large brown patches, and there was decided anæsthesia as far up as the elbows. The face was puffy, the lips and ears swollen. Dr. Munro saw her daughter at Stepney, a woman aged twenty-five, and was informed by her that Johanna died in 1874, after losing part of all her fingers and toes, the blisters and destruction of bone causing great pain.

Dr. Hayden saw her in her last illness, and at once recognised the case as one of leprosy. Johanna was a sail-maker, working in a factory with many others, and living in a district (beside the Limehouse basin) crowded with people in constant communication with the East and West Indies, and in which there were many coloured people.

Dr. Munro gives the following three West Indian cases:—

60. A widow, aged fifty-eight, with several children, went to live with a daughter who was a leper, and was attacked five years afterwards when she was sixty-five years of age.

61. A healthy woman attended her master's father, who was a leper, and was attacked after his death.

[Landré gives ten cases of contagion amongst well-to-do Europeans or their children, all of whom are stated to have lived continuously, or been in constant contact with lepers before they were attacked.]

62. Mr. F. Wigley, President of St. Kitts, related to Dr. Munro the case of a white gentleman who was attacked with leprosy after a leper servant had surreptitiously made use of some of his master's clothes at dances, at which he, of course, would sweat very much.

63. To go back to the College of Physicians' Report: Dr. MacDougall relates the case of a European boy in Sarawak, all of whose family were healthy, but who became leprous after playing constantly for four years previously with a Chinese leper boy.

Munro is again our authority for the statement that Tilbury, Fox, Plancke, E. Wilson, Van Holst, of Dutch Guiana, Manget of Demerara, and Nicholson of Antigua, each quote a case of a European infected by, or at least after cohabitation with, a leper woman.

Munro also quotes Schilling, to the effect that he could point out many examples of husbands and wives contracting the disease during marriage, 'did shame permit.'

64. In St. Kitts, Hannah Carty, when a girl, slept with and washed the clothes of T. Wilson, who was covered with leprous sores. She was attacked at the age of seventeen. Her family were all healthy.

In a report on leprosy in Venezuela, made by the United States Consul at Maracaibo, it is stated that the disease was first introduced in 1825, when a leper from Santo Domingo landed at Maracaibo. In three years the disease spread to such an extent, that an island about four miles from the city was set apart for the isolation of the sufferers. The number of lepers now on the island is said to be 125. After some time the lepers were allowed to intermarry. Of a number of such unions only two children have so far been born; neither of them has as yet shown any sign of leprous taint, and in March last one of them, who had reached the age of fourteen, was allowed to leave the island.—*British Medical Journal*, November 22, 1890.

Dr. L. Roussel, Government Medical Officer (*Journal of the Leprosy Investigation Committee*, No. 2), gives a leprosy return of 14 cases for the island of Rodrigues, and he considers that 10 or 12 more should be added to complete the full number of lepers in Rodrigues. From carefully questioning

the oldest inhabitants, he finds that the first leper known in Rodrigues was a fisherman, who came from Mauritius, although the disease began after his arrival. Of the first six cases five were fishermen, three of them were natives of Mauritius, and although not lepers on their arrival, must have imported the disease to Rodrigues. It was some time afterwards that the natives began to be affected, and the disease to spread over the island.

65. Dr. H. W. Blanc (*ib.*) says:—If leprosy may be introduced through the integument, then the initial lesion must be an ill-defined erythematous spot, which is soon followed by other macules (erythematous) in the vicinity, or on any other parts of the body. At least this is the sort of history I have received from a number of patients, and which I have been able to witness in one case, which occurred in the person of an English-born nurse, who had charge for several months of a severe case of leprosy in the ward of which he was nurse. The first lesions appeared one week after a cut from a razor while shaving himself in the ward. This man had *lepra maculo-anæsthetica*, and his case aborted in a year after he had taken large quantities of chaulmoogra oil, and painted every macule with a solution of pyrogallol.

66. Dr. Blanc also relates (*ib.*) that Father Boglioli had attended a number of cases of leprosy in the Charity Hospital (New Orleans), and remembered giving extreme unction to two of them, rubbing their hands with oil during the administration of the rites. Father Boglioli's case (of leprosy) began, according to Professor Jones, with a swelling of the mucous membrane of the nostrils. He had previously visited Donaldsonville, a little town near New Orleans, and, the season being winter, contracted a nasal catarrh. The early symptoms all suggesting disease about the nostrils, it seems to Dr. Blanc not improbable that the disease entered the system through the inflamed mucous membrane of the nasal passages, producing at the same time a local erythema, which would give rise to all of the symptoms.

67. Dr. W. H. Ross (*ib.*) states that, in the course of 45 years, the records of Robben Island only show one case which really originated outside of the leper wards. It occurred in a boy of European parents, without any leprous taint; but he and one of his sisters were strumous subjects. They were in

the habit of playing with the leper boys, and one day he is alleged to have pricked himself with one of their fishing-hooks. As he grew up to puberty his hands and feet became much distorted and contracted, and by slow stages of ulceration he grew gradually worse, and died at the age of 21. There was no other instance in this or any other family in the island, but J. K. was undoubtedly a leper.

68. A married woman, aged forty, the mother of nine children, with five alive and well, and a husband in good health, developed leprosy in May 1878. She had lived next door to a man named Brown, one of the only three cases of leprosy in Maryland referred to by Dr. Rohé (*Maryland Medical Journal*, July 1878). The families were intimate; but the woman denied any special intimacy. This woman became a leper some years after she had been in the neighbourhood, and the friend of Brown.

Mr. C. H. Boon, in a letter to Dr. Munro (*Journal of the Leprosy Investigation Committee*, Jan. 1891), says:—‘At present there are 120 known lepers in St. Kitts, and I think there are a good many more that are kept hidden from medical men. One thing is very noticeable in Nevis—viz. the way in which the leprosy spreads in each neighbourhood from single cases. It is not so easily traced in St. Kitts, as the people there do not own land like the Nevis people, and are consequently more nomadic. One thing has struck me very much—that is, the number of shopkeepers that have contracted the disease.’

Dr. Kaurin, Medical Superintendent of the Molde Asylum, Norway, states (*ib.*) that he has seen several cases of transmission of the disease among persons sleeping together in the same bed. On the whole, he believes that, as a rule, the disease will only be transferred if a person lives with lepers for some time, without observing due precaution in his intercourse with them.

Dr. Heidenstam (*Journal of the Leprosy Investigation Committee*, No. 1) states that it is known that there was no trace of leprosy in the island of Cyprus before the arrival of persons affected with the disease; and that in localities infected, where he has traced its origin, it is irrevocably proved that before the arrival of a leper the disease was unknown.

We have already remarked on the great difficulty in

proving contagion in any country in which leprosy is at all common. On the other hand, the evidence of cases similar to that of Dr. Hawtrey Benson's, in which a local epidemic of the disease develops in a district previously free from leprosy, and in which the origin and extension of the malady can be traced to certain individuals, is convincing.

There are several instances of this kind in recent literature, of which we shall give examples; and in order that the value of the evidence may be appreciated, it is necessary to give them in considerable detail.

LOUISIANA.

At one time there were lepers in Louisiana. A hospital was established to receive them, and they disappeared almost entirely.

In 1860 Madame Ourblanc, whose father came from the south of France, became leprosy. She died in 1870, leaving four sons and two daughters. The second son became leprosy in 1871, the first and fourth sons in 1872. The first daughter died of an acute disease; the second became leprosy. All these children lived with their mother at Abbeville.

In 1875 a nephew of Madame Ourblanc, who lived at a distance of eight miles, became leprosy. In 1873 a young woman not related to the family, who had nursed Madame Ourblanc during the last stages of her illness, became leprosy. A young man, who lived a distance of some miles, and was not related to the family, but who had often slept with the fourth son in 1875—who by that time had been leprosy for three years—became a leper, and other cases developed in the neighbourhood.

LEPROSY IN NEW BRUNSWICK.¹

Tracadie is a parish with a population of over 2000, situated on the coast of the Gulf of St. Lawrence at the mouth of the Miramichi river. The first settlers in Tracadie were the Le Bretons, who came in the year 1778. They lived with

¹ *Vide* a paper by Dr. Graham (*Canada Medical and Surgical Journal*, Oct. 1883), from which this account is taken.

the Indians, existed on the coarsest and most meagre diet, and suffered greater hardships than most of those who followed them; their children intermarried with the families who afterwards came to Tracadie, and yet it is a notable fact that none of the name ever suffered from leprosy. This family was followed by two brothers, William and Thomas Ferguson, Charles M'Loughlin, and Michel Basque. They came in 1785. The latter came from Acadia, as also did Joseph Sonier and family during the next year. In the few years following, a number of families came in from Acadia, some from near St. John, and some from the Province of Quebec.

Leprosy first appeared in Tracadie about the year 1820, in the person of Ursule Landry, who, with her sister Isabel, came from Caraquet about 1798, and married two brothers, the Benois. The account generally given by the people is, that before leaving Caraquet these sisters washed clothes for some French sailors, who were lepers. There are grave doubts, however, as to the correctness of this story. Ursule died of leprosy in 1828; Isabel was the next victim. The third was François Conier, who is said to have contracted the disease by carrying the coffin of Ursule Benoit. He stated to persons now living that the sharp edge of the coffin abraded the skin of his shoulder, and he thus became inoculated by matter which ran out from the corpse. The disease attacked others in the following order:—Joseph Benoit, Ide Sonier, John Robicheau, Olivier Robicheau, and Cyril Austin. Frank Sonier was ill a number of years, and his father's house was the rendezvous of the young people of the neighbourhood. A number of these afterwards suffered from leprosy. He at one time attempted to go to Cape Breton, to consult some person there who had a reputation in Tracadie for curing ulcers. He remained over night at the house of a Savoy in Neguac. Mary Savoy washed the clothes of the bed on which he slept, and afterwards had leprosy. This was the first case in Neguac. It is possible that other patients may have visited Cape Breton to see the same person, and this may account for the presence of the disease in that locality. Frank Sonier did not reach Cape Breton, having found himself too ill to proceed. It was not until a number of people who were intimate with the Soniers had taken the disease,

that public attention was drawn to it, and the lazaretto on Sheldrake Island, in the Miramichi river, was established. This was in the year 1844. At the same time, or, it is said by many, previous to the appearance of the disease in Tracadie, a Mrs. Gardiner, in the Miramichi district, 55 miles from Tracadie, contracted the disease. A man named Moore, in the same district, also suffered from it. These were followed by Stewart and the Tingleys. M'Comb, of Miramichi, afterwards took the disease. It is said that he contracted it in Tracadie while working in the lumber camps. Some of the latter were natives of the United States. The present condition of Tracadie and neighbourhood with regard to leprosy is as follows:—There are now in the lazaretto 24 patients, whose names and histories were recorded. They came from a district within a radius of 25 miles of Tracadie.

One Margaret Sonier, *née* Robicheau, had the disease forty years ago. She is now seventy years old. Her history is a remarkable one. She was admitted to the lazaretto in Sheldrake Island in 1844, when it was first established. During five or six years' residence there she lost all the fingers of both hands, leaving only the first phalanges of the thumbs. She was then sent out cured. She married one of the Soniers, and had three children, one of whom, Lucille Sonier, now twenty-four years of age, is in the lazaretto. The other two never contracted the disease.

During the short time that Dr. A. C. Smith remained in Tracadie he heard of four cases outside of the lazaretto. In some instances the disease is concealed as long as possible. Father Babineau is constantly on the watch for new cases, so that, as a rule, they do not long remain unrecognised.

Although the general opinion of writers on leprosy is that it is propagated by hereditary influences, yet in no case reported in Tracadie can this be satisfactorily proved. In every instance there was abundant opportunity for contagion, so that the part played by heredity could not be determined. It will be noticed on consulting the family charts which I have made, that the Sonier, Brideau, Robicheau, and Commeau families were very much afflicted with the disease. It did not appear in these until after Frank Sonier became affected. It then broke out in several households at about

the same time. Now these families came to Tracadie from Acadia (Westmoreland County), from near St. John, and from the Province of Quebec, where many of the same name may still be found. If the disease is hereditary, one cannot understand how members of the family remaining in Acadia should be free from it, and those in Tracadie should suffer to so great an extent. Endemic influences may be excluded for the following reasons :—

1. Along the New Brunswick coast, north of the Bay of Chaleur, and south of the Miramichi river, there exists a people of the same race, religion, habits, occupation, and condition in life as those of Tracadie, yet none have suffered from leprosy. It is impossible to understand how the disease should have arisen from endemic influences, and be confined to this peninsula.

2. The man M'Comb was of a different race from those of Tracadie, and lived under different circumstances in Miramichi. He came to Tracadie to all appearance healthy, caught the disease, and died of it.

It is impossible to account for the appearance of the disease at the same time in the three or four different families already named, on any other theory except that of contagion.

(1) Peter Noel came from a healthy family, so far as could be ascertained. He slept during the summer with a man in the advanced stages of leprosy, and a few years afterwards became a victim to the disease. He is now a patient in the lazaretto.

(2) James M'Grath caught the disease from one Michael Gould. Peter M'Grath slept with James, became leprous, and died. Peter lived for a time with the Drysdale family. Seven of Drysdale's children fell victims to the malady. He refused to send the first cases to the lazaretto, hence the greater number affected. It has been noticed that when those affected with the disease are not early removed to the hospital, but remain at home, other members of the family become leprous. When, on the other hand, patients are removed early, there is no further spread of the disease. It has also been a matter of observation that when patients remain at home and are careful to keep themselves separate

from the family, that others are not likely to become diseased. The disease has attacked patients at various ages between six and eighty, a fact which points to contagion rather than to heredity.

(1) Washerwomen have been engaged for years in the hospital washing the clothes of lepers and scrubbing the floors; none of these have taken leprosy. One whose husband died of leprosy was engaged in the hospital nine years, and did not contract the disease. None of the attendants—neither the physicians nor the Sisters of Charity—have ever taken it.

(2) As will be seen by the family record, Frank Robicheau, the son of a leper, had three wives, all of whom died of leprosy, yet he escaped.

(3) Julian Ferguson was admitted to the lazaretto suffering from the malady; she was at the time pregnant, and gave birth to a child in the hospital. She was afterwards discharged by Dr. La Bellois as cured. In six months she returned to the hospital, and gave birth to a second child. One of these children remained in the hospital, learned to smoke, and smoked the pipes of lepers. They both came out unaffected, grew up, married, and one at least is known to have a large family of healthy children.

Several children have been born of leprous parents in the hospital, and we did not hear of any afterwards having become affected. In order to overcome the difficulties raised by these cases, we must compare leprosy with other contagious diseases.

The Sisters are not nearly so liable to become affected as are members of a family when twelve or fourteen persons are crowded together in a house containing two or three rooms.

Leloir's summary of the chief points connected with this epidemic is translated by Archdeacon Wright (*Leprosy: An Imperial Danger*) as follows:—

The Epidemic of Cape Breton, noted by Fletcher, and published by Dr. A. M. Phedron, of Toronto, sent by Dr. Duhring to the American Dermatological Association in 1881.

(1) Betty MacCarthy, of Prince Edward's Island, native of Lancashire (England), married in 1836. In 1852 she

became ill, and died of a disease designated at Tracadie leprosy. She had five children:—

(a) Richard, who died of leprosy, having suffered from the disease twenty years.

(b) John, who died of leprosy, after twelve years of the disease.

(c) Mike, died of leprosy after suffering ten years.

(d) William, who died of leprosy when he was twelve years old. He was washed and buried by Joseph Brown.

(e) Mary, who died after being twenty years a leper. She married John Doyle.

(2) John Doyle died after six years of the disease.

(3) and (4) Two daughters of John and Mary Doyle died of leprosy.

(5) John Brown, who took care of William MacCarthy during his illness, and after his death washed and buried him, became shortly after a leper, and died of the disease.

(6) James Cameron, of Scottish origin, married in 1866 Susanna MacCarthy, one of the daughters of Betty, and had by the marriage two children, who, and also their mother, are in good health. He often slept with Mike MacCarthy, and in 1870 presented undoubted symptoms of leprosy. He is now (1881) suffering severely from the disease.

LEPROSY AT PARCENT, SPAIN.

The *Annales de Derm. et de Syphiligraphie*, vol. ix. p. 390, contains the following part of a memoir presented by Dr. Zuriaga to the Municipal Council of Valencia, in Spain, and translated into French by Dr. Paul Raymond:—

1. In 1849 there was no leprosy in the village of Parcent. In 1850 a leper from a neighbouring town of Sagra came to reside at Parcent with Vincent Poquet Andres. The two friends ate from the same plates with the same spoons, drank from the same glasses, and slept together. Within a year Poquet had acquired leprosy from his friend. Poquet's nephew, called Ramon Poquet Perez, who was in the habit of going to his uncle's house, shortly afterwards became affected with leprosy. Ramon had three married brothers, Baptiste, Joseph, and Rosa. Afraid of contagion, Baptiste and Rosa

ceased to have anything to do with Ramon; but Joseph and his children continued to visit him. Soon afterwards leprosy broke out in the house of Joseph. He had seven children, five of whom were affected. The two others, being frightened, left the house, established themselves elsewhere, and ceased all further communication with the family. They remained healthy. Joseph died of heart disease. His wife was still living when the report was written, and was quite well. The five leprous sons were living, but all of them in the cachetic stage of leprosy.

2. Joseph Mora lived on terms of intimate friendship with Vincent Poquet (the first leper affected at Parcent). Mora soon afterwards became a leper. Joachim Guyer, a friend of Mora's, also became a leper; and some years later his two brothers became affected in their turn. They dwelt in the same house. At the date of the report only one survived. Some time before his death Joachim Guyer went frequently to the house of Joachim Perez Mora, and was on very friendly terms with the two daughters of the latter, who mended his clothes. The two sisters became lepers, and shortly afterwards their five brothers. The parents alone remained free.

At the date of the report the mother had died of chest disease, the father being alive and healthy. Of the five brothers three were dead; the fate of the fourth was unknown. The other children were affected with nerve leprosy.

3. Ramon Poquet Perez, the second leper of Parcent, left home to be a soldier with five young men of the village, Ramon only at that time being a leper. There had never been leprosy in the families of these five men, and at the time of their departure they were quite healthy. Three of them avoided Ramon Perez. Two of them, Joseph Morell and Antonio Pollester, lived with him for several weeks. These became lepers and died of the disease; whilst their companions, who shunned Ramon, remained healthy.

4. Philomene Ripolia became leprous after her marriage, it being unknown how she acquired the disease; but at this time there were a number of lepers at Parcent. She had five healthy children at the date of the report, aged from twenty-three to ten—all of them being free from leprosy.

5. Josephine Mora became a leper without it being known how she acquired the disease, after there were others in the village. Before acquiring leprosy she had healthy children; two of them lived with her,—Joseph, aged twenty-eight, and Barthelemy, aged twenty-three. They nursed their mother, and first Joseph, and then Barthelemy became leprous. They engaged two servants for the care of their mother, Maria Rosa and Antonia Mora, who came from families in which there was no leprosy. Some time after coming to the house they both became lepers. At the date of the report all these patients were dead. Since 1850 to the date of the report—presumably 1888—there had been about sixty cases of leprosy in the small village of Parcent, of whom forty-five were dead. These facts were vouched for by the Mayor of Parcent, who supplied the information to Dr. Zuriaga.

Dr. Zuriaga adds that in these cases heredity was impossible, and that in several parts of the provinces of Valencia and Alicante prophylactic measures had been taken, and leprosy had disappeared. He further states that at Limat de Valldigna in Valencia, and at Pedreguer, Alicante, a state of matters existed, as regards leprosy, similar to what had taken place at Parcent.

In the *Annales de Derm.* vol. x., Dr. Paul Raymond publishes a translation of further facts communicated by Dr. Zuriaga. The facts recorded took place at the village of Limat de Valldigna in Valencia, Spain. Liberato Buignes, of a leper stock, several of his ancestors having been lepers, was the eldest of his family, and began to suffer from leprosy in adult age, although still young. The other brothers, as soon as they saw that he was leprous, left him and the country, never to return, and remained in perfect health. Liberato married and had several children (the eldest being eight years old), who were removed from contact with the father by their mother, in order to protect them from contagion. Rafael Flores, a friend of Liberato, but no relative, travelled with him, both being muleteers, for several years, eating and sleeping with him after Liberato had become a leper. After a few years Rafael, in whose family there was no leprosy, acquired leprosy from Liberato. Rafael has a younger sister

who lives with him, now that he has become a leper; she acquired leprosy from him when she was twenty-six. Some years after he was a leper, Rafael married and had children, who were removed from contact with their father, and remained healthy up to the time of the report.

Although leprosy is contagious, it does not follow that all or most of the persons who come in contact with infected persons become infected. It is, therefore, no proof against contagion to be able to state that very many persons have been in constant association with lepers without acquiring the disease.

Nobody doubts the contagious nature of syphilis, and we believe no competent person who has had an opportunity of putting himself in possession of the facts could doubt that tuberculosis is contagious; and yet it is a matter of everyday experience that doctors, nurses, relations, friends, and others, are closely associated with syphilitic and tubercular persons without acquiring either of these diseases. The facts on which the anti-contagionists rest their scepticism as regards leprosy are such as the following:—

Lewis and Cunningham, for example, state that they had seen children suckled by leprous women without being apparently infected thereby.

Considering, however, the age at which leprosy usually develops, this statement is only relevant in the case of children observed to the age of adolescence.

Dr. Saturnin, Trinidad (*Report of the College of Physicians*) states that the surgeon had dressed leprous ulcers for twelve years, that the washerwoman had been employed for sixteen years handling clothes of lepers, but that neither of them had become infected.

From Guiana, Cape of Good Hope, and Corfu (*ib.*), statements are made by medical men, to the effect that wives lived with leprous husbands without contracting the disease.

Of nine servants (*ib.*) employed in the leper hospital at Madras from two to fourteen years, all remained unaffected.

Instances such as that reported from Antigua (*ib.*) are not

unfrequent, in which a wife cohabited with a leprous husband without becoming affected, whilst the children acquired the disease.

A washerwoman at the Sandwich Islands lived with two leper husbands without becoming affected.

Olavide, in Spain, has never seen the leprous inmates of hospitals transmit the disease to the attendants, nor leper husbands affect their wives.

The Dominican nurses have been in the Trinidad leper asylum since 1868, without one of them having become infected.

It is notorious that, for many years, isolated cases of leprosy have existed in England in the persons of unfortunate men and women who have acquired the disease abroad, and have returned home; but in no instance has the disease spread either in their homes or in hospitals, with the exception of the Dublin and (probably) the Stepney cases.

For many years there have been lepers in the Paris hospitals, frequently in the London hospitals, in the same wards with other patients, and it is certain that no one became infected.

It may be therefore taken for granted as certain, that a leper husband or wife may not infect the healthy wife or husband; that a leper may be a member of a household for many years without another member acquiring the disease; and that, as has occurred amongst the Norwegians in America, a number of lepers may exist in a community and gradually die out, without communicating the disease to a single person amongst their friends or families; but all this does not in the least invalidate the fact shown by Dr. Hawtrey Benson's case, and others which we have adduced, that this immunity is not absolute, that a leper may communicate the disease to persons living in intimate association with him, and that there is at present no means of explaining the existence of the bacillus lepræ—the real cause of the disease—in the body of the leper, except by the assumption that he has acquired the parasite directly or indirectly from the body of another leper.

No one doubts that syphilis is a contagious disease because surgeons, nurses, and attendants may fulfil their

duties for many years in Lock Hospitals without becoming infected, and it is a matter of everyday experience that a member of a large family may pass through all the infectious stages of syphilis, living in constant association with brothers and sisters, without the disease being transmitted; yet it is quite certain that in all these cases the disease could be communicated by an inoculation of the simplest kind.

There is no doubt that in some countries, amongst the lower classes, syphilitic men sleep in the same bed with other men, in rare instances communicating syphilis in this way, but in the very great majority of instances with immunity to their bedfellows.

It is evident that the vitality of the bacillus lepræ, which has kept the organism alive in successive generations for four or five thousand years (and who can tell how much longer?), is nevertheless associated with conditions that render its transmission from one host to another an operation which is only successful by a combination of circumstances that, fortunately for the human race, take place comparatively exceptionally.

We have dwelt at considerable length on the evidence for the contagiousness of leprosy, because the subject is one on which differences of opinion still exist. It is impossible to over-estimate the importance of the question, believing, as we do, that the evidence is conclusive as to the contagious nature of the disease, and that the protection of numbers of men and women from the dangers of the most cruel death which nature or man has ever imagined, depends on an appreciation of evidence such as that which we have submitted to our readers.

If leprosy spreads by the contact of healthy persons with lepers, then it is clearly possible to diminish the chances of its spreading. The scepticism regarding the contagious nature of leprosy which followed the terror with which it was looked upon in the Middle Ages, is now beginning to disappear, and the contagious view is coming steadily, perhaps it would be justifiable to say rapidly, to the front. Still, the fact that not a few able and experienced physicians refuse to accept this view, shows how necessary it is that new

evidence should be sought for, and old evidence carefully weighed and sifted.

In a despatch from the Government of India to the Secretary of State, dated July 22, 1890, it is stated (*Journ. of the Leprosy Investig. Com.*, No. 2, p. 30), that many of the highest medical authorities in India consider that the evidence at present available goes to show that leprosy is only contagious in the sense that it is inoculable, and that inoculation plays only a very subordinate part in determining the spread of the disease. The very small number of authentic and unequivocal cases of communication of the disease from one individual to another, which even the strongest advocates of a belief in the influence of contagion are able to adduce, is considered by their medical advisers strongly to support this view. They also consider that the phenomena of the distribution of the disease within leprosy countries are altogether adverse to a belief in contagion playing any important part in causing the general diffusion of the disease.

It would appear from this statement, that in India leprosy is not at present generally considered contagious; but as we have already remarked, the great prevalence of leprosy in that country renders it unusually difficult to obtain satisfactory evidence.

It is easy to see that if Dr. Hawtrey Benson's case had occurred in any country in which leprosy was endemic, its value as evidence would have been greatly diminished.

Dr. Beaven Rake, the learned Medical Superintendent of the Trinidad Leper Asylum, has expressed himself as adverse to the contagious view, and his opinion deserves to be received with great respect; but one of his most recent statements on this subject shows that even in his opinion leprosy must be practically regarded, and should be legislated for, as a contagious disease. Dr. Rake states that although he is not prepared to admit that leprosy is contagious in the ordinary sense of the word, he still considers that every leper may possibly be a centre for the dissemination of bacilli and spores—that is to say, every leper may be a centre in which the active agent, the *causa vera*, may be multiplied. The necessary corollary of this opinion must practically be, that every possible means should be taken to lead to the

destruction, and prevent the dissemination of, the bacilli and spores with which the body of every unfortunate leper is teeming.

It is with the object of enabling the medical profession, which in such a matter must lead, to form an independent opinion, that we have endeavoured to submit—perhaps too concisely—the evidence on which the contagionists rest their belief.

CHAPTER VII.

IS LEPROSY HEREDITARY ?

UNTIL quite recent times, most authors, ancient and modern, have considered leprosy a hereditary disease. Some considered that it was hereditary only through the mother, and some that it might pass over one or two generations and reappear. The belief in the heredity of leprosy rested on the fact of the existence of 'leprous families';¹ but if leprosy is a contagious disease, the existence of leper families would not show heredity unless it was found that children developed leprosy, although removed from the chances of contagion from their leper parents. We have searched in vain for evidence to this effect, whilst, on the contrary, there is evidence to show that if children are removed from leper parents sufficiently early, they escape the disease. If we once grant that leprosy is contagious, heredity cannot be accepted as a cause of disease in a leper family, unless it were shown that the conditions were such as to exclude the possibility of infection of one member by another. Further, as leprosy is a parasitic disease, it cannot be considered hereditary. In a disease which is parasitic, it is conceivable that the parasite might be transmitted to the foetus *in utero*; but there is no evidence whatever that this has been the case with leprosy. Syphilis is a hereditary disease, and syphilitic children are born into the world already diseased, but children are not born leprous. It is possible that members of certain families afford a soil in which the bacillus takes root, and grows when introduced from without, more easily than in

¹ Carter states that Dr. Bo knew families in which leprosy was proved to have existed for more than a century.

some other families; but this, again, does not constitute the disease hereditary. The evidence seems to show conclusively, that whilst without the bacillus there is no leprosy, the bacillus is introduced into the leper after birth, and generally in adolescence and adult age.

The facts on which the belief in heredity is based are such as the following. Profeta, in 114 cases, traced heredity in three-fourths. Lewis and Cunningham found that of 80 lepers in an asylum, 28—that is, 35 per cent.—had one or more leprous relatives, the figures indicating a ‘tendency to transmit in the female line.’ Of 125 lepers in Iceland in 1877, the majority belonged to leprous families. In Madras, in 48 cases Dr. Day traced heredity in 19. At Nimar, in 14 per cent. the parents or grandparents of lepers were lepers. At Nagpoor, in 228 cases it might have been hereditary in 40. Lutz, in Brazil, found in 20 cases of leprosy only 3 in which heredity could have existed. In 91 cases observed by Dr. Heidenstam in Cyprus, in 52 no relative of the leper had had the disease. Hillis stated that in 183 cases heredity was acknowledged in 14 in the direct line, and in 11 in the collateral line, or 18·09 per cent. Leloir found in 107 unpublished cases, that heredity was possible in 47, and not possible in 60. The cases in which one member of a family is leprous and others remain free are so numerous that it is unnecessary to quote them. That there are many cases in which heredity is impossible is well shown by the fact that Europeans who leave countries in which there has not been leprosy for centuries acquire the disease in countries in which it prevails. Leprosy, therefore, is incontestably a disease which may be acquired without any hereditary taint.

Dr. Hansen, who recently visited North America in order to make inquiries regarding the descendants of lepers who had emigrated from Norway, found that *of the descendants of 160 leprous individuals none had become lepers*. Of the original 160 lepers, only 16 or 17 are now living, and there are no new cases. (This Dr. Hansen considers not to be an argument against the contagiousness of leprosy, but to show that the mode of life has much to do with favouring the occurrence of contagion.) (*Archiv f. Derm. u. Syph.*, 1889, Heft 3.)

Lewis and Cunningham state that they observed amongst

adult children of lepers in India many who manifested no indication of leprosy, and are married, and have apparently healthy children. They found in the orphanage of Almora twelve children of lepers, the parents being then or formerly inmates of the Asylum. Of this class of children, the total number admitted had been fourteen. One had died. A girl of twenty-two had married, and had children to all appearance healthy. Of the remaining twelve, seven were born in the asylum, of two leper parents, and five were the offspring of one leprous and one healthy parent. Their ages ranged from nineteen to five years. They were in excellent health, and showed no sign of leprosy.

It has been stated in a newspaper that at Maracaibo, which serves as a leper colony at Venezuela, marriages between lepers had been permitted. During the last fourteen or fifteen years, two children have been born amongst them. Neither child has yet shown any symptom of leprosy, and one at the age of fourteen has been allowed, under a certificate of perfect health, to leave the island.

The leper settlement at Kalawao, Hawaii, was inaugurated in 1866. From that time to 1884, 2864 persons were consigned there as lepers. At the end of this period, twenty-six children born at the settlement of leper parents survived, only two of them being lepers. Dr. Bockmann estimates that there must be in Minnesota about 100,000 persons of Norwegian descent, of leprous ancestors; yet leprosy never appears amongst them, all leprous Norwegians in the States being imported.

At Crete, Carter found amongst 88 grown-up children of lepers—several thirty years of age—only 6 per cent. were leprous. Bidentkap states that he has seen women suffering from far advanced tubercular leprosy bring forth children healthy in appearance, who continued healthy many years, and probably all their lives.

There are numerous recorded cases in which children became affected first, and the parents afterwards.

The heredity argument has been very clearly dealt with by Dr. Munro, and we cannot do better than quote his words *verbatim*:—

‘Firstly, let us see the value of the argument founded on

more than one person being affected in a family, the word being used to include all relations to the fourth generation, as Danielssen and Boeck have done, and from which they have concluded, that in 213 cases 189 were hereditary; such cases being most frequent on the *maternal* side, and in the second and fourth generations. Now, when we remember that, if all relatives within the fourth degree are included, as many as 50 to 100 or more persons would be taken in, there is nothing wonderful that in Bergen, where every four-hundredth person is a leper, or in St. Kitts, with nearly the same, even apart from contagion, some families should have two or more members affected. Again, as a man has twice as many grandparents as parents, this would account for the greater frequency in the second generation.

‘But is the argument founded on collaterals being affected of any value? I think not. In the cases I inquired into in St. Kitts, out of seventy-two cases, in eight the family history was uncertain, but in two of these eight the uncertainty was only in regard to the grandparents; all others were healthy. Among the remaining sixty-four the most careful inquiry from the patient’s friends and residents on the estates in regard to relations could elicit no history of leprosy in the family in thirty-four cases. The other thirty had leprosy in both lines in four cases, in the direct line only in five, and in the indirect line only in twenty-one cases; of these twenty-one, three were in brothers or sisters living together, one case only becoming affected four years after her brother, who was attacked in Antigua, but returned and lived in the same house with her. There were five in brothers and sisters, and also in uncles and cousins besides, and thirteen in uncles, aunts, or cousins (third cousins included). Now, of these thirteen I found that eight were in more or less continuous communication with the affected relatives; in one illustrative case, the boy having lived with his aunt while she was sick, apart from his mother. In two cases there was uncertainty as to contact, but in one of those who had been twenty years sick, his leprous aunt died of cholera three years after his attack, and he had lived all his life in one village beside his family and relations. In three instances only was it stated that there had been little or no communication, but of the truth of this

statement I am more than doubtful in one case; and in another case whose half-niece was affected twelve years *before* him, he attributed his illness to *sleeping with a leper*—an example of the danger of concluding that such a case is necessarily hereditary, because there has been no contact with the affected relatives.'

In justification of this argument, Dr. Munro gives parallel cases in which members of an English family, and three others of direct English descent, became diseased after being in constant communication with each other, heredity not being, in the circumstances, possible. Had they been blacks, they were so related to each other that a more apparently conclusive suite of hereditary cases in the collateral line could hardly have been imagined. Dr. Munro also mentions, as a proof against heredity, a great number of cases in which there is only one member of a family affected, including relatives. In families of twelve, six, and four brothers and sisters inquired into by him, only one brother or sister was affected. Dr. Boon (*loc. cit.* p. 77) informed Dr. Munro that a mother became affected with leprosy after her son's death from the disease. A similar case is related by Schilling, and two cases of mothers after daughters by Durand Fardel,¹ and a case in which a mother, father, and another child were attacked after a European child, who herself had been infected from a boy.² Whatever opinions may be held regarding the somewhat obscure origin of leprosy in the Sandwich Islands, there can be no doubt about the rapid increase in the number of cases within a comparatively short period of time; and, as Hansen has aptly remarked, if heredity were to be called upon to explain this rapid increase, it would have to be assumed that in the Sandwich Islands, women, between 1840 and 1850, bore children specially to lepers by preference; whereas the state of morals and general habits in these islands explain the unusual increase by contagion.

That the disappearance of leprosy from amongst the descendants of the Norwegian lepers in America is not due to the disease being less virulent, is moreover shown by the fact that Hansen did not find that such cases as he observed

¹ *Gaz. Méd. de Paris*, 14th July 1877.

² Landré, p. 51.

in that country were less virulent than in Norway ; and that the disease in favourable circumstances would be active in the States is evidenced by a letter from Dr. Hoegh, in Minneapolis, to Hansen, stating that he had a leper patient who had probably acquired the disease by mixing with lepers.

In the absence of proof, the heredity hypothesis must fall, and with the establishment of the contagiousness of the disease it is no longer necessary even as an hypothesis.

CHAPTER VIII.

ETIOLOGY

How ignorant the world has been regarding the etiology of leprosy until within the last few years is abundantly shown by the numerous and diverse causes to which the disease has been attributed. The human mind refuses to be satisfied without a cause, and where the natural one is not apparent is prone to assume one that is supernatural. Thus the Jews thought that leprosy was a direct punishment inflicted by the Almighty, and the Persians thought lepers had sinned against the sun.

There is much in the history of leprosy that illustrates vividly the looseness that has prevailed until quite recent times, in reasoning regarding the disease. During the plague people took refuge in the houses of lepers, because they believed that leprosy and the plague could not co-exist. That leprosy is not caused by poverty, or filth, or unhealthy conditions of life, is abundantly clear. It is not difficult to find the worst conditions compatible with existence, both in past and modern times, without the co-existence of leprosy; and in countries in which the habits of life are the same for all the inhabitants, leprosy may exist in one part and not in another.

Some of the hypotheses of ancient times regarding the causation of leprosy have not entirely died out even yet, of which the 'fish theory' is an example. Avicenna pronounced in its favour, considering that the disease was sometimes caused by fish—fresh, salted, or rotten. Galen and Heberden believed that leprosy was caused by salted or rotten fish. Before the discovery of the bacillus lepræ the theory might have seemed plausible, as some of the countries in which leprosy prevails are washed by the sea, such as Norway, the

Riviera, parts of India and the West Indian Islands; but it has been clearly shown that leprosy may exist equally in the interior of continents, far removed from the sea, and where fish-eating is no special habit. It seems very difficult to find a people who do not, or may not if they wish, eat fish; although Petersen states that leprosy exists in parts of Central Asia where water is so scarce that enough cannot be got to drink, far less to supply fish. It is quite certain that many people eat fish without getting leprosy, and equally certain that people get leprosy who have very little or no opportunity of eating fish, and no facts have ever been brought forward to prove that fish or any other food is the cause of leprosy. A glance at a map in which leprosy is depicted will at once show that the disease occurs in countries far removed from both the sea and large watercourses, and a leprosy fish has never yet been found.

There is not a single fact on record to show that the poison of leprosy has been once conveyed by anything that a leper has swallowed. Spoilt rice, maize, and pork have been blamed, and it is somewhat strange to find some modern authors add to these causes the use of olive oil, oil of sesame, salt, cheeses, alcoholic drinks, and 'intense moral emotion.' Thus a certain patient is said to have become leprous a few days after having seen a thunderbolt fall beside her, and another developed the disease after having assisted in a murder.

The one prominent fact that links the disease with something outside the person who suffers, is the parasite with which he is infected—the bacillus lepræ. Every leper harbours this parasite, and in no other disease has it been found; and as there is no spontaneous generation of vegetable parasites in the human body, the bacillus must have entered it from without. True, the bacillus has been found in the seminal ducts, and in the ovary of an unimpregnated woman. It is conceivable, therefore, that in certain instances the parasite may have been transmitted. It is not probable that it ever has happened so, and it is quite certain that in many cases it could not have happened. Englishmen who go to India, and when there acquire leprosy, must in India have acquired the bacillus lepræ. How the bacillus finds access to the body has not yet been ascertained. Theories of food—fresh and

putrid—as carriers of the organism, may be justifiable as hypotheses, so that investigation may be stimulated; but, so far, the parasite has not yet been found in any animal except man, and in no article of food.¹ But it is certain that persons who live in close association with lepers acquire this parasite; therefore it is highly probable that in these cases the parasites get conveyed from a leper to a previously sound person by actual contact.

The unfortunate Dublin leper, who became leprous after sleeping in the same bed with his brother, contained no bacilli in his tissues until he had been in close contact with a leper. It is certain, therefore, that in some way this minute organism had become conveyed during the close contact of the two individuals. Considering that a leprous sore teems with myriads of the parasite, and—as we ourselves can bear witness—that they are lodged even in the unbroken epidermis, it is evident that when persons are in close contact with lepers, the difficulty cannot be in the conveyance of the bacillus from the leper to the sound person, but in the bacillus acquiring such a footing in the epidermis or tissues of the sound person as to enable it to live and propagate there. It is not impossible that the spores of the bacillus, which are adherent to clothes, or bed, or furniture, might, under the influence of friction, penetrate the epidermis of a healthy person. But there are no facts to show that this is the case.

In regard to the means by which the bacillus may be conveyed from a leper to a healthy person, a fact mentioned by Dr. Castor is highly suggestive. He gives a remarkable instance in which a whole family became leprous, owing, as he believes, to the probable medium of the itch acarus; and in this connection it is not to be forgotten that itch is exceedingly common in Norway, particularly amongst the class of people who suffer most from leprosy. The system prevailing in that country of a number of people sleeping in one bed, affords an easy explanation both of the prevalence of

¹ Dr. H. W. Blanc, in his letter to the *Journal of the Leprosy Investigation Committee*, January 1891, on Leprosy in Louisiana, says: 'It may be said in passing, that the custom of eating raw ham is common among the poorer German population of New Orleans, and out of a list of 63 cases observed in this city during the past six years, there are 24 who are themselves, or whose parents were, natives of Germany.'

itch, and also of the facilities afforded for the conveyance of the bacillus from one person to another. As to the capabilities of the acarus in this direction, it is interesting to note a curious fact recorded by Mr. Godlee. In a paper on *The Organism characteristic of Vaccina* in the Pathological Society's *Transactions*, Mr. Godlee states: 'It may not be out of place to mention an accident which this method of experimentation is open to, and which once puzzled me for some little time. I had prepared several dozen glasses containing various fluids with great care, and placed them simply under bell-jars on the wooden shelves of a cupboard. The greater number of them developed blue mould, and it required some time to discover that the plant had been introduced by a minute acarus, to the hairs of which the spores were adherent in great numbers. I have since seen the same, or a very similar acarus, swarming, together with blue mould, under the covers of some old microscopical slides. It is obvious that no mere protection from draughts, such as that here employed, can prevent the introduction of seeds of any kind by means of messengers provided with legs, and this indicates one of the directions in which fallacies may be sought.'

It has long been believed that leprosy may adhere to certain houses, and although the Mosaic writer was in error in considering that the blue and red moulds in houses had anything to do with leprosy, he may possibly have been justified in believing that the disease in some way adhered to dwellings.

Dr. Cantlie, of Hong-Kong, has lately laid some stress on the possibility of house infection, and states that the house theory is believed in Demerara. This house theory is, however, not sufficiently based on facts to justify our attaching importance to it; whereas the fact that leprosy is conveyed by close personal contact justifies us in believing that, in most instances at least, the bacillus is conveyed directly from one person to another. The extraordinary vitality of the spores of bacilli is well known, and it is possible that a healthy person may become infected by them by contact in some unknown manner, long after the organism has left the body of the leper in which it developed.

Although there can be no doubt that leprosy was conveyed to Australia by the Chinese, it has never been demonstrated, in the case of white persons who became lepers there, that they had been in any particular way closely associated with Chinese lepers. Nor, we are informed on the best authority, has intimate association with lepers been shown in the two recent cases in New South Wales—the one an adult and the other a schoolboy, both of whom are now detained in the Coast Hospital (of Sydney).

As regards the hypothesis of an intermediate host, all that can be said is that it is not impossible.¹ The propagation of leprosy in leper foci in Norway, and its disappearance amongst the same class of people when they emigrated to America, can only be explained by the different habits of these people in the two countries. We know how, in the test case of the brothers in Dublin, the one man acquired leprosy from his bedfellow; and we need not wonder at the propagation of leprosy in Norway when we consider facts such as the following, vouched for by Leloir:—‘The Norwegian peasant is very dirty. The greater number of the peasants have never taken a bath. They wash well sometimes (once a week) the face and hands, and the feet once a year, but the other parts of the body are not washed from the day of their birth to that of their death. Their clothing is never taken off, even for the purpose of sleeping. It is generally made of wool. Their garments are never washed. Dirt is allowed to accumulate upon them, and, when not too rotten, they are often transmitted from generation to generation. They live promiscuously, gathered together in a small house—and what a house! The cabin of the peasant of the fyords is a hut made

¹ Dr. Arning (*Journ. of the Leprosy Investigation Committee*, No. 2) remarks: ‘It is interesting to note that the plague of mosquitoes and the plague of leprosy appeared simultaneously in the Hawaiian Islands. Mosquitoes, which had previously been quite unknown there, were imported, probably from China, towards the end of 1840. I have frequently examined mosquitoes bacterioscopically, which were found inside the mosquito nets of beds containing cases of severe cutaneous leprosy. I caught the insects when they were quite full of the blood sucked from the patients. Some of these I stained at once, others after some few days’ imprisonment, and then I submitted them to the microscope. I could not discover any trace of leprosy bacilli either in or upon them.’

of firs with a wooden roof covered with earth, upon which a little turf is placed. The chimney is often nothing but a hole made in the roof, and the rain falls through it to the beaten earth which forms the flooring. Dung and filth are accumulated around the house, amidst pools of dirty water. Amongst this there is found a reservoir of water—and what a reservoir! Often pigs, poultry, etc., live with the family.

‘In the west and south coast of Norway there are very few beds. Almost always several persons sleep in the same bed. If a stranger comes, whoever he may be, it is the duty of hospitality to give him a share of this bed. As for the bed itself, it is nothing but a kind of wooden chest, upon which are thrown some sheepskins or goatskins which are scarcely ever washed. Everybody eats at the same table, from the same dish, often with a common spoon, and drinks from the same vessel!’

Hansen attributes much importance to the habit of sleeping in the same bed with lepers, in connection with the communication of leprosy.

We have it on his authority, whilst confirming what has been stated by Leloir regarding the habits of the Norwegians when in Norway, that, under the civilising influences of life in the United States these habits are entirely dropped, and cleanliness and decency take their place; with the result that leprosy, instead of continuing to propagate itself, dies out with the death of the lepers.

Drs. Valladores and Yela, writing from Guatemala, think that leprosy is increased by want of fresh air; *the custom (amongst the poor class) of whole families sleeping in one room*; want of cleanliness; and use of alcoholic liquors.

Intimately associated with the presence of the bacillus lepræ in the human body as the cause of leprosy are the questions as to whether this organism has an independent existence outside the human body, either in dead organic substances, or in other animals; and whether it is possible, as in the case of the bacillus of tubercle, to cultivate this bacillus artificially. Numerous as have been the experiments in connection with both these questions, the results cannot as yet be considered as final. Hitherto the attempts to find the organism outside the body have entirely failed.

Dr. Beaven Rake examined the soil of graves in the cemetery of the leper asylum, but found no organism different from those found in earth taken from his garden, a mile away from the asylum. He examined salt pork, salt fish, pigeon peas—the three favourite foods of negroes and coolies in Trinidad,—and found various rods and spores, but no evidence of leprosy bacilli. It made no difference whether the food examined was decayed or not. Cultivation experiments with different portions of earths and foods also failed to show any leprosy bacilli.

Dr. Rake asks the suggestive question as to whether the spores of the bacillus lepræ answer to the tests of the bacillus itself.

Dr. Kaurin, Medical Superintendent of the Molde Asylum, states that he has made many experiments to find the bacillus lepræ elsewhere than in the human body—for instance, in earth, in the dust, and in the air in the rooms of lepers,—but as yet without success.

Although Bacteriology is a still very young science, its cultivators during the last few years have worked with such zeal and perseverance, that it is difficult to believe that the leprosy bacillus would have escaped observation if it existed outside the human body.

Although the attempts of the most experienced observers to cultivate the leprosy bacillus have not succeeded, it is right to mention here that an Italian bacteriologist, Bordoni-Uffreduzzi, claims to have succeeded where others have failed. This observer (*Arch. della sc. Med.*, xii. i.) states that he in two instances succeeded in growing the bacillus. He took the material which he used for inoculation from the bone marrow of a man who died of leprosy, which he states contained bacilli, and placed it in gelatinised glycerine blood serum at a temperature of 33° to 35° Centig. The colonies, the development of which began on the seventh day, consisted of bacilli, that when stained in solution of fuchsine and gentian violet in aniline water, and treated with alcohol, consisted of thin, sometimes straight, sometimes curved, rods, which averaged three micro-millimetres in length. Some of the bacilli were uniformly thick, but the majority showed a club-shaped thickening at one or at both ends. The author states

that he found this morphological peculiarity in the leprosy bacilli of bone marrow, whilst only seldom in bacilli situated within cells. Groups of these bacilli were enclosed in a gelatinous material, the groups being usually round, and the bacilli so arranged that the club-shaped end was towards the periphery. On this glycerine-gelatine-blood-serum the lepra bacillus, at blood temperature, forms ribbon-shaped colonies of a pale yellow colour, with irregular contours. The gelatine is not liquefied. On glycerine agar agar the development takes place in the form of small, round, whitish-grey colonies, which are somewhat raised in the centre, and have jagged borders.

Dr. Kaurin, medical superintendent of the Molde Asylum,¹ who does not believe that the bacillus lepræ has yet been successfully cultivated, states 'that he cannot acknowledge the experiments made by Dr. Bordoni-Uffreduzzi in Turin, who pretends having cultivated the bacillus lepræ from the marrow of bone; for although he has made many examinations, he has never succeeded in discovering the bacillus lepræ in the marrow.'

The weak point in connection with Bordoni-Uffreduzzi's experiments is, that notwithstanding the most persevering attempts made by highly capable bacteriologists and pathologists, his alleged success is so far entirely unconfirmed. Perhaps the weakest point in his statement is, as Dr. Kaurin has remarked, that the bacilli which he succeeded in cultivating were obtained from the bone marrow, a part of the body in which other observers have not succeeded in finding the leprosy bacillus at all. Amongst those who have in vain attempted to cultivate the bacillus, we have only to mention Campana, Beaven Rake, and Leloir,² to show how well

¹ *Journal of the Leprosy Investigation Committee*, No. 2.

² As a statement in M. Leloir's book seemed obscure, we wrote him on the subject, and were favoured with the following reply:—

' Mon cher Collègue et ami,

' LILLE, 2 Janvier 1890.

' C'est par suite d'une erreur d'impression que la phrase de la page 232, "*Les bacilles de la lèpre sont cultivables sur le serum humain gelatinisé et sur l'albumine de l'œuf comme l'ont montré Neisser, Hansen et d'autres. C'est dans ces cultures pures que l'on peut le mieux étudier la formation des spores aux dépens des bacilles,*" se trouve dans mon *Traité de la Lèpre*.

' Il fallait lire: "On a essayé de cultiver les bacilles de la lèpre sur le

justified is the almost universal scepticism with which the Italian observer's results have been received. In a matter, however, of such delicacy as the growth of a pathogenic bacillus, it would be neither fair nor wise to deny absolutely the possibility of his success. On the contrary, his published statements ought to be an incentive to renewed attempts to cultivate the organism.

Most interesting are the results obtained by Dr. Arning, by simple maceration of the bacillus at ordinary temperatures. In a letter which we have received from him, dated March 25th, he enclosed two slides. One, to use his own words, 'is a growth of leprosy bacillus, easily obtained by macerating tiny bits of leprosy tissue in ordinary water, at ordinary temperature, for weeks and months, and transplanting the film that forms on the surface into another small quantity of water, again giving a few weeks' time for further development. You will notice that the shape of the young rods is different from that in the tissues, although we often do meet with short rods where there seems to be recent growth and multiplication; but the staining reaction is absolutely identical. Both slides have been submitted to a prolonged rinsing with strong solution of nitric acid. From numerous reasons, I feel convinced that the swarms of young bacilli are true bacillus lepræ, and actually new growths, not simply the pre-existing bacilli liberated by the disintegration of the tissue. My simple little experiment has only been repeated by Dr. Stallard, of San Francisco. He has fully confirmed my results.

'The other slide shows material taken from the exhumed corpse of a leper. It had been buried for three months, and the decomposition of the soft tissues was nearly complete. You will easily recognise the characteristic heaps and innumerable numbers of single bacillus lepræ. Mixed up with

serum humain gelatinisé, et sur l'albumine de l'œuf;—comme l'ont fait Neisser, Hansen et d'autres auteurs. Jusqu'ici ces essais ont été infructueux." Cette erreur d'impression sera modifiée dans la prochaine édition de mon traité.

'En ce qui me concerne, je n'ai jamais pu réussir à cultiver la bacille de la lèpre, ni à obtenir même des semblants, des apparences de culture.

'D'après les renseignements que j'ai reçus de tous côtés, je ne connais personne qui soit arrivé à cultiver réellement la bacille lépreux.'

it are the large round oval spores¹ of some other bacterium, probably the potato bacillus.'

The appearances observed in Dr. Arning's preparations are certainly remarkable. The field is found thickly studded with minute bacilli, the protoplasm of which is in the form of spores, the spores being contained in a delicate sheath—generally two or three in a sheath, forming rods, either straight or slightly bent. The spores have retained the fuchsine stain, the delicate sheath being scarcely stained. When looked at through a dry lens, and a magnifying power of about 400 diameters, it appears as if the preparation came from a cultivation of cocci; but on examining with a good immersion lens, the cocci are found to be contained in the delicate sheath which we have described. The size and form, so far as an opinion can be formed by simple examination through the microscope, are those of the bacillus lepræ; and coming as they do from a substance and a fluid in which it was certain that this bacillus was contained, it seems very difficult to avoid the conclusion that we have here before us a genuine cultivation.

Dr. Arning's experiments well deserve repetition and control, not only on their own merits, but because such an experienced and cautious observer as Dr. Arning himself believes that in this case he has obtained a positive result.

The ideal evidence of a special bacillus being the cause of the disease is not forthcoming in the case of leprosy. It is laid down on the best authority, that to prove that a bacillus causes a disease, the bacillus should not only be found in the diseased tissues, but should be capable of being cultivated outside the body; and that when the product of pure cultivations is inoculated in the same species from which it was obtained, the same disease is produced. This is the case with the anthrax bacillus and with the tubercle bacillus, as regards animals, but it cannot yet be accepted that the bacillus of leprosy has been cultivated outside the body; therefore no importance can be attached to inoculations with what purports to be pure cultivations. The evidence that the bacillus is the cause of leprosy must be considered, therefore, as circumstantial, but

¹ These spores retain the fuchsine stain, just like the bacilli of tubercle and leprosy in treating with nitric acid.

it is circumstantial evidence which, in our opinion, amounts to certainty.

For forty years it was almost the unanimous opinion of medical men who directed their attention to the subject, that trichophyton tonsurans caused ringworm, microsporon furfur caused pityriasis versicolor, and that acorion Schonleinii caused favus; and yet during all that period no one had succeeded in cultivating these parasites artificially, and of course they had not seen the disease produced by cultivations.

The evidence of the bacillus lepræ is precisely of the same kind, and is equally strong. It is invariably found in leprous tissues everywhere, and at all times, and, so far, has been only found in these tissues. There is microscopic evidence that it enters the cells, and in the cells that it causes changes which lead to their destruction, and, like all fungi that grow in or on the body, it is attended by the symptoms of irritation and organic change.

The late Erasmus Wilson never could accept the evidence for trichophyton tonsurans, and there are no doubt minds so constituted that the evidence for the bacillus lepræ does not appear to them sufficient; but amongst those who have a direct and clear knowledge of bacteriology, we believe it will be now very difficult to find a sceptic.

What is known of the etiology of tuberculosis, renders it more easy to understand how leprosy is propagated by the vitality and multiplication of the bacillus lepræ. We do not consider that it is now necessary to admit that there is any question regarding the certainty that consumption and all tubercular diseases depend upon the reception into the human body of the tubercle bacillus. Those who have followed the remarkable series of investigations pursued in different countries since the promulgation of Koch's discovery—provided their acquaintance with the laws of bacteriology is sufficient—have, and can have, no doubt regarding this fact. Those who have not had the time or opportunity to follow the chain of evidence, will find it concisely and lucidly explained in Dr. Heron's *Evidences of the Communicability of Consumption*.¹ In the appendix to that book, they will find a summary of upwards of three hundred cases in which tubercular disease

¹ Longmans, Green, and Co., 1890.

can be traced to the inoculation of this bacillus, and of some remarkable facts concerning the means by which the parasite is conveyed to man from the lower animals. Dr. Heron refers to a map issued by the authorities at Baden-Baden, in which it is shown that where cattle suffered much from tuberculosis, the human population also suffered much from that disease; and reference is given to instances in which consumption was conveyed by the milk of tubercular cows. One case is related in which hens became tubercular by eating the expectoration of a consumptive man, and a healthy woman became infected by eating the half-cooked flesh of the hens. Cases are being steadily multiplied, particularly in France, in which it has been shown that the tubercle bacillus had been inoculated in a wound of the finger, and conveyed by the lymphatics into the lymphatic glands, and thus to the lungs. It is worthy of note, that in the three last International Medical Congresses, the production of consumptive disease by the contamination of the tubercle bacillus was accepted with practical unanimity.

It has been comparatively easy to bring home consumptive diseases to the tubercle bacillus, because that organism, unlike the bacillus of leprosy, can be artificially cultivated, and can be inoculated on the lower animals, many of whom suffer largely from these diseases; but indubitable as is the fact, that consumption and other tubercular diseases are dependent on the tubercle bacillus, it is only in comparatively rare instances that the mode of entrance of the parasite into the system can be ascertained. Consequently, for many years consumption was looked upon as a hereditary disease, springing up spontaneously in members of certain families, and was not considered contagious; the truth being, that some members of certain families are so constituted, that they form a ready soil in which this tubercle bacillus can grow; whilst stronger members of the same families, and the great majority of the healthy population, can resist the growth of this ubiquitous parasite. In the case of leprosy, it seems perfectly clear that many individuals can resist the lodging and multiplication of the bacillus lepræ in their bodies, whilst the chances of accidental contagion or contamination are greatly diminished in comparison with tuberculosis, by the fact that in the lower

animals that supply our food, and with which we are more or less constantly in contact, the bacillus lepræ is not found and cannot develop. This organism appears to be an exclusive parasite of man, but, these differences notwithstanding, there is a close analogy between the two parasites. They both may gain admission into the human frame without leaving any trace at the point of entrance; they both have an uncertain period of incubation; they both may develop rapidly or very slowly, and in both instances, once admission and development have taken place, the complete extinction of the parasite, if it ever does so, occurs with extreme rarity; although in both cases the parasite may be limited to certain isolated parts of the body, and may live very quiescent over a long period of years, the death of the patient in process of time probably taking place from some other disease. Of the two parasites, the tubercle bacillus develops the strongest poison, and thus can mercifully kill the victim without producing extraordinary ravages and mutilations, like those which take place before the patient succumbs to the enormous development of the leprosy bacillus which is compatible with life.

CHAPTER IX.

INOCULATION EXPERIMENTS

WHEN we consider that the history of Leprosy as a whole, and of individual cases of the disease, point—as we believe conclusively—to the fact that it is propagated by contagion, and by contagion only, an especial interest attaches to the attempts that have been made to inoculate the malady by conveying leprous products into the bodies of men and of animals.

Since the discovery of the bacillus, a long series of experiments have been made in order to test the inoculability on animals, but with one doubtful exception, to which we shall presently allude, all these attempts have hitherto failed.

Campana, Koebner, Leloir, Beaven Rake, Damsch, Wesener, Neisser, Hansen, Vidal, Gaucher, and ourselves, have inserted freshly excised tissue from leprous tubercles into the living tissues of animals, and more especially into the anterior chamber of the eye; but in no case has a general infection followed, nor has there been any multiplication of bacilli in the tissues of these animals. The experiments have been entirely negative. The bacilli are taken up and carried some distance by leucocytes, which, in the case of certain experiments, gave rise to the mistaken idea that there had been a growth in the inoculated animal. Campana and Leloir have shown conclusively that this is not the case, because the same appearances are observed when bacilli are injected which have been killed by being placed in absolute alcohol.

Special importance ought to be attached to the negative results published by Dr. Beaven Rake.

Dr. Rake, who has carried on his attempts to inoculate animals over a long period, and who has made a great number of experiments—having kept inoculated cats four and a half

years and five years after inoculation—states that in all the animals he examined he has failed to find any local growth or general dissemination of bacilli after the inoculation—whether beneath the skin, in the abdominal cavity, or in the anterior chamber. Feeding with leprous tissue has also given negative results.

Strange as it may seem, experiments have been made with the object of discovering whether leprosy is inoculable in the human being. The question has an ethical aspect, which this is not the place to discuss; but in regard to the most recent, and in many cases most remarkable, experiment—because it has been made since the discovery of the bacillus, that, namely, of Keanu,—this question can hardly be said to arise. A murderer condemned to death by the Honolulu Government, was offered, at the suggestion of Dr. Arning, who was at that time in the Sandwich Islands, the alternative of execution or of permitting himself to be inoculated by leprous matter, and naturally chose the latter. For the conception of the idea, and for the scientific precision and care with which it was carried out, medical science must ever be indebted to Dr. Arning.

In regard to the two other chief attempts that were made to inoculate leprosy—and which took place before the discovery of the bacillus—it should be borne in mind that the experimenters inoculated themselves in the first instance.

It has been found by Hansen and Beaven Rake, that local lesions of leprosy were not produced when leprous tissue from a diseased part of the body was inserted in a healthy part of the same person. Experiments of this kind, although of far less value than those which were made on persons entirely free from leprosy, have still a certain value, and their bearing should not be left out of sight. If it should be afterwards conclusively shown that leprosy can be successfully inoculated on a healthy person, the fact that the bacillus does not grow in the healthy tissue of a leper would have an important bearing on the scientific aspects of the question.

There are on record the following instances of attempted inoculation of leprosy from a diseased to a healthy person:—

Dr. Bargilli (Report of the College of Physicians) practised inoculation in two instances without result, at Mytelene.

Leloir¹ states, on the authority of the venerable Dr. X., that this gentleman (in Norway), about thirty years ago, inoculated himself repeatedly with portions of leprosy tubercles, leper blood, and pus, with the sole result of producing some septic lymphangitis. He then inoculated twenty healthy persons with blood, portions of leprosy tubercle and blood, and pus collected from the surface of ulcerating tubercles. Some lymphangitis was produced, but no leprosy. The inoculated persons were observed for years. These experiments, we are informed by a physician in Norway, have been well known there for many years, and probably have much to do with the negative opinion which, at one time, prevailed in that country regarding the contagiousness of leprosy.

Profeta² inoculated two women and eight men, himself and Dr. Cagnina included, aged from twenty-five to forty-four years, all of them being warned of the possible danger. Pus from leprosy ulcers and blood were placed in wounds made by scarification, and on surfaces laid bare by blisters; and he injected, subcutaneously, blood taken from the centre of a leprosy tubercle, and from points where there was complete anæsthesia; but the result, so far, has been always negative. The first series of experiments date back to 1868.

Keanu, sentenced to death at Honolulu, was offered the alternative of execution or to submit to be inoculated with leprosy. He chose the latter. On September 30, 1884, Dr. Arning injected pus from a granulating leprosy ulcer, into a blister which had been produced on the man's right arm.³ Similar pus laden with leprosy bacilli, was rubbed into a scarified portion of the man's left ear. On the left forearm an incision was made down to the deep fascia, and in the wound a freshly excised portion of a tubercular nodule was imbedded. Four weeks after the inoculation the patient complained of pains in the left shoulder, and afterwards in every joint in the left arm, and shortly after there was swelling of the left ulnar and median nerves, not painful at first, but afterwards becoming so. The wound healed with the formation of a keloid

¹ *De la Lèpre*, p. 237.

² Leloir, *De la Lèpre*, p. 238.

³ The leprosy matter was taken direct from a child who suffered from severe tuberculous leprosy, and who had just gone through a leprosy fever.

scar, and five months after the inoculation there was a waxy granulation tumour in the scar, in the juice of which leprosy bacilli could be detected. Six months after the inoculation, the painful symptoms in the left arm had disappeared, and the patient appeared to be well. The granulation tumour seemed to be smaller, although on May 15th, 1885, the keloid appeared larger. Sixteen months after the inoculation, bacilli could still be found in the juice of the keloid. On June 15th, 1886, the left arm was free from pain, the keloid was unaltered, and leprosy bacilli could not be found in the juice. Shortly afterwards Dr. Arning left Honolulu, but, as is well known, in a brief period (in September 1887) Keanu showed the full development of tubercular leprosy. Dr. Swift, of Molokai, considers that the fact of Keanu's son, cousin, nephew, brother-in-law, and jailer being lepers weakens the effect of his developing leprosy after Dr. Arning's inoculation. The importance to be attached to Keanu's case depends on the local symptoms developed in the inoculated part. Contagion through the ordinary channels, whatever they may be, would not, we consider, account for the appearances described by Arning at the seat of inoculation.

In reference to Dr. Swift's recently expressed opinion that it is improbable that the disease could have reached so advanced a stage in five years, Dr. Arning remarks in a recent paper:—

‘In order to prove that this may be possible, I will mention a well-known leprosy case, which took a still more rapid course: the case of Father Damien. In July 1882, Father Damien fell ill with neuralgia in his left foot. On the 25th November 1884, I examined him, and found the typical analgesia, with atrophy of the skin on the outer side of the left foot, accompanied by a swelling of the superficial peroneal nerve, and I did not conceal from him my diagnosis of his disease, which amounted to leprosy. In 1886, the first infiltrations into the facial skin appeared, and in July 1889, the poor man was dead. In this case the whole course of the disease, from the very first symptoms until ending in death, only occupied seven years; and only three years passed from the first appearance of tuberculous symptoms. I could mention many more similar cases of an equally rapid course of leprosy,

taken from my Hawaiian experiences, though such instances are not of frequent occurrence.'

The conveyance of the leprosy bacillus from an infected to a healthy person can only be regarded as an inoculation, although it seems nearly always impossible to trace the point at which the inoculation takes place. The fact can only be explained by the absence of inflammatory symptoms caused by the first transplantation of the organism. Still there are cases on record which appear to point to the local origin of the disease.

For example, Kaurin (*Tidsskrift for praktisk Medicin*, Nr. 23, 1886—*Arch. für Dermat.* 1887) relates that a boy, nine years old, was received at the asylum at Molde on Sept. 13, 1886, suffering from the eruptive stage of tubercular leprosy. The boy had four healthy sisters, and neither the parents nor grandparents were leprous, but two maternal uncles were lepers. One of these uncles lived from 1880 to Sept. 1885, in the same house with this boy. The man suffered from tubercular leprosy in the ulcerative stage, and had on both legs large, moist, badly dressed ulcers. The boy was a special favourite with this man, and often slept in the same bed with him, which was never the case with the other children. In the autumn of 1885, three small wounds were observed on the outer side of the right thigh of the boy, and in the summer of 1886, a nodular leprous eruption was observed on both lower extremities. The sisters, who never slept in the same bed with the man, remained healthy.

The frequency with which the first symptoms of leprosy are observed in the legs, hands, and face—that is, on the uncovered parts of the body—possibly indicates that the disease first manifests itself in the parts where the parasite finds entrance. The first symptom in Father Damien's case, as has been already stated, was neuralgia in the left foot, accompanied, as Arning found, by a swelling of the superficial peroneal nerve. The case of Father Boglioli, referred to by Dr. Blanc, in whom the disease appears to have developed first of all in the nostrils, seems to be of the same kind. It is easy to conceive how the unfortunate priest, who had been rubbing lepers with his fingers, may have conveyed the bacillus to the inner surface of the nostril.

We have stated that attempts to inoculate leprosy on animals have failed, but there is one possible exception to this statement which deserves mention. In the *Berl. Klin. Wochschr.* No. 13, 1885, Melcher and Ortmann report that they succeeded in inoculating a rabbit. A portion from a leprosy tubercle was inserted into the anterior chamber of the eye, but with the exception of a slightly progressive keratitis at the point of inoculation, the animal remained healthy until it died suddenly three hundred days afterwards. The lungs, heart, pericardium, and the eyeballs were found the seats of an apparently fresh tubercular eruption; the central parts of the lungs were free, whilst the pleuræ and the adjacent parts of the lungs were full of solitary and confluent nodules. In all the affected parts, large round and oval cells were found containing bacilli. The authors considered the bacilli to be leprosy, and not tubercle bacilli, and state that they coloured in alkaline solutions of aniline quicker than tubercle bacilli; also basing their opinions on the fact of the enormous number of bacilli in the cells, and their typical arrangement. They again report (*ib.* No. 9, 1886) that they had succeeded in inoculating two rabbits, which died four months after inoculation. The whole of the viscera were the seat of a nodular eruption, which they considered leprosy on the same grounds as in the previous experiment.

The difficulty in accepting these results consists in the fact that so many other experimenters have failed to verify them, and because it is difficult to avoid the fallacy of mistaking tubercle bacilli for leprosy bacilli, and nodules of tubercle for nodules of leprosy.

Whilst Dr. Kaurin, as we have seen, could not verify the correctness of these experiments, Dr. Arning writes us that after having seen and examined Melcher and Ortmann's preparations, he firmly believes in artificial visceral rabbit leprosy; but he adds that it remains a curious fact, that only about one-half per cent. of their inoculation experiments have given positive results. Dr. Arning's experience of the appearance of the leprosy bacillus has been great, and the value of his opinion is vouched for by the success of his own original work in that department of bacteriology.

It is clear, therefore, that this question, like that of the

artificial cultivation of the leprosy bacillus, must not be considered as definitely settled. If it should turn out that even a half per cent. of such inoculations are successful, we should hope that the conditions under which the bacillus can exercise its activity in a new organism, animal or human, would in course of time come to be better understood.

In connection with the negative results of cultivation and inoculation experiments, the suggestive question has been raised as to whether all the leprosy bacilli that are found in the human body are living. It is possible that after a certain time their power of life, or at least their power of reproduction, may cease. Campana, who has devoted great labour to this subject, states that in the old nodules of tubercular leprosy fewer bacilli are found than in the newer ones, and in the very old ones the spores are more apparent than rods. The analogy with other organisms of a similar structure leads us to infer that the spore elongates into a rod, that the protoplasm in the development of the rod gathers itself together in the shape of spores, and that in the mature organism the spore is set free, to again develop into a rod. If a mode of preparation is adopted that is destructive to the sheath of the rod, spores are alone visible; and we have little doubt that the masses of spores described by some observers are frequently due to the fact that in their mode of preparation everything connected with the organism has been destroyed except the spore. It is quite conceivable—we might be justified perhaps in saying probable—that the bacillus lepræ can be successfully transplanted, either by design or by accident, only in a certain phase of its existence. Possibly a condition of this kind may concur with the evident difference of susceptibility in different persons to account for the fact that, whilst some individuals acquire the disease easily from exposure, many others enjoy a complete immunity.

CHAPTER X.

VACCINATION IN RELATION TO LEPROSY

It is not to be expected that leprosy could be often communicated by vaccination, as the disease is exceedingly rare in childhood, and apparently entirely unknown amongst infants; whilst in accordance with an almost universal habit, vaccination is usually practised in infancy.

The alleged instances in which leprosy has been attributed to vaccination, both in communities and in individuals, seldom bear investigation, and we find that there are very few well-attested cases in which the disease can be even plausibly attributed to that cause.

The following case is vouched for by Professor Gairdner of Glasgow. A medical man, in a British colony, vaccinated his child with lymph taken from a child of a family in which leprosy was known to exist, and it was stated—although the fact has not been definitely proved—that the vaccinifer was afterwards known to develop leprosy. A Scotch ship-captain, who traded between Scotland and the colony, applied to this medical man to have his child vaccinated, and the vaccination was performed, the lymph being taken from the medical practitioner's own child. By an extraordinary coincidence, Professor Gairdner had occasion afterwards to see both children—namely, the son of the medical man and the son of the ship-captain—in Scotland, both being affected with tubercular leprosy.

Professor Gairdner saw the captain's child in Scotland when he was suffering from the erythematous stage of tubercular leprosy, but lost sight of him for a time. It was only when five years afterwards he had to see and diagnose tubercular leprosy in the son of the medical man, that he sought out and found the unfortunate son of the captain, who was then

near his end; "fearful ulcerations all over his face, body, and limbs, diarrhœa, etc.—a mere skeleton, and yet living—I never saw such a sight," are words used in a letter which we received from Dr. Gairdner at the time.

This is the bare statement of facts, so far as they are connected with the purely medical aspects of the two cases. The presumption that the disease was conveyed to the second and third child in the vaccine lymph is strong, but the case is by no means proved. The child of the doctor living in a colony where leprosy is not uncommon may have acquired the disease independently of the vaccination. The child of the ship-captain, on the other hand, visiting the colony only temporarily, had much less chance of acquiring the disease, and the presumption in favour of the vaccination is very much stronger. If it were known for certain that the original vaccinifer child was leprosy, the presumption of contagion through the vaccination would be stronger still.

Dr. Daubler (*Monats. f. Prakt. Derm.*, vol. viii. p. 123), relates two cases of leprosy at Robben Island in South Africa, in which he believes it to be proven that the disease was conveyed in vaccination. The first case is that of a woman, H., thirty-six years old, married, and the mother of a healthy child of twelve. There was no leprosy in the family. Several years previously, on account of an epidemic of small-pox, she was re-vaccinated, the first vaccination having been effected when she was two years old. In the course of the two months following the re-vaccination, she experienced attacks of shivering and fever three to five times weekly, was frequently thirsty, but passed less urine than usual, and whilst the points of vaccination swelled and became brown, she grew dull and weak. She had been vaccinated on both arms over the insertion of the deltoid. No pustules formed, and when she saw the medical man two months after the vaccination, the parts were swollen. The swelling had begun three days after the insertion of the lymph, and reached its greatest extent eight days afterwards. At this time the parts became yellowish, and within fourteen days of the vaccination on each point there was a raised, discoloured skin, of a yellowish brown colour, and as large as a two-shilling piece. These swellings gradually increased, and ten weeks after the

vaccination her physician found the skin of the arms and the upper third of the forearm brown in colour and uneven. The brown spots extended lower down when, after three more weeks in which she was feverish and ill, the spots became smaller and smaller, but the skin did not resume its normal colour. In the fourteenth week after vaccination she had a violent rigor, repeated twice within the following week. Subsequent attacks of fever were at longer intervals, and not so severe. At and shortly after the severe rigors, brownish spots developed on the cheeks and forehead. Eighteen weeks after the vaccination leprosy tubercles developed on the brow and on the cheeks. Two years later the woman was sent to the leper asylum at Robben Island, where she was seen and photographed by Dr. Daubler, tubercular leprosy being fully developed.

The other case was that of a girl, fifteen years old, who was re-vaccinated at the same time and by the same medical man who vaccinated the woman H. The same local appearances followed on the arms as those described in the woman. After two months there were maculæ on the forehead and cheeks, and after three months more leprosy tubercles on the forehead. When seen and photographed by Dr. Daubler, the disease had lasted three and a half years. Inquiries made at the homes of both patients, and from the medical man who vaccinated them, showed that the person from whom the lymph was taken had died of tubercular leprosy several months before, other members of the family being leprosy—facts of which the practitioner was ignorant when he took the lymph with which he vaccinated the patients.

The following case is given by Dr. Hillis (*op. cit.*), page 30. A fair Portuguese born in Demerara, aged twenty, the son of healthy parents, suffered for ten years from tuberculated leprosy, and has a sister aged eighteen suffering from the same disease. They have three sisters and one brother alive and well. They were both vaccinated with lymph obtained from a member of a Portuguese family, members of which were known by Dr. Hillis to be affected with tubercular leprosy, and they were the only members of the family vaccinated with this lymph. In the case of the boy, the first cutaneous

manifestation—a reddish-brown spot on the inner side of the right thigh—appeared within eighteen months of the vaccination.

Dr. Arning (*Archiv f. Derm. und Syph.*, Jan. 1891—*Journ. of the Leprosy Invest. Com.*, Jan. 1891) states that he made some direct experiments in order to throw light upon this question, by vaccinating lepers and then examining the lymph for leprosy bacilli. These experiments led to the result he anticipated. In cases of extensive cutaneous leprosy, in which skin apparently healthy contains bacilli, these were likewise detected in the lymph; but there were no bacilli to be found in the lymph taken from cases of pure *lepra nervorum*, in which no traces of the bacillus is to be found in the skin.

The same observer (*ib.*) remarks: 'I am able to state—having excellent authority for so doing, though unfortunately no statistics—that a very remarkable local accumulation of fresh leprosy cases took place in 1871-1872, in a place called Lahaina, on the island of Mani. This happened about one year after a universal arm to arm vaccination, which had been most carelessly performed. About 50-60 cases occurred suddenly in this locality, which up to that time had been comparatively free from the disease.'

The best authenticated cases which we have found are those related by Dr. Daubler, but the practice of infantile vaccination must fortunately continue to be a great safeguard against the conveyance of leprosy in this operation.

CHAPTER XI.

DIAGNOSIS

THE changes produced in the features and expression by the development of tubercular leprosy in the face is so characteristic, that it can hardly be mistaken by any one who has ever seen a fully-developed case, or even a good portrait of the disease. Hence a mistake has arisen (and medical works are not free from it), to the effect that the diagnosis of leprosy is easy. There could be no greater error. The earlier stages of tubercular leprosy, and still more of nerve leprosy, so far from being easy to recognise, are often difficult to distinguish from other affections of the skin. We speak well within our own experience in stating that, in Europe, an erroneous diagnosis has not infrequently been made in cases of nerve leprosy, by physicians who would not have made a similar mistake in cases of tubercular leprosy. We have seen a patient with well-developed nerve leprosy, who was sent home from India as a case of lupus erythematosus; and two other cases in which typical anæsthetic patches with pigmentary changes were (in the absence of assistance by the patients, who were unaware of the disease from which they suffered), in the first instance, erroneously diagnosed by observers experienced in dermatology. Even advanced trophic changes are apt to be unrecognised by men not familiar with nerve leprosy. Doubt was thrown (according to statements in the London newspapers) on the diagnosis in the case of the poor man at present in the Whitechapel Infirmary, suffering from an advanced stage of this disease; and a provincial surgeon of great experience, who saw a well-developed case of anæsthetic leprosy in London recently, informed us that the true diagnosis would never have occurred to him had he not been informed of the nature of the affection. Erasmus Wilson refers to a medical

man in the Indian army, himself a leper, who, with other medical men in India, did not recognise the nature of his own case. He looked on it as one of syphilis. As regards the general public in England, they are, as yet, fortunately, quite unfamiliar with the appearance of even advanced tubercular leprosy. A man whom we had occasion to see several times some years ago with leonine aspect, and with scarcely any sound skin on his body, was often met by us in Regent Street, where it was curious to note that his remarkable appearance did not apparently excite much attention in the passers-by; and quite recently one of our friends, of large experience in leprosy abroad, informed us that he met a young man with fully-developed tubercular leprosy on the face, taking exercise on a bicycle on the Bayswater Road without being in any way noticed by other persons in that thoroughfare. We repeat that the diagnosis of the earliest stages of tubercular leprosy, and of all stages of nerve leprosy, is a subject which deserves the attention of the profession in our great cities, particularly in London; as they may be consulted by patients who come from abroad, suffering from symptoms of leprosy, but who do not themselves suspect the nature of their disease.

In malarial countries, it may be necessary to distinguish between the febrile attacks that precede eruptions of leprosy, and malarial and other fevers. Vandyke Carter, who has closely analysed the points of difference, states that leprosy is distinguished from continued fever by its exacerbations, and by the apparent absence of visceral complications. It differs from eruptive fevers by having no fixed duration or course, or close relation to the concomitant skin eruption, and it is not protective against subsequent attacks. Aguish attacks in a leper produce no change in the symptoms, nor do other febrile disturbances. The essential and specific form of fever belonging to certain phases of leprosis, although it depresses the patient at the time, produces no material hurt.

Leloir has seen lupus confounded with leprosy, even in Norway, and remarks that it is easy to confound the disease with syphilis. The acute eruptions of tubercular leprosy present the greatest difficulties in diagnosis, until they show the characteristic brown colour. In cases of doubt, attention should be especially directed to the eyebrows, the hairs of

which are early lost, and the skin above the eyebrows, as a rule, soon swells, giving rise to the characteristic expression. When tubercular leprosy has fully developed, the demonstration of the bacilli is easy and decisive. The leprome, with its infiltration, can be easily distinguished by its clinical characters from the macular syphilide, and would not present any difficulty to the physician who is familiar with syphilis. In cases of doubt, however, it is only necessary to wait. The objection to the use of mercury, except most cautiously, to clear up the point, is that the metal is badly borne by lepers.¹

The development of the eruption in the two diseases is so different, that in a comparatively short time the difficulty would disappear. The early secondary stages of a syphilitic rash are distributed characteristically over the trunk and, as a rule, less markedly over the limbs. They run a certain course, and gradually fade within a certain time. In the early stages of tubercular leprosy there is, as a rule, a special selection of some part of the body, and the longer it lasts the less it is likely to be confounded, either as regards colour or infiltration, with syphilis. In both diseases it is only in the earliest stages that a temporary difficulty could arise. An acquaintance with the clinical aspects of the two affections will be sufficient, in the great majority of cases, to settle the question of diagnosis, and an accurate knowledge of syphilis would nearly be sufficient, even if the observer were comparatively little acquainted with leprosy. Among the most striking differences in the action of the two poisons is the condition of the hair. In leprosy the hair of the scalp is unaffected, whilst the hair of the eyebrows and eyelashes, and even the lanugo hairs, disappear. The genitalia and the parts where the mucous membrane of the digestive tract become continuous with the skin, are specially fixed upon by the syphilitic poison, portions which are extremely rarely affected in leprosy. The erythematous maculæ of leprosy may be confounded with other forms of erythema. In leprosy, erythematous patches are

¹ Dr. Beaven Rake relates a case (Rep. Trinidad Leper Asylum, 1889) which well illustrates the occasional difficulty of diagnosis, and in which mercury as a test was deceptive. In a boy aged eight, suffering from leprosy, grey powder was given, and the tubercles disappeared, to reappear, unfortunately, after a time, in the form of unmistakable leprosy tubercles.

more likely to be the seat of perverted sensation, and the functions of the skin glands are disturbed.

The erythematous eruption of tubercular leprosy may resemble very closely, in its essential features, the syphilitic roseola. In the leprosy eruption there will, probably, be present more or less infiltration, but if there is none, for a short time the diagnosis might be difficult. In such a case it is necessary to remember the difference in the course of the two diseases. In the macular syphilide it is almost certain that the initial lesion would be found in the usual situation, and probably the characteristic appearances of secondary symptoms in the throat. The course of the disease itself would soon clear up the point, the syphilitic rash after a time gradually disappearing—and reappearing in another form if it reappeared at all; whereas the type of the leprosy eruption remains the same. Large diffused erythematous patches are found in leprosy, but not in syphilis.

In papular and tubercular syphilis there are appearances which much resemble tubercular leprosy nodules; but in leprosy, when the whole surface of the body is examined, the integument in many parts will be found in a diffuse shining condition, particularly in the hands—a condition which is not found in syphilis. Nor is the large flat infiltration of the skin in leprosy—*leproma en nappe*—found in that disease.

The subsequent course of the malady can always be depended on to clear up the diagnosis, if a difficulty actually exists in the first instance. The secondary papular eruptions of syphilis disappear entirely, and the tertiary manifestations remain localised in certain parts, with a tendency to break down and ulcerate within a comparatively short period; whilst the infiltrations of tubercular leprosy remain with comparatively little change for a long time.

The acute tubercular eruption may at the beginning be mistaken for erythema nodosum, but the comparatively short duration of the latter eruption, and its distribution—more particularly on the legs—are distinctive signs; and in any case a doubt could not be long entertained.

Leprous ulceration does not possess the serpiginous tendency which characterises the syphilitic ulcer, and it progresses more slowly than the latter.

The infiltration of lupus produces appearances not unlike those caused by the infiltration of leprosy, but the distribution is very different, lupus being a disease which is limited to circumscribed and generally small parts of the skin, the rest of the integument not being infiltrated. The diffused uneven thickening of the skin in leprosy produces an appearance which is never found in lupus.

It is noteworthy that the two diseases with which tubercular leprosy is most likely to be confounded, namely—lupus and syphilis, share with it the pathological peculiarity of an infiltration of the connective tissue of the skin with small cells, and the consequent gradual breaking down of the connective tissue. The clinical points of difference are chiefly caused by the different distribution over the surface of the body, the different rate of progress of the disintegrating effect in the connective tissue, and the greater tendency to localisation in lupus and in tertiary syphilis; whilst in secondary syphilis, the general distribution of the rash has more of the character of an ordinary exanthem.

In pure nerve leprosy the diagnosis may be somewhat difficult, and requires a certain familiarity with the disease. The discoloured patch with raised border may be mistaken for a patch of lupus, but even where the characteristic colour of the erythema with its desquamation is not sufficient, the presence of anæsthesia ought at once to determine the diagnosis; and there is, of course, an absence of the discrete outlying papules and small deposits which so often accompany patches of lupus. For the less experienced observer in all these doubtful cases, stress should be laid on anæsthesia, which is absolutely distinctive. In addition to the permanent symptom of anæsthesia, the absence of sweat, the fall of hairs, the swelling of certain nerves, particularly the ulnar, are hardly less characteristic, and should be sufficient to exclude scleroderma, chronic rheumatism, *mal perforant* and other trophic affections depending on various lesions of the central or peripheral nervous system.

The characteristics which distinguish tubercular from nerve leprosy, have been sufficiently dwelt on in our description of the two varieties of the disease.

The pemphigus of nerve leprosy is distinguished from

ordinary pemphigus by the presence of anæsthesia in the spots, the limited number of bullæ, the subsequent pearly cicatrix with dark brown border, and the accompanying symptoms of neuritis in certain nerves.

There is little doubt that vitiligo (leukoderma) is frequently mistaken for nerve leprosy, by persons who are not familiar with skin diseases, particularly amongst dark races. The spots of vitiligo and of nerve leprosy have in common the absence of pigment, but all the other symptoms of leprosy fail to occur in vitiligo, which is an affection of pigment pure and simple. The functions of the skin are normal in the vitiligo patch, and the sensibility is unaffected. For the less experienced the diagnosis will be most easily made by testing the sensibility of the part. If the sensation is normal, and if there are no other symptoms of nerve leprosy present, the diagnosis of vitiligo may be made with confidence.

The thick and imbricated scales in psoriasis vulgaris distinguish that common disease from the spots of nerve leprosy, in which the scales are much thinner. Sensation is normal in psoriasis, and perverted or absent in nerve leprosy.

In the latter stages of nerve leprosy the swelling of the peripheral nerves distinguishes the disease from changes produced in the extremities by lesions of the central nervous system. The deformities of the hands and feet caused by chronic arthritis have a resemblance to the deformities produced by nerve leprosy, but the swollen joints of arthritis do not occur in the latter affection. The affections of the bones of the hands and feet in nerve leprosy are distinguished from other diseases of the bones, by the fact that there is in leprosy no localised diseased deposits, and no new bone formation around the parts which have been destroyed, the mutilation being caused by simple atrophy and destruction of the bone.

CHAPTER XII.

TREATMENT

THE more intractible a disease is, the more numerous are the remedies advocated for its treatment, and to this statement leprosy forms no exception. The rational, irrational, and fantastic modes of treatment which have been used for this disease are too numerous to be mentioned. Of the three drugs that are given more or less indiscriminately in all chronic and unmanageable ailments, mercury appears to be almost unanimously condemned as being very hurtful to lepers. Arsenic is considered by some observers to be of use. Others, and amongst them Bidentkap, consider that it has little or no influence. Iodide of potassium, which has been more or less largely used, almost as a matter of course, has been experimented with by Danielssen on a large scale. His experiments have been carried on over a period of forty years, and the result of this long experience has been to satisfy him that this remedy works remarkably, especially in the tubercular form. He has tried it in many ways, and always with the same result—a more or less violent eruption of nodules with feverish symptoms being produced. Even when the remedy is given in very small doses—as, for example, 0.10 centigramme, administered in three to four doses daily, before or after meals—its continued use for a few days always produces an eruption, and when larger doses are given the eruption appears more quickly. It affects patients both as a powerful poison and as a means of cure. He also states that iodide is useful as a control test. If the nodules have disappeared, and the condition of the patient is such as to lead one to suppose that healing has set in, he gives iodide in convenient doses, and, as a rule, after a short application of the remedy, a new eruption of nodules appears—showing that no effective cure had

been obtained. If, however, no such eruption becomes visible, a definite cure has taken place. Danielssen states that salicylate of soda has always been found effective and useful in both forms of leprosy. By its use in tubercular leprosy the fever is lessened, the eruptive period is shortened, and newly-formed nodules disappear. The remedy taken internally does not appear to affect nodules of old standing. The external application of a concentrated solution causes the nodules partially to disappear, but when the remedy is discontinued the nodules again become apparent. The dose usually administered by the author was 1.00 gr., four times a day. Chaulmoogra oil has been employed by Danielssen since April 1887. In a case of tubercular leprosy it was given during a period of eight months, but, although mixed with olive oil, it caused such severe eruptions of nodules that its use was discontinued. Salicylate of mercury was administered in the form of pills, but no improvement was observed, although it was better borne than most quicksilver preparations.

Gurjun oil was first recommended by Dr. Dougall, who used it extensively in the Andaman Islands, and who found that it produced better results than any other drug he had previously tried, restoring to comparative health patients who had long suffered from the disease.

In regard to the action of salicylic acid, Bidentkap, who states that he has used it for a long period, remarks that he has seen more harm than benefit from its use. Carbohc acid and creosote he found equally powerless. In recent years gurjun oil has been largely used, and, as a rule, favourably reported on. For example, in the reports to the Government of India, several surgeons write encouragingly regarding it. The civil surgeon of Sibsigar states that very great improvement, if not recovery, took place in nine cases treated by the oil in periods varying from three months to a year. Dr. Bensley, civil surgeon of Nuddea, states that patients improve after gurjun oil, though the symptoms reappear soon after the patient discontinues the medicine; but his cases were not sufficiently long under observation. Dr. Hillis states that gurjun oil seems to exercise a specific action on the sweat glands, as evidenced by the perspiration produced in

anæsthetic parts when the remedy has taken effect, and that there is always returning sensation when this sweat is produced. In thirty-two patients treated with gurjun oil, a very great improvement took place in all the symptoms in sixteen, eight had their symptoms much relieved, and one so far recovered that he was able to return to his family and friends. There were only two cases in which the oil had no appreciable effect on the disease. Dr. Hillis concludes that in gurjun oil we have a most valuable agent for the treatment of leprosy in all its forms.

Several medical officers, reporting—1877-1879—to the Government of Bombay, state that patients improved under the action of gurjun oil, and that ulcers and cracks particularly healed under its application, one of them asserting that he was able to discharge a patient cured. Surgeon Trimnell reports to the Madras Government (1876) that in sixty-four cases two were cured, and great benefit was experienced by the others.

We have selected a few of the favourable notices of the curative action of gurjun oil in leprosy, but we ought to add that many observers who have tried it freely are of opinion that it is of no great value. Bidenkap, for example, states that he has tried gurjun oil, without result, although the frictions connected with its use seem to have a favourable influence on the disease of the cutaneous nerves—equal to that of massage. The oil has an irritating effect on the intestinal canal, but we have been able to overcome this difficulty by simply decreasing the dose for a time. After a little experience, the patient learns how much he can take without any inconvenience, and with this dose he ought to continue. We have found it best to give it in capsules, and after closely observing its action, we have not been able to notice that it produced any effect on the general health. From our own experience, we can testify favourably to its use, as we have observed under the administration of this oil internally, with stimulating applications externally, anæsthetic patches gradually disappear and sensation return.

Dr. Beaven Rake considers that the merits of gurjun oil have been greatly overrated; as an external application it is of great use in removing scabs or desquamation. Dr. Neve

of Kashmir (*Lancet*, vol. ii. p. 999) states that distinct improvement follows the external application of gurjun oil.

Dr. Justin F. Donovan, in his report on the Lepers' Home, Spanish Town, Jamaica (*Journ. of the Leprosy Invest. Com.*, Jan. 1891), states in regard to treatment:—

‘In spite, however, of such drawbacks, the results of a trial with gurjun oil during the past six months in those cases is, on the whole, encouraging. One, an adult, the subject of mixed leprosy of four years' duration, has benefited materially by the treatment carried out for over eight months, the anæsthesia being markedly alleviated, and the tubercular deposits having become absorbed to a considerable extent. Two boys—one eighteen years and the other eight—with tubercular leprosy, are showing marked improvement; in the younger case the tubercular deposits and plaques have disappeared very rapidly.’

Dr. Abraham communicated to the Epidemiological Society, January 8, 1890, notes of a case which had been under the care of Dr. Phillippo, of Jamaica. The patient was a young man who suffered from aggravated symptoms of mixed leprosy. He was treated with gurgun oil internally and externally, from September 1879-81, when chaulmoogra oil was substituted for the gurjun oil internally, the rubbings with the latter being however continued. Improvement was first seen in the face—the lips, ears, and nose gradually becoming natural before the end of 1881. The treatment was kept up with some intermissions until January 1886, when he was considered cured. For upwards of five years he has been free from any return of the old troubles, his strength has steadily increased, and his general health improved; and although there are marks left of the old disease, the nails and hairs have been coming back, and even the eyebrows have been slowly growing.

Chaulmoogra oil, introduced for the treatment of leprosy by Le Page of Calcutta, has also been strongly recommended by some observers. Dr. Beaven Rake observed its effect in eighteen patients. The chief results he found to be increase of perspiration, decrease of tubercles, improved appetite, increased sensation, greater suppleness of the skin, and lessened pain in the joints. He relates the case of a private patient

who had been under treatment six years, taking 75 drops daily, and latterly 45 drops. There was much improvement. The face became clear, the tubercular outbreaks less common, and strength improved. In *Leprosy in Foreign Countries*, p. 49 (Honolulu), a communication from the leper hospital, Madras, states that all the patients not suffering from inter-current diseases are treated by the daily application of chaulmoogra oil, mixed with cocoanut oil, in the proportion of one of chaulmoogra oil to twelve parts of cocoanut oil, and this is carried out as follows:—The European patients assemble in one of the verandahs at seven a.m. and continue rubbing the oil into their bodies until nine a.m., after which they take a bath. The natives begin the rubbing at nine a.m., and continue till eleven o'clock, and then have their bath. All patients suffering from sores meet in a verandah set apart for the purpose at seven a.m. and two p.m. and have their ulcers dressed. Rice-flour poultice is the chief emollient application, but special dressings—such as carbolic oil, iodoform, camphor, turpentine, sulphate of copper, etc.—are used in the form of ointment or lotion.

At a meeting of the New York Medical Society, February 15th, 1890, Dr. Fox (*New York Medical Journal*) reported the case of a man who had suffered from typical leprosy. Sensibility of the fingers (as it appears) was completely restored by the systematic administration of chaulmoogra oil. In the year 1884 all the leprosy spots on the skin had disappeared. Since that time the patient, who formerly exhibited the most typical symptoms of the disease, independently of the insensibility of the fingers previously mentioned, has perfectly recovered.

Dr. Rennie (*China Imp. Marit. Custs. Gazette*, 1890), in his report for the half-year ending September, on the Health of Tamsui and Kelung, states that in early cases of leprosy he has observed improvement follow the administration of chaulmoogra oil internally, and gurjun oil emulsified with lime-water, externally. The improvement, however, was very gradual.

Carter, as quoted by Munro, states that under the use of chaulmoogra oil the nodules in the skin subside, and the sensory nerves more or less regain their function. Two cases

are given in detail by Leloir, in which it was tried in the St. Louis hospital; in one of these, by its prolonged use in large doses, great amelioration followed, but in the other case the result was unsatisfactory.

In the *Monats. f. Prakt. Derm.*, 1885, there is published a case by Dr. Unna, in which it is shown that by applications of pyrogallol, chrysarobin, resorcin, and ichthyol, very remarkable changes are produced in leprosy of the skin. The treatment was combined with the administration of ichthyol internally; but the absorption of the leprous swellings is caused, it must be assumed, by the stimulating external applications. The patient was suffering from extensive tubercular leprosy, and the treatment was continued from December 18th to April 5th, the various ointments being applied to selected parts of the body. Considerable inflammation was produced, and at one time the poisonous effects of pyrogallic acid showed themselves. A ten per cent. chrysarobin ointment was finally mostly used, with a ten per cent. pyrogallic ointment to the face, neck, and ears. On April 5th an ulcer of the nose was healed, the last traces of thickening had disappeared, and the infiltration of the whole body was relieved. There were no swollen lymphatic glands, and the general health was better than for many years. The patient had gained weight, and was dismissed as cured, with instructions to continue ichthyol internally. The report of such a favourable result naturally attracted much attention, but, unfortunately, the hope which it seemed to hold out has not been fulfilled. In answer to an inquiry we made, Dr. Unna has been so courteous as to inform us that he did not hear from the patient after she left for Brazil, but that he had learned that she died some years later, though in what condition he does not know; but in the absence of information to the contrary, we can hardly assume that it was from any other cause than leprosy.

Another case under the title of, 'Cure of a Case of Leprosy by Unna's Method,' was published by Dr. Dreckmann (*Monats. f. Prakt. Derm.*, vol. vii., 1888). A man, aged forty-two, had suffered from the disease four years when he came under Dreckmann's notice. His wife, aged thirty-eight, had suffered from leprosy eighteen years; her brother had been diseased twenty years; the four children of the patient and his wife

were healthy. He believed he had acquired the disease from contact with his wife. The usual numerous tubercular nodules were found on examination, and there was total loss of sensation in the hands, feet, and calves of the legs. There was also thickening of the mucous membrane and ulceration of the nose, thickening of the left vocal cord, tubercles on the edge of the epiglottis, and firm, uneven infiltration of both tonsils. The under parts of the thighs, feet, both forearms, and hands were treated with 10 per cent. pyrogallic acid, and the remaining parts of the body were rubbed with 10 per cent. chrysarobin ointment twice daily with a tooth-brush. The leonine expression of face and the catarrh of the conjunctiva disappeared under the treatment. The ulcer of the nose, induration of tonsils, and tubercles on the epiglottis were cured. The anæsthesia of the hands, feet, and calves of the legs disappeared. The report of the case was made five to six weeks after treatment was discontinued.

Dr. Dreckmann most courteously responded to our request for information regarding the subsequent progress of the case, and we were informed by him that he had heard that the boy died in the end of 1889, and that, although he had no direct information regarding the cause of death, he had little doubt that it resulted from relapse of the leprosy.

Dr. Cantlie (*Leprosy in Hong-Kong*) writes encouragingly of the immediate effect of the action of chrysarobin and pyrogallic acid, in combination with salicylic acid and ichthyol, as recommended by Dr. Unna. He states that after a week's course of the ointment, a marked improvement in all cases took place, and frequently it happened that in six weeks' time the facial deformity had gone, and the leper was well enough to be admitted by his fellows to earn his living. The extent of improvement Dr. Cantlie found was that, first, the leonine expression is ameliorated, or (as in three cases) wholly disappears. Second, sensation returns to the face and limbs completely or in part. Third, patients unable to obtain employment before are able to obtain a livelihood—a questionable advantage for those who admit the leper into closer association with themselves; for, if no real cure has been produced, the danger of contagion is probably not lessened by the absorption of the fibrous induration

caused by the tubercular deposit, or the rousing of deadened nerves into fresh activity.

The treatment recommended by Dr. Unna, which essentially consists in the administration of ammonium sulpho-ichthyolicum internally, and chrysarobin externally, has been tried by Bidentkap, who reports that it has perhaps done good in one case, but has completely failed in several others.

The fact that Dr. Unna's patient seemed relieved of her disease by her treatment, and was regarded by him as cured, led to considerable interest being taken in the details of the procedure to which she was subjected. Although, unfortunately, the patient after all does not seem to have been really cured, whilst other attempts to cure leprosy by the method have failed, there can be no doubt that, at all events for a time, the infiltration in this patient's skin, so far as symptoms are concerned, disappeared. We therefore append the following lengthy extract from the report of the case, in order that our readers may note the mechanism by which such changes were produced in the skin, as to lead Dr. Unna and Dr. Dreckmann to believe that their patients were cured.

A woman, aged about thirty-eight, presented herself at Unna's clinic for treatment of leprosy. The only healthy parts of the skin were the scalp, the neck, and the supra-clavicular and inguinal regions. Comparatively free parts were found on the back, breast, and abdomen. The arms, legs, and face were almost covered with more or less compact infiltrations in the form of diffuse swellings, flat papules, and very prominent tubercles. The conjunctivæ were on both sides hyperæmic, especially at the borders of the sclerotica. The corneæ were free.

DETAILS OF TREATMENT.

Dec. 18.—Leaving the face and trunk untreated. On right arm pyrogallie acid; on right leg chrysarobin; on left arm resorcin; on left leg ichthyol. They were all rubbed up with oil and fat to a 10 per cent. strength, spread on lint and fixed with bandages.

Dec. 21.—Right arm painful, swollen; to-day all four remedies given up, and limbs bound in cooling ointment.

Dec. 23.—Left arm resorcin ; on right leg chrysarobin ; on left leg ichthyol. Right arm still very painful ; covered with crusts.

Dec. 24.—Right arm too painful to continue ; on right side of trunk and right leg 50 per cent. ichthyol ; left trunk and leg 10 per cent. resorcin ; left arm also resorcin ; right arm 5 per cent. ichthyol, to encourage healing.

Dec. 28.—Right (ichthyol side) more improved than left ; resorcin changed from 10 per. cent. to 20 per cent.

Jan. 1, 1885.—Right (ichthyol side) better than left, particularly on back and leg. On this side nodules almost to level of skin. Even on left side nodules flatter. Pigmentation on all nodules the same. One spot on left leg covered for two days with 10 per cent. hydrochinon ointment ; a distinct but not striking improvement. Right arm under ichthyol lotion almost healed, except several small places dressed with 2 per cent. ichthyol ointment. Henceforth patient gets 5 drops ichthyol internally morning and evening.

Jan. 2.—Began a pure ichthyol treatment. Whole body, with exception of right arm and leg, treated daily with a 66 per cent. ichthyol ointment. The right arm is still covered with ichthyol cooling ointment, and the leg with the hydrochinon ointment. Pain and redness of eyes since yesterday diminished.

Jan. 3.—Ichthyol drops changed for ichthyol pills ; four pills daily, each containing a decigramme.

Jan. 5.—Eight pills daily.

Jan. 8.—For several days on the face (where no treatment was applied) there was a marked change. Swellings on brow flatter ; countenance not so livid, being fresher—more natural ; hands much better ; right arm has been healed four days, but the pyrogallic acid has left keloid scars. Nodules were much flattened ; 66 per cent. ichthyol used. On left leg the 10 per cent. hydrochinon ointment has flattened the nodules, which were, however, of a rather dark brownish red. From to-day on that part a 10 per cent. 'brenzkatechin' ointment used. From to-day ten ichthyol pills instead of eight, and the face rubbed with ichthyol ointment ; a daily bath.

Jan. 16.—Patient improved ; the larger nodules on trunk quite flat ; healthy skin looks clearer ; face nodules, although flattened, still all present ; ears in same condition ; nodules more distinct on left arm than on right ; on left arm the 'brenzkatechin' no marked effect. From present time face, ears, left arm, and left leg bound up with strong resorcin-muslin ointment, 25 grammes to each sheet.

Jan. 19.—Resorcin not well borne in face, causes headache, elsewhere prompt action ; the nodules which had previously resisted,

all considerably flattened ; left forearm and left leg resorcin-muslin ointment (5 grammes) ; left upper arm packed up in 10 per cent. pyrogallic acid ointment ; internally 1 gramme ichthyol daily.

Jan. 20.—Pyrogallic could not be borne. Resorcin-muslin good effect on left forearm and left leg ; applied to face.

Jan. 21.—Whole body rubbed twice daily with 5 per cent. pyrogallic ointment, with exception of both forearms and legs, where resorcin was continued.

Jan. 25.—Headache, dark urine, constipation, pyrogallic rubbed in only once daily.

Jan. 30.—Urine clear ; general condition good ; pyrogallic treatment lasted nine days ; bath taken. Pyrogallic makes lepra patch black while the surrounding part remains clear ; trunk and thighs free from nodules ; remains of nodules exist only in face, especially on nose, ears, round most obstinate patches of forearms and thighs. Attempts to clear up dark spots with—

R. Ung. Zinci benz., 500·0.

Ammon. sulfoichthyolici, 50·0.

Sublimat., 0·5.

Daily bath ; ichthyol continued internally.

Feb. 2.—Sublimate ichthyol ointment causes pain on nose and ears for half an hour ; resorcin-muslin continued on nose and ears.

Feb. 4.—On joints of hands pyrogallic-muslin ointment laid on parts which are still slightly raised ; rest of body ichthyol sublimate ointment.

Feb. 8.—Patient at own instance put in the evening pyrogallic-muslin on both legs and large part of face.

Feb. 9.—Headache ; nausea ; black urine ; debility ; small pulse ; plaster removed and all treatment suspended ; muriatic acid given.

Feb. 11.—Prescription for the still roughened skin—

R. Ung. Zinci benz., 500·0.

Ammon. sulfoichthyol., 10·0.

M.

Feb. 14.—Patient well ; pyrogallic symptoms passed over ; smooth, soft skin ; one gramme ichthyol daily begun, as before the pyrogallic poisoning.

Feb. 16.—Skin cleaner and whiter, but on seat of previous nodules it is inelastic, as if too large ; on trunk zinc-ichthyol gelatine ; arms and legs 10 per cent. chrysarobin begun.

Feb. 19.—Small portions of pyrogallic muslin on right ala of nose and joints of both hands.

Feb. 23.—Zinc-ichthyol gelatine continued.

Feb. 25.—From this time whole body to neck rubbed with 10 per cent. chrysarobin; face, neck, and ears 10 per cent. pyrogallic vaseline, rubbed in twice daily.

March 2.—Eyes affected; skin red and tender; treatment suspended.

March 3.—Prescription—

R. Ung. Zinci benz., 500·0.

Resorcini, 10·0.

M. For whole body twice daily.

Daily bath.

March 6.—Slight remains of nodules still on nose, ears, left cheek, and both elbows.

March 7.—Chrysarobin again on lower parts and pyrogallic on upper parts of body. In addition, on nose, ears, and elbows small pieces of pyrogallic muslin.

March 14.—Treatment well borne, but left eye inflamed. Treatment suspended. On elbows the plaster has injured the epidermis but not nose and ears, which are only slightly brown.

March 15.—To decolorise the skin:—

R. Ung. Zinci benz., 500·0.

Resorcini.

Acidi citrici ā ā, 5·0.

M.

The whole epidermis comes well off.

March 20.—Remains of thickening only found on nose, left cheek, and right elbow. They are painted twice daily with—

R. Spir. saponat. (Hebra), 50·0.

Præc. albi Mielck, 1·0.

M.S. Shake.

To whiten the skin there is at present used—

R. Ung. Zinci benz., 500·0.

Præc. alb. Mielck, 5·0.

M. f. ung.

A bath of one hour daily; ichthyol internally (1 gramme daily) continued.

March 23.—Soap spirit discontinued. On face a mask of hydrarg. carbol. muslin. The pain disappeared from the eyes.

March 25.—Under this mask on several thickened parts small pieces of salicylic plaster (20).

March 29.—Small ulcer on nose, treated for first time; applied to it resorcin-muslin ointment, strength 25. Hydrarg. carbol. mask continued on face.

April 1.—In order to whiten the old pigment spots—

R. Ung. Zinci benz., 500·0.

Acidi salicylici, 20·0.

The salicylic plaster has removed the thickening from nose, elbows, and ears. Colour of face become uniform.

April 5.—Ulcer on nose healed; last traces of thickening disappeared. The infiltration on the whole body removed. No swollen lymphatic glands; general condition better than for many years. Has gained weight. Dismissed as cured, with instructions to continue taking ichthyol.

On *April 18*, before she returned to Brazil, the patient was again examined, and found well. A spontaneous continuous desquamation of the previously pigmented lepra spots is in progress. Ammon. sulph. ich. to be continued for the whole of the following summer.

Alas, that such strenuous exertions, directed with such intelligence and experience, should, after all, have turned out fruitless!

The history of the case is in many ways instructive, and proves clearly that the infiltration produced by the leprosy bacillus may under stimulating applications to the skin be absorbed to such a point that for a time it can no longer be recognised. The bacillus, however, remains apparently uninjured, and although the treatment does not save the patient from his inevitable fate, Dr. Unna has done good service in making such an exhaustive experiment with strong drugs that had not been sufficiently tested previously.

Dr. Beaven Rake (1887) states that he has tried ichthyol in the treatment of five lepers, but cannot say that it is superior to other drugs.

Dr. Castor, Medical Superintendent of the Leper Hospital, British Guiana, considers that there is no therapeutic agent of any avail as a cure, although painful symptoms may be relieved by treatment. He had tried pyrogallic acid without success, and, as an illustration of the tendency there is to spontaneous disappearance, he relates a case in which patches disappeared and sensation returned all over the body—only partially, however, in the hands and feet, and also parts of one leg, whilst the other regained its normal power and function. No drug was used in this case. Bidentkap has found that tepid tub and stimulating baths act favourably on

the general health of the patients, who are improved by tonic remedies when anæmic and weak. During the eruptive fever the ordinary antipyretic treatment is indicated, especially quinine. As regards local applications, he has had the best results from chrysarobin, under which the spots and tubercles often fade and disappear, returning, however, unless the disease is arrested spontaneously or by other means. He uses chrysarobin in the form of a plaster. The following is his formula:—

R. Olei Olivarum, 20,
Resinæ Calophonii, 20,
Ceræ flavæ, 40,

liquentur et per horam dimidiam inter perpetuam agitationem in balneo aquæ seponantur. Dein refrigeratis addatur mixtio liquefacta.

Gummi resinæ Ammoniaci, 2,
Balsami Terebinthinæ Venetæ, 2,
add. demum :

Chrysarobini, 12 (sive 16)

(sive Pulveris de Goa).

This plaster is thickly spread on lint and applied to a limited portion of the diseased skin. Generally, in thirty-six to forty-eight hours the characteristic erythema will appear, and the plaster is removed. In a week or two, the skin having resumed its normal appearance, a new application is made on the same place, and this is continued until the leprosy symptoms disappear.

Nerve-stretching,¹ regarding which favourable reports have been sent from India, has been tried by Beaven Rake, who performed 100 operations on 60 patients—having stretched the sciatic nerve 26 times, the external popliteal 11 times, the median 14, the ulnar at the elbow 18, and the ulnar above the wrist 4 times, and the supra-orbital once. He considers the chief indications for the operation are perforating ulcer, and some cases of necrosis and pain, whether associated with perforating ulcer or with peripheral neuritis. In some cases sensation was slightly improved by nerve-

¹ A case is reported by Bomford in the *Lancet*, Feb. 26, 1881, in which stretching of the ulnar nerve is stated to have produced speedy and very favourable results.

stretching, and sometimes ulcers healed after the operation. In many cases there was no difference. Occasionally, relief was obtained from pain. The operation was done for anæsthesia in 33 cases, without very encouraging results. Perhaps the most striking result was the relief from pain, especially when associated with perforating ulcer.

Dr. Neve of Kashmir says (*Lancet*, 1889, vol. ii. p. 1000), in regard to the treatment of leprosy, that 'nerve-stretching is most valuable as a palliative. During the past few years, more than 270 nerves have been stretched in this hospital, representing about 100 cases of leprosy. Great improvement is often obtained in the tracts supplied by the nerves; but we cannot anticipate improvement in the face and parts supplied by cranial nerves, neither do we observe it.'

The treatment of leprosy ulcers should, of course, be conducted according to ordinary surgical principles. Gurjun and cashew-nut oils have been used with advantage. Dr. Rake recommends creolin, and states that a 5 per cent. solution rapidly heals eczema complicating leprosy, and forms an excellent stimulant for indolent leprosy ulcers. In excision of leprosy tubercles—a procedure justified in certain cases of early leprosy—pure creolin is useful as a caustic to prevent recurrence.

We believe we have seen useful results in early stages of anæsthetic leprosy by applications of pyrogallic acid ointment. Certainly spots which were entirely anæsthetic have disappeared under this treatment, and sensation has returned.

It is not only reasonable to suppose, but there is clinical evidence to show that an effort is made by the constitution to resist and overcome the bacilli after they have become lodged in the tissues. It is clear, therefore, that it must be beneficial for the patients that they should be placed in the best possible conditions to promote a state of good health. First amongst these conditions—more particularly for persons born in temperate climates—must be, if they are affected when abroad, a return to their native land or to some temperate climate. Hot baths, exercise, massage, are means that readily suggest themselves. At the same time some drugs, particularly gurjun oil, which have been found useful in the treatment, should have a fair and long trial. After a sufficient

time, should the disease appear to be increased or not to be arrested, one or other of the treatments which we have already indicated should be put in force. For all ulcers and breaches of surface, perforating ulcer of the feet, etc., the ordinary resources of surgery will necessarily be put into requisition; and it is fortunate that—although by far the greater number of lepers die of their malady—there are sufficient cases of cure recorded to justify holding out to the patient a ray of hope.

Dr. Kaurin,¹ medical superintendent of the Molde Asylum, states that hitherto no specific remedy for leprosy has been found. At an early stage the disease may be cured by good diet and regimen, by careful nursing of the skin, baths, and symptomatic treatment. For the present he has, he remarks, two patients at Reknoes, who, he hopes, will be cured.

The condition of the eyes in leprosy requires special treatment. In sixty-four lepers whom Leloir found at Molde, in Norway, forty-one had an affection of the eye, thirty-seven were affected in both eyes, and six were blind. Kaurin had diminished the number of blind lepers by practising two operations for the ophthalmic lesions of tubercular leprosy. He limits the advances of the disease by keratotomy. Danielssen and Hansen obtained analogous results by cauterising the conjunctiva around the tubercle. To prevent epiphora, and remedy the inooclusion of the eyelids caused by the paralysis of the orbicular muscle in nerve leprosy, Kaurin performs tarsoraphy of the inner third of the eyelids, thus raising the lower lid, preventing the tears flowing, and allowing the eyelids to shut.

On the hypothesis that leprosy is at first a purely local disorder, Dr. Beaven Rake considers that if a case is found sufficiently early, free removal with the knife, followed by rubbing in nitric acid, and the use of large doses of mercury internally, might arrest the disease. So far this treatment is purely experimental, and the experiments have not been sufficiently continued.

There is a case reported of a woman at Molde, whose leg had been amputated because the limb was affected with leprosy. The woman had continued well for seven years.

¹ *Journal of the Leprosy Investigation Committee*, January 1891.

Sir John Kirk, to whom we referred regarding a statement in Dr. Livingstone's book (see p. 276), to the effect that sores in the hands of Drs. Kirk and Livingstone, which appeared to have been caused by the discharge from a leprous ulcer in an African chief, were cured by caustic, has favoured us with the following reply:—

‘Sekeletu, the chief, was in an advanced stage of leprosy; his hands were all oozing. It was essential for us to gain the good-will of this man in order to obtain the help necessary to carry out our exploration, and Livingstone and I both did what we could to heal up the open sores. As, however, I was out hunting for food daily, or botanising in the thickets, my hands were often cut; and the matter from the chief's leprous sores getting into one of these, brought on a most obstinate eroding ulcer that gave out matter, and looked like the sores on the chief's hands. So after trying every other means, I had to burn the whole piece out all around the sore, by placing a bit of nitrate of silver in the hollow and allowing it to melt and eat out the wound to a good depth—almost, in fact, to the bone of the finger. The same happened with Dr. Livingstone. I would never pretend to say that the local sore caused by inoculation of matter had anything of the disease of leprosy in it. All I can be sure of is, that it was a nasty obstinate sore that took on the appearance of the local sores from which the matter came. But, of course, we know that the local affection is but a small part of the disease; and there is nothing in our case to show that the disease itself could have been communicated, had we not taken the steps we did for getting rid of the affected tissue.’

THE EFFECT OF TUBERCULIN IN LEPROSY.

It was hoped that Dr. Koch's fluid might have a curative effect on leprosy, but sufficient experiments have already been made to show that the results are disappointing. As might be expected, however, from a substance that produces such intense vascular disturbance, very decided effect has been produced in some cases on the local condition.

In a case of old anæsthetic leprosy which was sent by Dr. Colcott Fox to Mr. Cheyne, at King's College Hospital,

reaction was produced by the fluid, and a succession of leprosy bullæ appeared on the feet. Although there had been no active symptoms of leprosy for many years, a dark brown slightly raised border showed itself round a large part of the abdomen, and it seemed to us to be beyond doubt that the field of skin within the border was slightly paler than the skin outside. The action of the fluid had evidently been to produce sufficient change in skin that had been previously affected, to indicate a part that had been the seat of a large patch at an earlier period of the disease. The patient thought that, after a course of injections, there was slight improvement in the anæsthesia of the hands, and of the power of movement of the contracted fingers.

This woman is under the permanent care of Dr. Burney at the Greenwich Infirmary, who, writing April 4, reported to Mr. Cheyne as follows:—

‘She states that before she was injected she suffered with pains in the extremities every month, lasting from four to five days. These pains have not since re-appeared. The anæsthesia of the arms existed up to the junction of the middle with the upper third of the radius, whereas it now does not reach higher than about the middle of the metacarpal bones. About the same may be said of the lower extremities. She has increased in weight, and this cannot be attributed to any extra diet. She complains that she has not been able to get her breath so well since the injections. She has had two or three slight fainting fits. On the whole, I am of opinion that she has greatly improved, and the patient herself attaches great importance to the relief of the periodic pains.’

Dr. Arning (*Journ. of the Leprosy Invest. Com.*, January 1891) reports regarding two cases of nerve leprosy which were treated by tuberculin as follows:—‘In one patient, on four days following each other, grms. 0·002, 0·004, 0·008, and 0·01 of Koch’s fluid were injected, and in the other, grms. 0·02 and 0·06, without the very slightest disturbance of the general condition or any febrile rise of temperature. The pulse and breathing were not perceptibly affected, nor was there observed any erythema of the skin or mucous membrane, nor nausea, nor any changes in the urine. The

injections were made partly in the healthy skin and partly in the anæsthetic spots, with absolutely no local or general reaction in either case.

‘An example of tuberous leprosy was unfortunately not at hand at the moment, but a case of Dr. Engel-Reimer’s, of the General Hospital, Hamburg, of an advanced stage, showed a promptly-produced temperature reaction, although the actual leprosy tissue of the cutis and mucous membrane did not seem to be affected as we see in the case of tuberculous tissue: the reaction was only general, not local. It may be, therefore, in this case, that there is a complication with tuberculosis of internal organs; moreover, one must not lose sight of the fact that leprosy, especially in advanced tuberous cases, reacts with high fever at the slightest provocation. Catching cold, or getting wet, slight disturbances of digestion, and some medicines, may sometimes cause in these patients vigorous and violent fever.’

In a case which was treated in the London Hospital, and reported by Dr. Abraham in the *Journal of the Leprosy Investigation Committee*, No. 2, after the third injection of tuberculin (gram. 0·005) two large swellings resembling nodes appeared, one in front of each tibia, and several tubercles unobserved before made their appearance in the forearms, near one knee, and on the face, and some of the older tuberosities became swollen. The progress of the case under treatment is shown in the following extracts:—

*Fourth injection (8th day).—*Grm. 0·007.

The temperature rose to 99·8° in four hours, and declined gradually to 98°. The node-like swellings on the legs, which had subsided, reappeared, and numerous new tuberosities became apparent on the face, shoulders, arms, hands, and legs. Some of them were translucent. The hoarseness had increased. The patient complained of thirst and sore throat, and was drowsy the day after injection. She had much pain in the right elbow, and a painful lump below right scapula.

*Fifth injection (13th day).—*Grm. 0·007.

Large red tubers appeared again, most of them evanescent. There was slight headache, much pain in the back over the scapular regions, where there is a lump each side. Some of the small hard nodules, especially of the lobes of the ears, have swollen up, become

soft, and are now almost indistinguishable to the touch. The temperature rose gradually to 102°, 10 hours after injection, kept up over 100° for 21 hours, then came down to 97·5°, and rose again to 99·4°.

Seventh injection (17th day).—Grm. ·006.

The highest temperature was 100·8° in four hours. A fresh crop of temporary nodules as before.

It seems clear from this case that the vascular disturbance produced by tuberculin is so great, and of such a character, as to make evident and prominent leprosy infiltrations that previously had not been sufficiently marked to be detected by the eye or finger. There are no facts yet recorded which justify us in believing that this action destroys the bacilli or cures the disease.

In further illustration of the action of tuberculin, the following is extracted from the *Journal of the Leprosy Investigation Committee*, January 1891:—

‘Dr. M. J. Goldschmidt, of Madeira (*Berlin Klin. Wochenschr.*, 12th January 1891), has treated with the fluid five cases of leprosy, of which four were of the tuberous type. In one case the disease was quite recent. Injections of less than one milligramme of Koch’s fluid produced no appreciable effect, while with one milligramme a general reaction was noted after twenty-four hours in those cases, as well as a local reaction in two of them. Stronger doses, but less than one centigramme, have always, except in one case, caused fever, and in one patient an intense and prolonged local reaction was produced. The liquid placed in contact with the leprosy parts appeared to irritate them strongly, but not the healthy skin.

‘Prof. Babes and Kalindero, of Bucharest, contribute an article to *La Semaine Médicale*, of 26th January 1891—“Sur la réaction produite par le remède de Koch chez les lépreux”—in which the effect of the fluid in leprosy is discussed from the observation of seven cases. From the bacilli being more numerous in proportion to the amount of diseased tissue in leprosy than in tuberculosis, and more scattered in apparently healthy organs, they were led to expect that the action of the fluid would be less considerable, more retarded, and of a special character; and their observations confirm this view.

The seven cases treated had been known and studied a long time previously, and were without any clinical or bacteriological sign of tubercle. In all a general reaction was observed, which, however, essentially differs from that established in tuberculosis; it is not due to a latent tuberculosis, but is a reaction peculiar to leprosy. A rather stronger dose is required to produce a febrile reaction in leprosy than in tuberculosis, and the differences are as follows:—(1) In leprosy the general reaction—instead of in about six hours—does not ordinarily appear until twenty-four hours after injection, more rarely in twelve hours, although in one case of anæsthetic leprosy with pemphigoid eruption it came on in two hours. (2) The duration of the fever and concomitant symptoms varies, but it generally lasts longer than in tuberculosis. (3) After a first reaction a second appears on the following day, and often a third on the day after. (4) Contrary to what we observe in tuberculosis, there is a cumulative action if the injections are repeated daily. (5) Whilst in tuberculosis there is almost always a pronounced local, as well as general reaction, in leprosy the former ordinarily fails, or is less marked after the first inoculations; it may appear, however, after large doses. (6) The local reaction in tuberculosis is commonly followed by an abundant elimination of tuberculous products and marked amelioration, but in leprosy the congestion of the infiltrated spots and neighbouring parts is followed by a slight formation of small crusts and a less marked desiccation. There is amelioration of the general condition, and sometimes a general weakness. (7) In nerve leprosy, only once was a local reaction established, with hyperæsthesia in place of anæsthesia, and the appearance of red patches. After repeated general reactions in such cases, however, improvement was noted in the general condition and intellectual faculties, as well as in the sensibility and power of movement of the extremities affected. The authors consider that these differences prove that leprosy, although simulating tuberculosis, is a distinct malady, and that Koch's remedy can distinguish for us (*a*) whether an affection is leprosy or tuberculosis; (*b*) whether, at the time being, leprosy is associated with tubercle; and (*c*) whether a suspicious trophoneurotic disease be leprosy or not. They

observe that it remains to be seen whether the remedy can cure leprosy, produce a durable improvement, or prevent its further development.'

The treatment of leprosy from the historical and antiquarian point of view is not without interest, and a notice of what has been written on this part of the subject by Aretæus in the second century, and Schilling in the eighteenth, will suffice as illustrations of the therapeutic methods of their respective times.

Aretæus (*Dr. Adams's translation for the Sydenham Society*) introduced his therapeutics of leprosy by the natural remark that as remedies ought to be greater than the diseases, what method of cure would be able to overcome such a malady as leprosy? 'Yet,' he states, 'it is proper to apply every medicine and method of diet, even iron and fire, and these indeed if applied to a recent disease hold out a hope of cure, but if the malady is fully developed and has firmly established itself in the outward parts, and, moreover, has attacked the face, the patient is in a hopeless condition.' He then recommends frequent and copious venesection, followed by the hiera in a potion, 'not once only' diluted milk, emetics, frequent and continuous courses of hellebore at all seasons, but especially in the spring and autumn, giving it every alternate day; then 'whatever liquid medicines one has had experience of,' amongst which are mentioned gum vernix, brassica, sideritis scordioides, trefoil, with wine and honey; shavings of an elephant's tooth in wine, the flesh of wild reptiles (the vipers) formed into pastils; 'vipers are to be used to season food; soap is to be used in the bath; purslane and houseleek with vinegar, and also the decoction of the roots of dock with sulphur vivum, proves an excellent detergent. The compound medicine from levigated alcyonium, natron, the burnt lees of wine, alum, sulphur vivum, costus, iris, and pepper, these things are all to be mixed together in each case according to the power, but in proportionate quantities, and this compound is to be sprinkled on the body and rubbed in.' For the callous protuberances of the face we are to rub in the ashes of vine branches, mixed up with the fat of some wild animal, as the lion, the panther, the bear, or, if these are not at hand, of the barnacle goose; for like in the unlike, as the ape to man, is most excellent. Also the ammoniac perfume with vinegar and the juice of plantain, or of knot-grass, and hypocistis and lycium. But if the flesh be in a livid state, scarifications are to be previously made for the evacuation of the humours. But if you wish to soothe the parts excoriated by the

acid defluxions, the decoction of fenugreek or the juice of ptisan, will form an excellent detergent application; also the oil of roses or of lentisk. Continued baths are appropriate for humectating the body, and for dispelling the depraved humours.

The patient is put on a wholesome regimen as regards food, exercise, and cleanliness; and minute regulations are given as to diet. There is further recommended 'natural hot baths of a sulphureous nature, a protracted residence in the waters and a sea voyage.' White hellebore is recommended above all other things, 'for in power the white hellebore resembles fire; and whatever fire accomplishes by burning, still more does hellebore effect by penetrating internally—out of dyspnœa inducing freedom of breathing, out of paleness, good colour, and out of emaciation, plumpness of flesh.'

Venesection and white hellebore, if they did not cure the leprosy, would at all events, if industriously employed, shorten the period of the poor leper's sufferings.

Simpson refers to a certain Christian Livingstone who 'took a reid cock, slew it, baked a bannock (cake) with the blood of it, and gave the same to the leper to eat.' And to Michael Scott's cure: 'It ought to be known that the blood of dogs and of infants two years old or under, when diffused through a bath of heated water, dispels leprosy without a doubt;' from which we may infer that from the time of Aretæus to the sixteenth century no great progress had been made in the healing art, at all events as regards the treatment of leprosy.

We extract from Danielssen and Bœck the following summary of the treatment of leprosy recommended by Schilling in the end of the eighteenth century:—

'The diet during the first three months must be plain. The patient should use chiefly bread, vegetables, and fat soup. At the commencement of the cure, so long as the "obstruction" lasts, milk must not be taken; later it may be allowed. The cure itself always begins with laxatives. But mercurials are constantly abstained from, because they always produce in lepers violent accidents and very often a dangerous diarrhœa. When more powerful purgatives are required, and when, at the same time, signs of plethora are present, the patient must be well bled.

'In respect to the skin, and in order that perspiration should regularly continue, warm baths are employed, but with caution if the

disease has made great progress; because under their influence palpitations of the heart, convulsions, and fainting-fits arise.

‘For the production of perspiration movement is most useful. The patients, for this reason, ought to be encouraged to take exercise assiduously, the more so as there exists in them a great inclination to indolence.’

Schilling attaches great importance to the humours being diluted—rarefied in a considerable quantity of ‘dissolvent and detergent’ fluids. For this purpose he employs first softening and emollient decoctions; after which he passes to those which are more energetic and more sudorific. Amongst these demulcents he enumerates barley-water, gruel, and resolutive herbs, such as agrimony, ground-ivy, fumitory, arbutanum, veronica, etc.; tisanes to which are sometimes added emulcents and purgatives—for example, mallow, pellitory, senna-leaves, rhubarb, and aniseed. For six weeks the patient should drink eight pounds of these liquids daily. Under this treatment, Schilling has observed all the secretions improved, with a copious red or blackish sediment in the urine.

After this regular course, more powerful resolutes and sudorifics are ordered, especially root of soap-wort, sarsaparilla, china root, contrayerva, dragon-wort, rampion, wild ginger, sassaffras wood, juniper, leaves of hart’s tongue, holy thistle, pareira brava, and other similar herbs. It is preferable to give them as decoctions.

The greater the consumption of these decoctions, he remarks, the more prompt and complete the cure. When nausea sets in the use of these means is discontinued. The most rigid regimen should, at the same time, be observed.

The body, however, is naturally apt to become weak under this treatment. For this reason nutritious substances and good wines may be added. Everything acid and spirituous must be avoided, for acids are liable to engender in lepers intermittent fevers (tertian and quartans), sometimes also slow fevers, difficult to cure. Alcoholic drinks, on the contrary, often produce hot fevers, especially in tropical climates.

‘Whilst the patient makes use of these curative means he should avoid cold air, for it may easily happen that a critical perspiration is suppressed by the cold, causing severe diarrhœa.

‘After having employed these remedies for about three months, it is advantageous to practise bleeding, and to take as much blood as the strength of the patient will allow, and in order the better to determine “resolution,” it is well to unite with the decoctions the use of resolutive and bitter extracts, such as fumitory, thistle, small

centaury, pimpernel, absinth, tobacco, etc. If it be necessary to excite the abdominal organs there may be added to these remedies extract of rhubarb, aloes, or a digestive salt, such as the acetate or sulphate of potash. It is necessary to be circumspect in the use of these latter remedies, and to employ them only rarely and cautiously.'

CHAPTER XIII.

DO LEPERS RECOVER?

ALTHOUGH leprosy has been recognised in all ages as practically an incurable disease, it is satisfactory to know that it can be considered as not absolutely so. There are a sufficient number of well-attested cases on record to prove that the disease may not only be arrested, but that the evidences of it may disappear. Unfortunately, these cases are few; sufficient, however, in number to show that the bacillus lepræ may, even after it has established itself firmly in the human body, cease to be able to perpetuate itself there.

Dr. Fiddes (*College of Physicians' Report*) mentions two such cases. In one—a negress aged fifty-five—the disease had disappeared fifteen years. Both feet had been removed through the metatarsus, and all the fingers and the thumbs of both hands at the metacarpal joints. The other was a woman, eighty years of age, in good health, in whom an equally extensive destruction of the extremities had occurred.

Dr. Munro states that he has seen a case of nerve leprosy in St. Kitts, which, as far as the arrest of the disease may be concerned, after it had deprived the patient of all her fingers, might be called cured. She was a leper in 1817, and was nearly seventy years old when Dr. Munro saw her in 1872. She was then in fair health. Dr. Munro also saw in Edinburgh, in 1874, at a meeting of the Medical and Chirurgical Society, a case of leprosy which he considered might be looked upon as cured, the tubercles having disappeared, and left the face dusky (he was a white man), scarred, and wrinkled. Danielssen told Leloir in Norway, that he had seen several rare cases of tubercular leprosy cured by softening and ulceration of the tubercles. These cures took place without any passage to the anæsthetic form, without anæsthesia, or

paralysis, or consecutive atrophic troubles. He had seen, he said, a man whose cure remained good for thirty years, and in a woman for twenty years.

Dr. Kaurin communicated to Leloir the particulars of a case of mixed leprosy, beginning in 1863. The tubercles entirely disappeared, and the leprosy was apparently cured. The health became excellent for many years, and the man died of cerebral hæmorrhage at the age of ninety-five, and at the post-mortem examination there was not a sign of leprosy. Another case was related by Dr. Kaurin. A boy with general tubercular leprosy, which began at the age of five years nine months, entered the hospital April 1872, with well-marked symptoms of tubercular leprosy. In 1880 there had been no sign of leprosy for several years. The young man left the hospital, June 3rd, 1884, appearing in excellent health, and without a trace of leprosy. These are the only two cases of cure known to Dr. Kaurin.

The official statistical report for Norway, published in 1882, shows the total number of 107 cured lepers in the previous 25 years. Of this number 32 had not been treated in the hospital, and 75 in the hospital. Of the latter, 61 had been treated in the Lungegaard hospital in Bergen, by Danielssen. In the same period, 4891 patients had died, and of these 2352 succumbed in the hospital. The number of deaths in the Lungegaard hospital was 165.

If a patient loses all the symptoms of tubercular leprosy, enjoys good health, but retains some slight symptom of nerve leprosy of an unprogressive character, the case may be considered as much a case of cure as a case of phthisis in which all the symptoms have become arrested, although the patient is left with a patch of fibroid tissue in his lung in which, doubtless, the spores of the tubercle bacillus are embedded. Probably such a case is that published by Sandreczky (*Monats. f. Prakt. Derm.* No. 11, 1891). The author, who is familiar with the disease at Jerusalem, describes the case of a boy, eight years old, in whom the symptoms of mixed leprosy were fully developed. The eyelids, ears, and nose were swollen and infiltrated. There were tubers on the forehead, eyebrows, and eyelids, some of them suppurating. Amongst the symptoms were ulceration and contraction of all the finger joints, with

partial anæsthesia of the face, arms, and hands, and sharp pains in the upper and lower extremities. During four years the treatment consisted of open-air exercise, gymnastics, massage, quinine and iron, hot baths with various substances—such as soap, sulphur, and salt, followed by development of sweat. Frictions of soft soap, chrysarobin and iodine, were for a long time unsuccessful, but in the course of the second year improvement took place, first in the ulceration, then in the anæsthesia; then gradually the deposits in the neck, nose, and pharynx disappeared, and lastly, the tubercular nodules vanished. Contraction of the fingers remained.

Danielssen (*Archiv. f. Derm. u. Syph.* 1890, *Heft* 6) was able, so long ago as 1868, to report 43 cases of cured leprosy, and lately he has communicated to C. Boeck that, on the whole, about 100 lepers have been discharged from the Lungegaard hospital as cured; whilst about 50 patients left so greatly improved, that several of them have lately become perfectly cured.

In the *Medico-Chirurgical Society's Transactions*, vol. lxxix., there is an account by Mr. Hutchinson of a woman who, born in England, acquired leprosy in the West Indies, and returned to England at the age of forty-four, suffering from symptoms of mixed leprosy. She was shewn at the Medical and Chirurgical Society by Mr. Hutchinson, at the age of seventy-one, looking florid and healthy. Her skin, although nowhere quite anæsthetic, excepting in the region of the right ulnar nerve, was in many parts deficient in sensation, and the right eye showed characteristic changes, which, however, had not been aggressive for many years. About two years after her return from Jamaica, being then forty-six years of age, 'a wealthy relative placed good wine within her reach, to which she attributed the great improvement that subsequently ensued.' In about a year she thought herself well; she had had no return in the skin, and had continued in good general health.

CHAPTER XIV.

ISOLATION OF LEPERS

WHILST at all times there have been countries in which lepers have been allowed to mix freely with the rest of the population, without fear of contagion, the tendency has usually been to avoid contact with them. This fear of contagion reached its supreme degree in Europe in the Middle Ages, and it was after the avoidance of contact with lepers became almost a passion, that the disease began to diminish in most European countries. The absolute isolation of lepers under ordinary circumstances seems almost an impossibility; human nature, in most persons, will not permit a member of a family, whose intellect and affections are unchanged, to be cast out, because he is afflicted with a disease which, however disfiguring, is in many cases and for a long time, not necessarily repulsive. The affection which prevents a leper from being forsaken by his family does not, however, act as a hindrance in the case of persons not closely related; and the consequence is, that where leprosy is regarded as contagious, the leper is avoided by the general community, but continues to live in intimate relationship with his own family—a fact which, doubtless, has much to do with the existence and perpetuation of so-called leper families.

The natural tendency of mankind in all ages and in all countries, appears to have been to segregate lepers. Where leper asylums have not been founded, we find the tendency is to leper villages. The leper villages of China and Tonquin are well known; and Carter found at Candia, in 1874, a leper village in which were ninety lepers. If only lepers lived in these leper villages, the large proportion of sterile marriages would lead to the extinction of the malady; but, unfortunately,

as regards the propagation of the disease, the family of the leper usually follows him to his village.

The Persians had laws for the expulsion of lepers before the time of Herodotus; and in the Middle Ages the lepers when walking were, in some countries, obliged to make a constant noise with a rattle,¹ to wear two artificial hands of wool, one tied on the breast, the other on the head, and to make themselves otherwise conspicuous. Their treatment as outcasts must have caused the speedy death of numbers of them from hunger and cold.

Even in India (vide, e.g., *Report of Civil Surgeons of Midnapore*, 1877), the majority of the people consider the disease to be contagious, and do not, as a rule, hold communication with lepers. (See *ante*, Mr. Macnamara's letter.)

In Finland, lepers were isolated in houses built on islands in the lakes, and on the death of the leper, the house and all its furniture were burnt. Similar leper huts were found by Savory in Candia, and Boeck discovered them in the island of Siera. In comparatively recent times, a leper-house has been discovered at Bagdad, surrounded by thick walls, and containing many small rooms into which all the lepers were compelled to retire.

Richard, in his *History of Tonquin*, states: 'In Tonquin leprosy is so common that there are pieces of land assigned where those attacked by it must reside. They are shut out from society, and it is even lawful to kill them if they enter cities or towns.'

About 1325, Bishop Hacon, of Bergen, declared it to be the law of the Church that it was illegal for lepers to live with persons in good health; and a priest who became leprous was ordered to abstain from exercising ecclesiastical functions, either in or out of church. The duty of deciding whether a person was a leper was left to the clergy.

To avoid mistakes, Gadesden, in England, declared that nobody should be isolated as a leper if his face and body were not corrupted; and Gordon, in France, said that isolation should not be put in force until the disease had reached the second stage. The various allusions to leprosy in the Old

¹ The 'wooden clapper' used by lepers was formed of two or three tablets of wood.

Testament render it quite certain that isolation was practised by the Jews; and Moses, in separating lepers, probably followed what he had seen practised in Egypt. The place where lepers were transported by the Jews was called Beth Chofschitch, which means 'houses of impurity.' The idea that a house may contain the germs of leprosy within it appears to have always existed at various times; although the writer in Leviticus made the mistake of supposing that the ordinary blue and red moulds¹ had something to do with leprosy. The fact remains, that the idea that persons living in certain houses were more apt to acquire the disease was believed by the Jews, and very probably by the Egyptians.

In the Middle Ages, the Church used all its immense authority to secure isolation of the leper.

In 1757, in France, leprosy was declared to be a valid cause for divorce; and Lobineau, in *Histoire de Bretagne*, states that one of the effects of this law amongst the upper classes was, that many husbands had three wives living at the same time. In 789, Charlemagne promulgated laws forbidding the marriage of lepers. A similar law was passed in Great Britain by the Welsh King Hoet Dha, who died in 950, and there are Acts of Parliament which forbid cohabitation if either husband or wife is a leper; the leper in these circumstances being considered as dead.

A similar law was passed in Norway in 1781, and again in 1790, allowing husbands whose wives were placed in the leper hospital at Bergen to re-marry, the woman being declared to be civilly dead.

In 1776 a law was passed in Iceland to prevent lepers from marrying.

Prohibition of marriage amongst lepers, even in our own time, has been found necessary. Dr. Vandyke Carter relates that about 1874, the Bishop of Crete found it necessary to recommend the priests not to sanction marriages with or amongst lepers, an order which, to some extent was obeyed.

By an old Norwegian law (earlier than 1263) lepers were freed from military service.

Where tyranny and savagery could override the ordinary

¹ *Penicillium glaucum* for the blue, and probably *micrococcus prodigiosus* for the red moulds.

feelings of justice and mercy, isolation seems to have been sometimes practised by the most thorough of all methods—the death of the leper. Tamerlane is said to have given an order, that all lepers should be exterminated wherever his arms extended, in order that healthy people should not be attacked.

It is stated by Dr. Corney, P.M.O., that the natives of Fiji, who believe in the contagiousness of leprosy, were, until quite recent years, in the habit of killing all affected persons as soon as they developed breaches of surface, or soon after; and they allege that since this practice has been discontinued by the action of our Government, the disease has increased. Now that murder is not permitted, segregation is practised to a limited extent by the native district chiefs.

Dr. Bransomeren Taylor, of Fuh Ning, Fuh Chow, in China, informs us that whilst there are lepers in the vicinity, there are none in the town itself; and that in a small village about a mile from the city a leper hospital still exists, but there are no lepers in it. Regarding this asylum, Dr. Taylor has been told that a mandarin, about sixty years ago, desirous of stamping out leprosy, having invited all the lepers to a great feast in the hospital, surrounded it with soldiers and then set it on fire.

Even in England, in the fourteenth century (Simpson), a leper woman, 'quick with child,' was buried alive; and in 1346, lepers were driven from London.

Dr. McDougall (*College of Physicians' Report*), referring to Labuan, states that the universal belief amongst the people there—whether Chinese, Malay, or Dyak—is that the disease is contagious, and they all alike separate lepers and avoid contact with them.

An attempt has been recently made to establish a lazaretto in the Bahamas, where the lepers are not prevented by law from mixing with other persons.

In Jamaica, no restrictions have been imposed. In Dominica, no restrictions are imposed, unless the lepers are receiving relief from the parish fund. In St. Vincent, segregation and legal provision were attempted, but failed. In Barbadoes, lepers amongst the independent classes exclude themselves from society, whilst the destitute are either sent to the lazaretto or become beggars. In Trinidad and British

Guiana, there has been and is no effectual segregation. The negroes, it is stated, mix freely with lepers, although believing in contagion; whilst in Dutch Guiana, any suspected person found to be a leper by a medical committee is sent to a leper establishment. There is no isolation in the Cape of Good Hope. In Cairo, lepers beg in the streets. In Jerusalem, contact with the lepers is said to be avoided, and indeed the direct successors of the lepers 'outside the gate,' in biblical terms, are still to be found in the same position. In Damascus, the fear of contagion is stated to have compelled lepers either to live in caves or huts outside the villages, or to seek refuge in a leper house in a city. In Rhodes, they are said to be banished to desert spots, or some uninhabited island, to subsist as they best can.

Jewish lepers (Kalisch's *Commentary*, 1867), under the penalty of eighty stripes, were forbidden to approach the mountain of the temple, yet were not rigidly condemned to isolation, and in towns without walls were even allowed to enter synagogues. They were required to make themselves known at the first glance by appearing in public with rent garments, bare head and covered beard, and if any one approached inadvertently, the lepers were to cry, 'Unclean, unclean.' They were even interred in a separate burial-ground.

The effect of isolation in Cyprus is unmistakable. Dr. Heidenstam states that the number of lepers in this island previous to 1878 exceeded 150, since which 120 have been placed in the leper asylum. Of these, 57 have died during the last ten years, 63 still remain, and there are not more than 30 lepers outside the hospital, the whole number of lepers existing in the island not exceeding 100, showing a decrease of one-third during this comparatively short period.

Dr. Hillary states that in 1766, the legislature had passed restrictions against communication with lepers in the French and Spanish West India Islands.

Dr. Munro gives statistics in connection with St. Kitts, which speak strongly of the value of segregation. The number of lepers decreased from 95 (in 20,149) to 53 (in 20,700) between the years 1817 and 1854. During the first two decades of this period, segregation was strictly enforced by the

slave-owners, but on the other hand the period commenced only ten years after the abolition of the slave-trade, a traffic which imported new lepers. But after the manumission of the slaves and the consequent absence of restrictions, the numbers increased from 53 (in 20,700) to 72 (in 28,000) in 1872, although during this period there was no importation of diseased negro slaves.

Carston Niebuhr states that Mahometans try to avoid infection, and set apart houses for lepers, in which they are placed even against their will.

Isolation seems to have been more practised by the Jews than by the Syrians, as Naaman evidently associated with healthy persons, whilst Uzziah was at once thrust out.

The importance of isolation in checking leprosy in a country is best shown on a large scale by the Norwegian statistics. In the year 1857 there were in that country, at the beginning of the year, 2871 lepers. During the year 243 cases came under notice, and 293 died, 16 emigrated, 2 were reported cured, and at the end of the year the total number was 2803. Of that number 427 were in hospitals.

In the year 1867, at the end of the year, there were 2698 lepers, but the number of these which had been brought into hospitals had reached 787. The effect of the increased proportion being placed in hospitals was shown by the gradual diminution of the total number of lepers, till at the end of the year 1882 we find them reduced to 1433, of whom 553 were in hospitals.

In 1885 a law was passed rendering the segregation of lepers compulsory, with the result, Hansen states, that whilst little more than thirty years ago there were 3000 lepers in Norway, at the present time there are not more than 800—a fact that, as he remarks, would be difficult to explain if we were to assume that leprosy is hereditary. To show that this diminution is not due to any decrease in the virulence of the disease, Hansen adduces the fact that, in the years 1856-70, until isolation became more rigidly enforced, the number of lepers in a small place called Nordmære, near Christiansand, increased from 106 to 147. After 1870 isolation was more generally practised in the district, and the number of lepers

sank to 83, the number of new cases also being diminished by one-half.

We understand that in Norway isolation is not absolute; the doors and gates are not kept locked, and the inmates of the asylum may be sometimes met in the neighbouring roads, those who have no ulcerations being allowed to go out. They are kept in on market-days, and at Trondhjem—and probably at other places—they are permitted to enter houses or churches, or come in contact with other people.

We have already explained the extent to which leprosy scourged the population of England and Scotland between the tenth and sixteenth centuries. Considering the comparative rapidity with which the disease was extinguished in England, it is instructive to learn how it was dealt with by the authorities and by the people.

Isolation was enforced and rendered possible by the multiplication of lazarettos, all over the country, the regulations both in England and Scotland being of a stringent character.

In the earliest code of laws enacted in any part of Britain, there is a canon to the effect that a married female was entitled to separation, and the restitution of her goods, provided her husband was affected with leprosy. (About the year 950.)

Simpson quotes the following edict in regard to lepers in London:—

‘According to the record of Edward III., that king sent in 1346 “a commandment under his Great Seal, to the mayor and sheriffs of London, willing them to make proclamation in every ward of the city and suburbs, that all leprous persons within the said city and suburbs should avoid within 15 days, and that no man suffer any such leprous person to abide within his house, upon pain to forfeit his said house, and to incur the king’s further displeasure. And that they should cause the said lepers to be removed into some out-places of the Fields, from the haunt and company of all sound people.” It further appears that the magistrates ordered “that the lepers walk not about the streets nor tarry there; that the keepers of the gates swear that they will not permit lepers to

enter into the city." Stow adds, "There was at one time a brief for removing them from the city and suburbs. At another time there was an edict for levying an hundred shillings out of a tenement of the lepers, and delivering it to their officers for sustaining them."'

By the rules and regulations of the leper hospital of St. Julian at St. Albans, no brother was to transgress the bounds fixed of old, nor to attempt to go beyond the bounds of the hospital without his close cape, nor stand nor walk about in the King's Road before or after service.

The religious duties forced upon the inmates of the hospital of Sherburne were of an austere character:—'All the leprous brethren, whose health permitted, were every day expected to attend matins, nones, vespers, and compline. The bed-rid sick were enjoined to raise themselves, and say matins in their bed; and for those who were still weaker, let them rest in peace, *et quod dicere possint dicant.*' During Lent and Advent all the brethren were required to receive corporal discipline three days in the week, and the sisters in like manner, *donec omnes vapulent.* All these, and other laws, Bishop Kellaw 'did by his charter confirm and order ever thereafter *inviolabiter observari.*'

By the law of England lepers were classed with idiots, madmen, outlaws, etc., as incapable of being heirs. Rotharis, king of Lombardy (eleventh century), decreed that lepers should be expelled from society, and should have no power to alienate their effects or dispose of them to any one, and should be regarded as dead. The law of Normandy was the same.

The Church regarded the leper as dead, and performed the service for the burial of the dead over the leper on the day when he was separated from his fellow-creatures and confined in a lazar-house. A priest robed with surplice and stole went with the cross to the house of the doomed leper. The minister of the Church began the necessary ceremonies, by exhorting him to suffer with a patient and penitent spirit the incurable plague with which God had stricken him. He then sprinkled the unfortunate leper with holy water, and afterwards conducted him to the Church, the usual burial verses being sung during their march thither. In the Church the ordinary habiliments of the leper were removed; he was

clothed in a funeral pall; and while placed before the altar between two trestles, the Libera was sung, and the mass for the dead celebrated over him. After this service he was again sprinkled with holy water, and led from the Church to the house or hospital destined for his future abode. A pair of clappers, a barell, a stick, cowl, and dress, etc., etc., were given to him. Before leaving the leper, the priest solemnly interdicted him from appearing in public without his leper's garb; from entering inns, churches, mills, and bakehouses; from touching children, or giving them ought he had touched; from washing his hands or anything pertaining to him in the common fountains and streams; from touching in the market the goods he wished to buy with anything except his stick; from eating or drinking with any other than lepers; and he specially forbade him from walking in narrow paths, or from answering those who spoke to him in the roads and streets, unless in a whisper, that they might not be annoyed by his pestilent breath and with the infectious odour which exhaled from his body; and last of all, before taking his departure, and leaving the leper for ever to the seclusion of the lazaret-house, the official of the Church terminated the ceremony of his separation from his living fellow-creatures by throwing upon the body of the outcast a shovelful of earth, in imitation of the closure of the grave.

The canons of the Church of Scotland, 1242 and 1269, speak of lepers as separated from society in accordance with general custom. The statutes of the Society of Merchants at Berwick-upon-Tweed, drawn up about the year 1283 to 1284, forbid a leper to enter within the gates of the burgh, and any leper who contravened this order was to have his clothes burnt, and to be ejected naked from the burgh. 'One good man' was to gather alms for them, that they might be kept in a place competent for them outside.

By the laws of Kingcase, any one communicating personally with the lepers of the hospital was liable to the pain of exile from the burgh. In 1530 the Town Council of Edinburgh ordained that no leper should come amongst other clean persons, nor be found in church, fish, or flesh markets, 'under pain of burning of the cheek and cutting off the tongue.'

In 1591 there were five male lepers in the Greenside

Hospital in Edinburgh, and two of their wives were allowed to be with them. Neither the lepers nor the two wives were allowed to leave the hospital by day or night, or to receive any one, and they were ordered to keep the door fast and closed. One woman, 'Janet Galet,' was allowed to go to the markets for provision, but to go nowhere else, and in order to secure obedience and terrify the lepers, a gibbet was erected at the gable of the hospital, as indication of the punishment that awaited transgression of the rules.

One of the statutes of this hospital was to the effect—

'That none of the lepers cry or ask for alms, otherwise than by their clappers, and that every one of them, his day about, sit at the door of the said hospital to that effect, the rest always remaining within the same, and that they distribute equally amongst them whatsoever money they procure by their said begging, and give the just declaration thereof to the visitor every Saturday under such pain as the Council shall enjoin unto them.'

In Scotland, we find that in Glasgow, so late as 1573, the magistrates ordered four persons named as lepers to be inspected, and if found to be diseased, they were to be excluded from the town and removed to the hospital at the Bridge-end. The Scotch Parliament, in 1427, elected that lepers should not sit either in church or churchyard, or other place within the burghs, but at their own hospital, and at the port of the town, and other places without the burgh. In the Kirk Session of Aberdeen, on May 13th, 1604, it was ordained that Helene Smythe, a poor woman infected with leprosy, be put in the hospital, appointed for keeping and holding all lepers affected, between the towns, and the keys of the said hospital to be delivered to her.

In the Regulation regarding the Separation of Lepers, it is stated—

'If any man dwelling or born in the king's burgh is stricken with leprosy, and has substance and gear (geir) of his own to sustain and clothe himself, he shall be put in the hospital of that burgh where he dwells. And if he has nothing to live upon, the burgesses of that town shall make a collection amongst them, for meat and cloth to him; and that collection shall be the sum of twenty shillings.'

Coming to modern times and more limited instances, we find Dr. Thomas Wright Hall, in a letter to the *Journal of the Leprosy Investigation Committee*, January 1891, on leprosy in Bahia stating 'that he knows of a case in which leprous families of negro slaves were exiled deep into the fertile woods of Northern Brazil. In their exile they were furnished with means of rearing poultry, pigs, goats, of fishing, and trapping game, of cultivating cassava, yams, plantain, maize, etc., and then they were left entirely to themselves. Among these exiles, when visited after the lapse of many years, leprosy was found extinguished; a sound negro colony occupied the place of the old leprous one.'

In the Australian colonies the same thoroughness which has characterised the dealings of the Governments with other infectious diseases has been shown in regard to leprosy. The few lepers in Victoria (where leprosy has been dealt with under a section of the Public Health Law Amendment Act) are detained in weatherboard huts, in a separate enclosure, within the limits of the quarantine station at Point Nepean. In Queensland the leper station is on Dayman Island. In South Australia the disease is confined to Northern territory, and the patients occupy bark huts isolated on a proclaimed leper station at Middle Point. In Western Australia the single leper is kept in a hut erected for his accommodation, outside the quarantine ground at Woodman's Point—a neck of land projecting into the sea, about six miles from Fremantle. The twelve lepers in New South Wales have been kept in a separate portion of the grounds of the coast hospital, ten miles from Sydney, and the discovery of two fresh cases in the interior of the country has led to fresh legislation empowering the compulsory removal of lepers.

The horror with which leprosy is regarded by the Australians will ensure restrictive measures being faithfully carried out, and further experience in these colonies will be of great utility in showing how far isolation can be depended on to root out the disease in a new country.

CHAPTER XV.

PROPHYLAXIS

It follows, we hope clearly, from what has been written in the previous part of this book, that of the different points of view from which leprosy may be regarded, there are two the importance of which exceeds all the others. These are the scientific questions which are concerned with the life-history of the bacillus lepræ, and the means by which the living organism is conveyed from the tissues of a leper to a healthy man; as well as the practical questions of great interest regarding the means to be taken to prevent the spread of the disease, and, if possible, to gradually extinguish it altogether.

As regards the latter point, that of prophylaxis, exaggerated and wild statements have been made. Those who consider that it is possible to stamp out this disease in one or two generations have forgotten to take into account the powerful springs that move human nature. Whatever isolation might do, if efficiently carried out, complete isolation—such as would guarantee the rapid extinction of leprosy—is impossible. Wherever it has been attempted, deception and concealment have been practised in a ratio with the strictness of the measures established to protect society against the leper. It may be taken for granted that the husband will shelter the wife and the wife the husband, and the mother the child, against the action of the law, however justifiable, until the ravages of the disease or the dulled instincts of affection render concealment no longer possible or desired. This is, however, no reason why the most complete isolation obtainable should not be aimed at, under rules adapted to the circumstances of different countries and races.

Every leper with ulcerating sores, who is subjected to restraints which reduce to a minimum the chance of the

bacilli with which his sores seem being transplanted to a healthy person, represents one source of danger the less for society. It stands irrefutably on record how much isolation, even when not absolutely rigid (previously to 1885), has done for Norway; and there is no doubt that the so-called leper villages in China, although they have not led to absolute isolation of lepers, have, by diminishing the contact between them and the healthy population, contributed to check the spread of the disease. There is absolutely no valid reason why leprosy should have been extinguished with comparative rapidity in England, other than that the terror that was inspired by the extent and revolting character of the malady roused the people to a pitch which suppressed some of the strongest qualities of human nature, and overcame the family affection, which is the best security for the individual whose misfortune it is to be a danger to his fellows.

In regard to the question of isolation, and its bearing on legislation, it should be remembered that leprosy by no means stands alone. We have amongst us, producing an immense amount of misery and death, diseases which, if the cost were not too great, could be extinguished as easily, or rather with the same difficulty, as leprosy. We have little doubt that small-pox could be extinguished, but society has not yet seen its way to submit to the inconvenience or expense. Consumption and other scrofulous diseases, which are produced, like leprosy, by the growth in the tissues of a specific organism, could be, if not suppressed, certainly enormously diminished, if society chose to submit to the loss of liberty and the cost involved in the fight against the bacillus of tubercle—in this case rendered immensely more difficult by the fact, that the microbe finds an additional habitat in the bodies of the domestic animals, whose flesh we eat and whose milk we drink.

In many respects syphilis has a close analogy to leprosy, considered from this point of view. Every individual who has been contaminated with syphilitic poison is, for a very considerable time afterwards—apart from the means by which this poison is usually conveyed from one person to another—a source of danger to every one with whom he comes in contact. The spoon with which he eats, the cup from which he

drinks, the tobacco-pipe with which he smokes, the impress of his lips when he kisses, the contact between skin and skin when huddled in the narrow bed of the common lodging, are all means by which not only is the conveyance of syphilis possible, but to which its direct transference has not unfrequently been traced; yet no serious proposal has been made to isolate the syphilitic person, or to remove the syphilitic infant to a special asylum where contamination of the nurse would be impossible. And still the mortality of syphilis exceeds the mortality of leprosy, even in those countries in which that disease is most common.

But although isolation, like taxation, must not be pushed to limits which human nature will not bear, it is reasonable and right that it should be carried to as great an extent as a proper regard for the feelings and rights of humanity will permit. Fortunately, so far as this country is concerned, the question as regards leprosy can hardly be said to exist. So long as the leper is housed with a regard to the requirements of ordinary civilised life—even amongst the comparatively poor—and ordinary cleanliness exercised, the comparatively few cases that reach this country are entirely harmless. When the leper slept in the same bed with his brother, as was the case in Dublin, the disease was transmitted, but experience shows that a leper may be received into a hospital, infirmary, or private house without any infection of healthy persons. So far as we know, there are only two cases in England of transmission of the disease recorded during this century, one the Dublin case so often referred to, the other a woman who lived near the East India Docks, alluded to by Dr. Munro, in whose case the source of contagion was not discovered. During these years there have always been lepers in England, and the number usually in Paris is estimated from 60 to 100, and no infection has followed from them.

It must be remembered, that the majority of lepers who come to this country do not belong to the class of the very poor, and naturally live under conditions which are adverse to the spread of the disease. If these lepers lived amongst the class in which, unfortunately, one room has to serve for all purposes for a large family, and in which the number of persons sleeping in a bed is only limited by its size, we have

little doubt that the disease would spread as it has done in Norway, and as it spreads in the Sandwich Islands and in British Guiana.

What is wanted in this country is full instruction in regard to all the circumstances of the disease, more especially regarding its symptoms and contagious nature, on the part of medical men practising in cities, and seaports more particularly, as to them falls the duty of seeing that the few lepers who find their way here are so cared for, that they can be treated with safety to the persons amongst whom they live.

The case stands differently with countries like the East and West Indies and British Guiana. In these countries there live, subjected to English law, numerous lepers, many of them under circumstances which favour the further development of the disease by contagion; and it ought to be incumbent on the Governments of these colonies and of the Indian Empire, to take such measures to restrict the spread of the disease as are justified by the local circumstances in each case. That this will eventually be done cannot be doubted.

So long as leprosy is believed to be an hereditary and not a contagious disease, it is useless to expect legislation in this direction. With the discovery of the bacillus lepræ, and the accumulated evidence of the contagiousness of the malady, the belief in contagion amongst medical men in all countries is now rapidly gaining strength, and will, we firmly believe, soon become practically unanimous. The suddenness with which the discovery of this bacillus, and the whole question of pathogenic organisms have been sprung on the medical world, has alone prevented the acquisitions brought to pathology by the magnificent discoveries of Koch and Hansen being thoroughly realised.

To grasp the bearing of these discoveries aright requires a certain amount of practical knowledge of bacteriology. Knowledge of such a technical kind is hardly possible, except to the younger generation of medical men; but even in Norway, where for many years, under the legitimate influence of very high authority, contagion was not credited, scepticism has given way, and we learn, on the authority of Leloir, who

recently visited that country, that Norwegian physicians now almost unanimously believe in the contagiousness of leprosy.

The tendency to compulsory segregation is again manifested everywhere. A Leper Repression Act was passed at the Cape of Good Hope, July 11th, 1884. In Norway, segregation was made compulsory in 1885. Under an Act to facilitate the segregation of lepers in the Hawaiian Kingdom, 821 lepers had been removed to the asylum between July 17th, 1887, and March 12th, 1889. For some considerable time lepers in New South Wales have been kept in a lazaretto near Sydney, and quite recently a Bill has been passed by the New South Wales Legislature to empower the authorities to compulsorily segregate lepers.

As this Bill is probably the most stringent Act for the isolation of lepers that is at present in force anywhere, we subjoin it in full.

‘ 54° *Victoria*, 1890.

‘ A BILL

‘ To provide for the notification of cases of Leprosy ; for the detention and isolation of Lepers ; the appointment of Lazarets ; and for other purposes.

‘ BE it enacted by the Queen’s Most Excellent Majesty, by and with the advice and consent of the Legislative Council and Legislative Assembly of New South Wales in Parliament assembled, and by the authority of the same, as follows :—

‘ 1. This Act may be cited as the “Leprosy Act of 1890.”

‘ 2. In this Act the expression :—

‘ “ Board of Health ” means Board of Health as constituted under the authority of the “ Infectious Disease Supervision Act, 1881.”

‘ “ Governor ” means Governor with the advice of the Executive Council.

‘ “ House or Premises ” means and includes any house, part of a house, room, ship, vessel, boat, tent, van, shed, or other structure.

‘ “ Legally qualified Medical Practitioner ” means a legally qualified Medical Practitioner within the meaning of the “ Medical Practitioners Act of 1855,” and any Act amending the same.

‘3. On the appearance of any case of Leprosy in any house or premises the householder or occupier of the said house or premises, and also the medical practitioner attending the case, shall immediately report in writing such case to the proper authorities in manner following, that is to say:—If the case occur within the Metropolitan Police District then the report of the case shall be made to the Secretary of the Board of Health, and if the case occur beyond the Metropolitan Police District then the report shall be made to the Officer in charge of the Police Station nearest to the said house or premises. If any person required by this Section to report any such case shall fail to make such immediate report as hereinbefore required, such person shall be liable to a penalty of not less than *ten* nor more than *fifty* pounds.

‘4. (1) The Governor may, by Proclamation published in the *Gazette*, direct that any suitable place be set apart as a Lazaret for the reception and medical treatment of lepers, and may make regulations for the safe custody of such lepers therein.

‘(2) The Board of Health shall, upon report being made as aforesaid, or upon report made by any legally qualified medical practitioner, that any person is suffering from Leprosy, cause investigation by two or more legally qualified medical practitioners, and upon being satisfied that such person is suffering from that disease, may order that such person be removed to and detained in such Lazaret until released by order of the Board, or be isolated in such place and in such manner as the Board may direct; and any person who wilfully refuses or neglects to obey any such order or any directions given by the Board, or escapes or attempts to escape from such Lazaret, may with such necessary force as the case may require be removed or brought to any Lazaret, or other suitable place.

‘(3) Every such order shall be in writing, and shall be signed by the President, or Secretary, or any two members of the Board, and may be addressed to a member of the police force or other person as the Board of Health may consider expedient; and any order so signed shall be a sufficient warrant to any member of the police force for arresting the person named or described therein, and for removing him or bringing him to any Lazaret or other place, and for taking all such steps and doing all such things as may be requisite to enforce the said order.

‘(4) Any person who wilfully disobeys, or obstructs the execution of, any such order, or who trespasses on any such Lazaret or other place, or communicates or improperly interferes with any person detained therein, shall be liable to a penalty of not less than *ten* nor more than *twenty* pounds.

‘(5) Every person who, prior to the passing of this Act, has been detained as a leper in the Coast Hospital at Little Bay shall be deemed to have been lawfully detained, and to be a leper detained within the meaning and for the purposes of this section.

‘5. Any order purporting to be signed by the President, or Secretary, or any two members of the Board of Health, shall in all proceedings be admissible without further proof, as *prima facie* evidence that such order has been duly made in pursuance of this Act.

‘6. The Governor, upon the recommendation of the Board of Health, may make and issue regulations for the purpose of carrying this Act into effect; and such regulations shall be forthwith published in the *Gazette*. Any person who shall wilfully disobey, or act in violation of any such regulations, or who shall resist or wilfully obstruct any person in the lawful exercise of any of the powers conferred under this Act, or who shall, without lawful excuse, neglect or disobey any requirement made under the provisions of this Act, or shall neglect or refuse to obey any order or direction of the Board of Health made under this Act, within the time limited in that behalf by such order or direction, shall for every such offence be liable to a penalty not exceeding *twenty* pounds.

‘7. All proceedings for offences against this Act, or against any regulation made under this Act, may be had and taken, in a summary way, before any Stipendiary or Police Magistrate or any two Justices of the Peace, under and subject to the Acts in force for the time being regulating summary procedure before Justices. The amount of every penalty inflicted under this Act or any such regulation, together with costs, may be recovered and enforced by distress and sale of the goods and chattels of the person ordered to pay the same, and in default of sufficient distress, such person shall be liable to be imprisoned, with or without hard labour, for any term not exceeding *six* months, unless such penalty and costs be sooner paid.’

A school in New South Wales has, it is stated, been closed by order of the Minister of Public Instruction, in consequence of reports that some children in it are developing symptoms of leprosy.

The people of San Francisco, thoroughly alarmed by the arrival of Chinese lepers in their country, have also passed the following stringent Act:—

(Preamble.) ‘Whereas, the public welfare demands that some action be taken to prevent the landing of persons within the city and county

afflicted with the disease known as leprosy or elephantiasis, which diseases are, in the judgment of this Board, contagious under certain circumstances and conditions; and whereas, in view of the dreadful results of said diseases, every means justifiable for the protection and preservation of life should be taken by this Board to prevent the free and unrestricted coming of persons from foreign ports who are so afflicted; therefore the people of the city and county of San Francisco do ordain as follows:—

‘(No leper or person afflicted with elephantiasis to land from any ship or boat.)

‘Section 1. No person afflicted with the diseases known as leprosy or elephantiasis shall, upon any pretext whatsoever, be permitted to land from any vessel or boat upon the shore or within the limits of the city and county of San Francisco.

‘(Captains, officers, owners, consignees, or agents of vessels arriving to prevent the landing of lepers from such vessels.)

‘Section 2. No captain or other officer in command of any vessel arriving at the port of San Francisco, nor any owner, consignee, agent, or other person having charge of such vessel, shall land, or permit to leave said vessel in this port, any person afflicted with the diseases known as leprosy or elephantiasis.

‘(Captains, or other persons having control of vessels arriving, or in the harbour, having leprosy, etc., on board, to report the same to quarantine officer within 24 hours of the arrival.)

‘Section 3. All captains or other officers bringing vessels into the harbour of San Francisco, and all masters, owners, or consignees having vessels in the harbour which have on board any cases of leprosy or elephantiasis, shall, within 24 hours after the arrival of said vessels, report the same in writing to the quarantine officer, or as soon thereafter as they or either of them become aware of the existence of said disease on board their vessels; the said report to state the name, place of birth, last residence, age and occupation of all such persons so afflicted.’

The following extract from a letter written by the Hon. W. Keswick, H.M.S. Consul-General at Hong-Kong, to W. M. Gibson, Minister of Foreign Affairs, Honolulu, shows that an attempt has been made to protect Hong-Kong from leprosy. He states ‘that every master of a junk, vessel, or boat, bringing into the Colony, or from one part of the Colony to another, any person who shall, in the opinion of the Court before which the offence shall be tried, have come

to the Colony for the purpose of mendicancy, or any person suffering from leprosy or any contagious disease, incurs a penalty not exceeding 10 dollars for every such person so brought by him as aforesaid.' A perusal of Dr. Cantlie's *Leprosy in Hong-Kong* shows that this law has been practically inoperative.

The feeling in favour of compulsory isolation, with few exceptions, is so strong in the West Indies and in British Guiana, that it seems highly probable that the Governments of these Colonies will before long be compelled by the force of public opinion to take action. The laws now in force seem to do little more than offer shelter to pauper lepers not otherwise provided for.

An ordinance was enacted in British Guiana in 1870, which in essential particulars corroborated the provisions of a previous ordinance of 1885.

It will be seen from the following clauses of this ordinance, that any pauper leper may claim admittance to the leper asylum, and that if any leper so exposed his diseased person in the public streets as to constitute a nuisance, he may be forcibly removed to a leper asylum; but a leper who is not a pauper, and who does not expose himself to the imputation of vagabondage, retains his entire freedom. Even after a leper has been convicted of vagabondage, he may regain his liberty if he can find security to the amount of 96 dollars that he can be privately supported, and shall not be suffered to be at large.

'Clause 4. The Governor, on its being certified to him, by any medical practitioner, that a person is a leper, and on its being further certified by such medical practitioner, or any two justices of the peace, that such person is a fit subject for gratuitous relief, may, on application by or on behalf of such person, make an order for such person to be admitted into a leper asylum, and to be maintained there, free of charge, until discharged by order of the Governor, or of a judge, as hereinafter provided.

'Clause 5. From and after the taking effect of this ordinance, it shall be lawful for any stipendiary or special justice of the peace, upon information on oath of any credible witness, that any person afflicted with leprosy has been wandering about, begging or collecting alms, or seeking precarious support, or wilfully, or intentionally, exposing his or her leprosy in any public road, street, or place, to the disgust

and annoyance of any inhabitants of the Colony, to summon such person to appear before him ; or, if he shall think it necessary, such justice shall issue a warrant, under his hand, directed to any constable or officer of police, authorising or directing such constable or officer of police to cause any such person to be brought before him at a time and place to be specified in such summons or warrant.

' Clause 6. If upon the hearing of the case it shall be made to appear, to the satisfaction of the said justice, upon the oath of any medical practitioner, duly admitted to practice in this colony, that such person is afflicted with leprosy, and it shall be made further to appear upon the oath of some credible witness that such person has been seen wandering abroad begging or collecting alms, or seeking precarious support, or wilfully or intentionally exposing his leprosy on any public road, street, or place, to the disgust and annoyance of any inhabitants of the Colony, then it shall and may be lawful for such justice, unless security be given as hereinafter provided, to make an order, subject to the approval of the Governor, for the removal and conveyance of such person to a leper asylum, and on approval of such order by the Governor, any constable or police officer, thereto directed by such justice, shall remove and convey such person to such leper asylum as may be designated by the Governor, there to be detained until discharged by order of the Governor, or of a judge as hereinafter provided.'

A further clause (No. 13) indicated that :—

' No person afflicted with leprosy shall be in any way employed, whether for hire or not, in the preparation for sale, or in the sale, of any article of human food, and in case any such person shall be so employed, the person knowingly employing him or her shall be guilty of a misdemeanour, and shall be liable, on conviction before any inferior Court of criminal justice, to a fine not exceeding 96 dollars, or to imprisonment not exceeding three calendar months.'

The diminution of leprosy and the treatment of lepers is one of the great problems which the Indian Government, urged forward by the force of public opinion, will shortly have to face, and its solution is on every side surrounded with difficulties. The delay that has taken place in grappling with the question in that country has undoubtedly been greatly due to the fact that the disease has not been generally accepted as contagious by the medical authorities in that empire ; but with the growing conviction on all sides that the

disease is communicated by contagion, it will be impossible long to avoid legislation of some kind. The form which such legislation may take, and the questions that will have to be considered in dealing with it, may be inferred from proposals that have been already made by competent men who are well acquainted with the conditions which prevail in India. In such a matter no one can speak with more authority than Vandyke Carter, who suggests (*Leprosy in Foreign Countries*, 1886) 'that in India segregation is practicable in three modes, either separately or combined:—

'1. By erecting plain asylums at certain centres, each of which would be a refuge common to several districts; and a place of detention, under due management and supervision.

'2. By founding leper colonies or village communities mainly of the affected, who, while allowed more liberty of movement, should yet be prevented from mingling with the peasantry around; hence still the need of strict supervision. Many spots would thus serve—such as deserted forts, decayed villages, and places now waste yet not far from other sources of supply, or not without near resources easily resuscitated.

'3. By requiring the strict isolation of leprous subjects retained in their homes at express wish of friends. Suitable separate lodgement would be indispensable; unsuitable shelter is even now sometimes supplied. Joining of such home-isolation with more public measures should not be overlooked; for to it experience in Norway seems to point as a means essential to complete success within a moderate period of time; and in India it would have to be still more largely resorted to.

'For carrying out the above, in addition to funds, legislative authority is needed to take up the vagrant sick, to remove the sorely diseased who is insufficiently guarded at home, and at times to enforce continued isolation of the infected until medical sanction of liberty be granted. Such authoritative interference will, I am aware, be differently regarded by many, and disliked by the masses; yet it cannot at present be dispensed with, and sufficient precedent exists in several British enactments against small-pox and contagious diseases of men and animals.'

That a certain kind of isolation would be not only endured but welcomed by the natives, at all events of some parts of India, may be inferred from what Sir James Lyall (*Journ. of the Leprosy Invest. Com.*, No. 2, p. 44) has himself heard and seen. 'He believes,' it is remarked, 'that in Sikh times and the early days of British rule, in the case of all but rich and influential people, a leper was generally expelled from his home and forced to live apart from his family in a hut on the outside of the town or village. Here he was provided with food, drink, and clothing by his family, or sometimes by a kind of rate levied on the village community. He was forbidden to draw water at the wells; to bath in the tanks or at the ghats; or to mix with the crowd; or to sit in the streets; but he was allowed to sit outside the towns or villages, by the sides of pathways or high-roads, and beg for alms. Under the British rule, when law and legal procedure predominate, families or communities have no power in this way to drive out a leper from his house and property against his will, and so his Honour believes that lepers, with or against the will of their nearest relations, commonly live on in their houses with their families and defy the public opinion of the community. Hence, therefore, it may be said that more stringent legislation than that proposed in the Bill will be only a return to customary law.'

In regard to Burmah, a measure of isolation would apparently also be favoured by public opinion. Quoting from the same journal, we find (p. 54) that Dr. Frenchman relates that 'he has spoken to many Burmese elders, and they tell him that the proper place for a leper is with the sandalas (grave-diggers) who live outside the town. They say that it used to be the custom in this town (Thayetmyo) before the British advent.

'The Officiating Chief Commissioner believes that public opinion still enforces, to a certain extent, the old rule which compelled lepers in large towns to live together in one part of or outside the town, and he thinks that a measure for the compulsory segregation of lepers would certainly be in accordance with the customs of the people, and would be popular in Burmah.'

Mr. Smeaton (*Journ. of the Leprosy Invest. Com.*, No. 2,

p. 54) is also of opinion, 'that the Burmese generally would accept with satisfaction any measures which would help to prevent the spread of leprosy and the increase of the leper class. All the gentlemen whom he has consulted think that such a measure would be expedient. The Rangoon Municipal Committee consider that it is in accordance with Burmese ideas that an Act for the segregation of lepers should be passed.'

When action is taken in Louisiana the probability is that it will be firm, if public opinion, when it is ripe, is guided by that of the medical profession in the State.

It appears probable that, before long, public opinion in the West Indies will force the enactment of measures calculated to secure more complete protection of the unaffected population than is at present possible.'

Twelve years ago Dr. Munro remarked (*Leprosy*, p. 94):—

'It is sad to think that in any colony of England a leper should be allowed to *keep a school*, as I have seen to my horror in St. Kitts. In misgoverned Crete such things might be, but done in an English colony, with the tacit sanction of the Government, acting under the instructions of the Home Government, themselves instructed by the Royal College of Physicians of London as to the non-contagious nature of the disease, the latter acting on utterly worthless *negative* evidence, so done, such an affair is a disgrace to humanity.'

In the *Lazaretto* of St. Kitts of January 26th, 1891, we find the following statement:—

'On the 12th instant we applied to the Police Magistrate for a warrant, under the new Act, to apprehend and segregate in the Leper Asylum a leper by name Sebastian. The individual in question was employed by one Barrington Hennigan to milk his cow, from which he supplied us with milk. Sebastian has been examined by a medical man, who certifies that he is a leper, with his left hand covered with leprous ulcers. We publish these facts, that people who object to leprous milk may be on their guard against obtaining it from a man who is so criminally careless as to employ a leper to milk his cows. This man was so well known by his own class to be a leper, that it is quite impossible that Barrington could have been ignorant of it. We imagine

that very many of our St. Kitts readers would discover a similar state of things in the people who supply them with food. We were told a few weeks ago by a gentleman in Sandy Point of his having met with a similar disagreeable experience in his milkwoman. In that case the milk was kept in a room in which a leper lived.

'We have to record another case of a leper who has been for some time in the habit of milking his own cows and selling the milk to his customers in Basseterre. This man Benjamin lives in College Street, and though he has lost the tips of his fingers, manages to milk with the stumps.

'On Sunday, the 11th instant, several respectable families in Basseterre received their milk strongly tainted with iodoform. The person who milked those cows evidently had an ulcerated hand which he or she dressed with iodoform ointment!!! It is an interesting question how many cows are milked by ulcerated hands, on which the tell-tale iodoform is not used. Taking the most favourable view of the mode by which that milk got the iodoform taint, the person who milked the cow must have at least been dressing their own or some one else's sores with the remedy. Iodoform is used here for only one thing—very foul ulcers.'

Dr. Justin F. Donovan, in his report on the Lepers' Home, Spanish Town, Jamaica (*Journ. of the Leprosy Invest. Com.*, January 1891), remarks that leprosy may be checked 'by the strict isolation of lepers who are not paupers, whose friends are willing and able to look after them under medical surveillance. Until, however, legislative enactments are passed, empowering the police or sanitary authority, on the certificate of a qualified practitioner, to take up and send to the Home any vagrant or destitute leper, and secure his detention there until cure be effected, and the proper isolation be adopted in those cases which are isolated in private life, the present half-measures of allowing lepers to come and go as they please will be found to prove insufficient for stamping out the pest, which has so many foci of infection in various districts of the island.'

Dr. Grieve, Surgeon-General of British Guiana, describes a condition of overcrowding in the poorer classes which is

eminently calculated to further the spread of leprosy. 'Dwellings for the poorer classes,' he remarks, 'are huddled together in confined yards where there is no opportunity for each building to get a fair share of fresh air, or even of our plentiful sunshine. The houses themselves are too often wooden boxes, which can be closed at night so completely that not a breath of air can enter, for even that safety-valve, the chimney, is wanting. When so closed they are often crowded with people until there is scarcely room for more to sleep upon the floor.'

As an illustration of the special difficulties which each colony may have to face in endeavouring to segregate lepers, Dr. Cantlie's suggestion for Hong-Kong may be conveniently referred to. He shows that a leper there may claim protection as a British subject, and that, if born in Hong-Kong, he has a right to its hospitality; that the establishment of a home for lepers in Hong-Kong would probably lead to more lepers coming from the mainland; notwithstanding which Dr. Cantlie considers it imperative that the Government should establish a leper retreat for British subjects, whether they be Chinese or foreigners, and suggests that one of the numerous islands around Hong-Kong might be obtained from the Chinese Government for the purpose. In the meanwhile, he recommends the immediate institution of a quarantine leper station.

Dr. H. W. Blanc, of New Orleans, in his letter to the *Journal of the Leprosy Investigation Committee*, January 1891, suggests, in reference to the compulsory segregation of lepers, 'that when a case is decided to be leprosy, it shall be sent to a lazaretto, to be there confined at the expense of the State; all personal communication with the outside world to be interdicted, and intercourse with friends to be permitted only where bodily contact is impossible.' Such a law would be as stringent as that just passed in New South Wales, and it is doubtful whether it could be strictly carried out, even in a highly civilised community, if the cases were at all numerous. In the New South Wales Act, it is stated that the Board of Health *may* order the leper to be removed to a lazaretto, evidently reserving the discretionary power to permit isolation in the Lepers' Home.

The Norwegian physicians, fortified in their opinions by their long and intimate acquaintance with the disease, and by the results of isolation in their own country, are strong advocates of compulsory isolation, but of compulsion tempered with mercy and consideration. In Norway, poor lepers who cannot provide for themselves are now obliged to enter the asylums. By the law of 1885, the Sanitary Commission of the Board of Health in each district has the right, as we have previously seen, of ordering a leper, if he wishes to live at home, to have his own room, at least his own bed; that his clothes ought to be washed separately, that he must have his own spoon, fork, knife, etc., and *if he cannot or will not submit to this regimen, he is obliged to enter an asylum.*

Dr. Kaurin, medical superintendent of the Molde Asylum, states (*Journ. of the Leprosy Invest. Com.*, January 1891), for example, 'In every country where there are lepers, annual statistics of their number should be procured, to show the decrease and increase of the disease, and then a sufficiently large number of hospitals should be established. It must be fixed by law that each leper shall either be isolated in his own home, that is, he shall have his own room, his own bed, his own knife, fork, and spoon, his own clothes, etc., or, if this cannot be effected, he must be brought to a leper asylum. As is the case with every infectious disease, isolation is the only and best measure to prevent leprosy from spreading, and gradually make it disappear.

'In countries where it might be difficult to isolate the lepers in their own homes, or to send them to leper hospitals, attempts might be made at isolating the lepers in certain parts of the country, where parcels of land could be gratuitously given to them, and where they might live in matrimony, and on the whole have their freedom as much as possible. There ought to be some functionaries living among them who, for one thing, should look after the strict observance of the isolation, and who should—which is of the greatest importance—bring the children immediately after they are born to a special infant asylum, where no intercourse with lepers should be permitted. By such means the children of lepers might probably keep sound and healthy, for, as above mentioned, I do not consider the disease hereditary, and I beg

to remark that experience has proved that children who have leprous parents, but are taken away from their leprous relations immediately after their birth, generally will be saved from the disease.'

Dr. Hillis, whose experience has special reference to Guiana, states that he would place—as a remedial measure—segregation of the affected in separate asylums, considering the good results that have followed segregation where it is enforced to be a sufficient answer to those who are adverse to restriction.

Dr. Castor, whose experience is in the same colony, recommends segregation, either pure and simple, or in a modified form. He considers that it is much to be desired that lepers should be registered.

Those who only know leprosy by accounts of the ravages and mutilations of the advanced disease, must learn with astonishment that one of the practical difficulties in connection with the management of lepers is the question of their marriage. Dr. Castor, for example, in his report of the asylum at Mahaica, British Guiana, 1890, complains that during the year several marriages had taken place between the leper inmates of the male and female asylums, the clergymen having power to celebrate these marriages without the consent, or even knowledge, of the medical superintendent. Dr. Castor very properly remarks that, although it is impossible to interfere with the marriage of lepers outside the asylum, yet when they voluntarily seek admission, and are fed and clothed at the public expense, some restriction should be put on their marriage. In tubercular leprosy, at all events, running its usual course, the idea of marriage is one that should be discouraged in every possible way, considering that within a comparatively short time one or both of the married persons will become miserable, helpless, and bed-ridden. The marriage of a leper with a sound person should, it seems to us, be not only discouraged but strictly forbidden. Dr. Castor's opinion, that the sexes in leprosy should be strictly segregated, must meet with general approval.

A law enforcing the compulsory isolation of lepers can only be effective in any country where leprosy is common, if it is strongly supported by public opinion. Those who have

little practical experience of lepers and leprosy must not forget that for a considerable time, and often for years, the stricken member of a family suffers comparatively little, requires little attention, is not specially repulsive in appearance, is as full of love for his parents, and brothers and sisters, and in return is as much loved by them, as if he were not afflicted by the disease. To realise what compulsory isolation in an asylum of all the lepers in a country would mean, when such cases are considered, it is only necessary to apply in imagination the same law to consumptives when their disease runs a slow, insidious course. What would the consequences be in England if a law were passed that every husband, or wife, or child, who developed a slight cough attended with weakness, and in whom slight physical changes were detected in the apex of one lung, should, on the strength of what his probable fate would be several years afterwards, be immediately and forcibly conveyed from his family with no, or scarcely any, hope of ever again rejoining them? Imagine the evasion, concealment, and subterfuge that would be practised, and the difficulty, if not impossibility, of passing a law which would be effective! As a matter of fact, already, and with no compulsory isolation, in all but the very poor, leprosy is in most countries concealed as long as it is possible.

Case for case, there would be the same difficulty in isolating the leper in the early stages as there would be in the case of the consumptive, the unalterable principles of human nature which would have to be overcome being the same in both instances; but in the case of leprosy, the principle of the protection of the greatest number, although doing violence to individual feeling, would be more justifiable than in the case of the consumptive. Although both diseases are fatal, leprosy is a more cruel disease, and inspires greater terror. Its victims are less numerous, and isolation therefore more possible, but above all, in the case of leprosy isolation would be more effective.

Whilst the domestic animals suffer so largely from consumptive diseases, it is impossible to safeguard human beings completely from the tubercle bacillus; but as the leprosy bacillus lives only in the human body, complete and effective isolation would certainly stamp out the disease. The Govern-

ment of any country is therefore justified, in so far as it can be done without infringing the principles of common humanity, in taking the necessary steps to prevent the possibility of the bacillus lepræ being conveyed from the body of a leper to the body of a healthy person. The safety of the people demands that the measures taken should, as far as possible, secure this end; but from the very nature of the case, any measures which are effective presuppose co-operation of the community at large, and of the families in which leprosy has obtained a footing. The chief difficulties in carrying out the provisions of any such law are ignorance, poverty, and indifference — conditions that unfortunately largely prevail in most, if not all, the countries in which leprosy is common.

In India, the task of isolating all the lepers in asylums would not only in many cases have to encounter the opposition of family affection, but would meet with an obstacle of another kind, apparently quite as serious, namely, the financial one.

‘There are, it is estimated,’ Dr. Griffiths remarks (*Journ. of the Leprosy Invest. Com.*, No. 2), ‘half a million lepers in India. The cost of supporting them at Rs.5 per head per mensem would amount to some 300 lakhs of rupees a year (three millions sterling, taking the rupee at 2s.), and this takes no account of the cost of retreats, establishments, etc.’

The best hope for India would appear to be that of educating the people to a better understanding of the contagious nature of the disease, and supplying them with every facility either for removal to an asylum, or, as in Norway, for practical isolation in their own homes. The contagious nature of the disease should be preached in season and out of season, and practical means of disinfection, cleanliness, and avoidance of actual contact taught in every possible way. Such measures are neither heroic nor speedy in their effects, but in proportion as public opinion gained force, the disease would diminish in successive generations. The extinction of the disease in India by any practicable measures cannot be hoped for in the near future; but its diminution can certainly be attained by increasing the segregation of poor and forsaken lepers into well-managed asylums, by

encouraging the natives to fear the disease and shun the unfortunate sufferers, and by instructing the leper's relatives how he may be attended and cared for in his own home with security to others.

Whatever the difficulties may be in India, they are certainly not less in China. There, little or nothing can be expected from the Government, central or provincial. The Chinese are essentially a charitable people, and skilled in organising shelter and distribution of food in times of scarcity; but they are lacking either in the knowledge or in the power of initiative necessary to deal with such a subject as the suppression of leprosy. The leper villages sufficiently indicate the sense of the people on the question, and show that their instinct is to avoid the leper; but in many, if not in all, parts of the empire there is such a residuum of poverty, that there will be always masses of people to whom association with lepers and the remote danger connected with it will be a matter of indifference. The changes that are necessary in China before the population at large can have the requisite knowledge and power of co-operation, and sufficient means to seriously meet the difficulty involved in effectually isolating even poor lepers, are so great and so remote, perhaps even so improbable, that for many generations to come there seems little hope of leprosy losing its hold over the Chinese people.

Something must be gained by the zealous and able men who are now acting as medical missionaries in various parts of China; but their number is so small as compared with the population on whom they have to act, and the conservatism of the Chinese is so extreme in every matter of practice or opinion, that the impression which they can make must, in such a question, for a long time be insignificant. Still their influence must count for something, and when the day comes that Western ideas take some root in China, an increased sense of the dangers of contact with lepers will certainly tend to check the extension of the disease. Nothing of much importance is possible in that country which goes in the face of popular or public opinion, such as it is, and hope for China in this question, as in so many others, is therefore only to be found in the education of the people. In this education, which so far has been undertaken almost entirely by religious

and medical missionaries, lies the only hope of the abatement of leprosy. In the meanwhile, it is incumbent on every country or colony to which Chinese emigrate to take extreme care to prevent the importation of Chinese lepers. The same precautions should be taken before Indian coolies are received into any of the colonies to which they are sent. It seems certain that in some instances they carry the disease with them, and it would be more merciful if in such cases the unhappy coolie were not permitted to leave Hindostan.

The drastic measures by which the people of England freed themselves from the plague of leprosy are hardly likely to be repeated in any country governed by a civilised power; but the measures which are now proving so effective in Norway are well suited to modern ideas of sanitary protection and sympathy with sufferers. To adapt such principles to a large and poor population like that of India is a problem which must be difficult to solve; but in smaller communities, like those in the West Indies, a right appreciation of what the dangers are, and what can be done to meet them, would certainly result in diminution of the disease within a comparatively short time, and possibly in its virtual extinction.

It is certain that if medicine can do little for the unfortunate leper, medical knowledge in its widest sense can show peoples and governments how, in leper countries, healthy persons may escape the disease.

The first part of the history of the world is the history of the human race. It is a history of progress, of discovery, of conquest, and of suffering. It is a history of the struggle for existence, of the struggle for power, and of the struggle for knowledge. It is a history of the human mind, of the human heart, and of the human soul. It is a history of the human race, of the human race, and of the human race.

The second part of the history of the world is the history of the human race. It is a history of progress, of discovery, of conquest, and of suffering. It is a history of the struggle for existence, of the struggle for power, and of the struggle for knowledge. It is a history of the human mind, of the human heart, and of the human soul. It is a history of the human race, of the human race, and of the human race.

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DESCRIPTION OF PLATES

PLATE I.—Showing some of the appearances of tubercular leprosy in the fully developed stage.

The poor boy whose likeness is shown in the photograph was born in Barbadoes in 1872, of healthy parents, and is, therefore, now about nineteen years of age. He was brought to England for education when he was seven years old, being accompanied by a relative with whom he lived, and who sent him to a day school. There was at the time no mark anywhere on his skin.

When he was in his eleventh year, patches were noticed on the right cheek and left hip, and were cauterised, the scars being still visible.

The disease progressed in the usual manner, and in nine years has reached the stage which is indicated in the photograph. The tubercular infiltration in the lips, which is indicated in the photograph, prevents the opening of the mouth, and leprosy disease of the larynx has reduced his voice to a low hoarse whisper. An acute attack in the larynx during the past winter threatened his life, and it is probable that in this direction the chief danger at present exists. The symptoms and sufferings of which this poor lad is the subject do not materially differ from those of ordinary cases of tubercular leprosy, and need not therefore be further described. The disease appears to have entirely cut him off from his family, but in the Infirmary he finds all the care and alleviation of which his condition admits.

This boy and the man whose photograph is shown in Plate II. are fortunate in finding themselves under the skilful and unremitting care of Dr. Larder, the medical superintendent of the Infirmary.

PLATE II.—This, like Plate I., is a reproduction by the Autotype Company of a photograph of E—— Y——, who is suffering from nerve leprosy, and is at present, and has been for some time, under

the care of Dr. Larder in the Whitechapel Infirmary. Fuller notes of this man's case will be found in the *British Medical Journal* for July 20th, 1889, where the author of this book published a somewhat detailed account of the symptoms, in order that the facts on which the diagnosis had been made should be accessible to the profession.

No material change has taken place in the patient's condition since that time, and the following notes are extracted from the author's paper:—

E—— Y—— has a wife and six children alive and healthy. Forty years previously he made several voyages to Riga, and five or six voyages to Corfu and the Mediterranean, and it must have been during one of these voyages that he was infected with leprosy, as with these exceptions he was never out of the country. About six or seven years ago he experienced numbness in the left hand, his attention being specially called to the fact by a knife dropping from his grasp—a characteristic symptom, to which Dr. Hillis has called attention, as being often the first indication which lepers in Guiana have of their becoming lepers. After about six months he felt a numbness in his left foot, and at about the same time his right hand became numb. About four years after the appearance of these symptoms, he lost a part of the fingers of the right hand, the ring finger suffering first.

As upwards of thirty years had elapsed between his voyages to the Mediterranean and the first development of his symptoms, the incubation in this case must have been unusually long.

Both hands and arms are anæsthetic to the elbow, the zone of anæsthesia gradually passing into the sensitive area. The left ulnar nerve is slightly thickened over the inner condyle. In the left hand, the fingers and thumb are drawn down *en griffe*. There are nails on all the fingers, but on the fore and middle fingers they are represented only by thin fragments; and, characteristically, the distal phalanx is represented by a short stump, and on the middle finger this phalanx is shrunken to one-half. On the flexor surface of the forearm there are several large scars produced by burns. There are pigmentless areas on the fingers, extending in streaks into the darker pigmented skin of the hands. Right hand: distal phalanx shrunken to about half its length, but still covered by skin and nail, and of the fore-finger only the proximal phalanx is left; in the middle finger the distal phalanx is lost, the hand being covered with a rough substance which looks like the

remnants of a nail; of the ring finger and little finger only the first phalanx remains. Over the ends of all the mutilated fingers the skin is firmly drawn, the bone being covered with fibrous tissue. On this hand also there are pigmentless patches.

In both hands the muscles of the thenar and hypothenar regions are much shrunken, the palmar fascia is inelastic and contracted, with the flexor tendons projecting against it.

Anæsthesia is complete in both legs up to the knees. On the right foot the big toe is shrunk to about one-third, on account of the disappearance of the proximal phalanx, and of the head of the metacarpal bone. There is an ulcer on the ball of the foot, and the skin is brawny and hard up to the middle of the leg, and scaly over its whole area. In the left foot the big toe has disappeared, no cicatrix being left. The distal phalanx of the second toe has disappeared, and is represented by fibrous tissue. There is ulceration on the ball of the foot. He is not able to move the toes, though he can slightly flex the fingers of both hands, but cannot extend them. In the left hand he cannot undo the *griffe*.

The ulcerative inflammation of the cornea, still present at the time we write, has now, we are informed by Dr. Larder, lasted more than three years.

In the right eye the affection of the cornea is shown—although necessarily very imperfectly—in the photograph. The poor man has the characteristic pale, anæmic expression of nerve leprosy, and suffers continuously from severe lancinating pains in both legs.

PLATE III.—The object of this Plate is to show the size and shape of the leprosy bacilli, and, for the purpose of comparison, the size and shape of the tubercle bacilli; and also to illustrate the fact that leprosy bacilli are contained in cells.

The Plate consists of four figures, reproduced by the Autotype Company from negatives by Mr. Andrew Pringle. Although they have not the diagrammatic effect of drawings done by hand, they reproduce the bacilli, as regards size and form, with a precision and fidelity to which, in such minute objects, the draughtsman cannot attain. They show that, morphologically, leprosy and tubercle bacilli are distinct, and to persons familiar with microscopical preparations of this kind, and with micro-photographs, they prove that leprosy bacilli are contained within cells. Figs. 3 and 4, in which the latter point is shown, are reproductions of preparations

by a method which was tried for the first time, and which is capable, with some experience, of producing more effective preparations, and, therefore, more effective photographs. Those who are acquainted with the difficulty of obtaining good micro-photographs will understand, when they have examined these autotype reproductions, how perfectly demonstrative are the original stained preparations, and the photographs prepared from the negatives.

We are indebted to Dr. Larder, of the Whitechapel Infirmary, for assistance in obtaining the material from which the preparations were made, and especially to a friend, Mr. E. E. Henderson, of St. John's College, Cambridge, for the care which was necessary to secure suitable preparations for Figs. 3 and 4. The principles on which we proceeded to obtain preparations, showing beyond possibility of cavil that leprosy bacilli are contained in cells, were these: (1) to obtain isolated cells from a discharge of a leprosy ulcer, so as to obviate the fallacy of mistaking any interfascicular spaces for cells; (2) to preserve the nucleus, and prepare it in such a way that it would stain easily in logwood; (3) to stain the preparations with a dye that would show the cell substance around the nucleus; and (4) to introduce nothing in the mode of preparation which would interfere with the capacity of the bacilli for stain.

These principles were carried out by getting a minute drop of discharge from the secretion of an ulcer on the back of the hand. The small drop being placed on a cover-glass, another cover-glass was superposed on this one, and the two glasses were then gently moved over each other, care being taken not to use so much pressure as to break all the cells. They were then, before being allowed to dry, placed for a few minutes in a mixture of absolute alcohol and water, which was gradually strengthened until they were finally put in absolute alcohol. The following day they were stained by fuchsine for the bacilli, logwood for the nuclei, and fluorescin for the cell substance. If we were to repeat the process, we should use the fluorescin in more concentrated solution, and allow it to act longer. Control experiments were made with preparations strongly acted on with nitric acid. By this method, it will be found that a sufficient number of cells escape destruction to show that the bacilli develop within the cell, although the breaking up of cells, both in the discharge of the ulcer, and by the friction of the cover-glasses, sets a number of bacilli free.

Fig. 1. Leprosy bacilli from a leprous ulcer, prepared by the ordinary fuchsine method. The characteristic tendency of the bacilli to group is shown in the dark clumps, which under the microscope can be seen to consist of agglomerated bacilli. In some of the bacilli the protoplasm collects at one end of the rod, which then acquires the club-shaped appearance that is associated with the development of the organism. Magnified a thousand diameters.

Fig. 2. Cultivated tubercle bacilli in the seventh generation, from a preparation belonging to Mr. Pringle. As compared with the leprosy bacilli, it will be seen that they are more uniform in size and shape, and that the protoplasm fills the sheath more uniformly. There is an absence of the club-shaped end. Magnified a thousand diameters.

Fig. 3. Two cells, in the centre of which the contours of the nucleus can be distinctly made out. The broken nucleus of a third cell, with a somewhat indistinct contour, is shown on the border of the preparation. Under the microscope it is seen that in these two cells the nuclei are broken into several pieces, and that there are bacilli between the pieces. Magnified a thousand diameters.

Fig. 4 is from a preparation in which the staining manipulations were specially directed to bring out the relations of the bacilli to the nuclei, the cell substance being unstained. In two cells which are close together masses of bacilli are seen grouped around and close to the nucleus, which, in the right-hand cell, is still entire, but is beginning to break up, and in the left-hand cell, in which the bacilli are very numerous, is already broken. The shape of the nucleus, and its relations to the grouping of the bacilli and the form of the groups, shows the characteristic cellular appearance, even in the Figure. In the preparation it is unmistakable. Magnified a thousand diameters.

APPENDIX

NOMENCLATURE

THE references to leprosy in various languages extend backwards for more than two thousand years, and during that period the disease has been known under a great variety of names. As the subject of nomenclature has some interest from an antiquarian and literary point of view, we subjoin a list of some of the words which have been used to designate the disease in several ancient and modern languages.

Egyptian.—Uchetu.

Sanscrit.—Kushtha.

Hebrew.—Zaraath (Saraath).

Greek.—Lepra. Elephantiasis.

Latin.—Lepra vera. Elephantiasis Græcorum.

English.—Leprosy.

French.—Lèpre vraie.

German.—Lepra. Aussatz.

Spanish.—Elefantiasis de los griegos.

Italian.—Elefantiasis dei Greci. Lepra, lebbra.

Another Hebrew title is 'Bohak'—*freckled spot* in the Authorised Version, and *tetter* in the Revised Version; 'bohak' in the Arabic Version. Used for white leprosy, most of the cases so designated being vitiligo. *Baras*, an Arab term, in addition to meaning leprosy, means white spots upon cattle; *abraz*—a leper, also lizards with white or dark spots, land made bare of herbs by pasturing, land abounding in herbs of various colours, a spotted or piebald horse. The Turkish or Tartar word for leprosy is 'Ala,'

which also means speckled, spotted, striped. The Greek term *lepra*, *lepros*, means rough, scabby. The Arabic and Turkish names refer to the discoloured spots on the skin, the Greek both to the whiteness and roughness of the affected spots, the Hebrew word points to its malignant nature as 'a blow' or 'grievous visitation.'

In the interior of Africa, leprosy is named, according to Richter, *damadyand*, *didyam*, and *dschiddam*; according to Horst, *sghidam*, etc.

According to Danielssen and Boeck, leprosy in India is called *fisanikhun*, or *khora*; at Surinam, *boasi*; the negroes name it *kohan*, *koban*, and *kokobe*. In Greece the name is *lova*; in Italy, *il male di san Lazaro*, *la lebbra*, *il male di fegato*, *male di Commacchio*; in France, *ladrerie*, *grosse maladie*, *lèpre*; in Holland, *melaatscheid*; in Germany, *maltzell*, *malatzey*, later *aussatz*, in times more distant *prutssiill*, and in old Anglo-Saxon, *seo mycle adl*, *the myckle ail*. In Iceland, it is called *holdsveiki*, *limafalls-syki*, *likthrá* (*likprá*). In Sweden, it is named *spetalskan*; in Denmark, formerly it was called *likwoerthing*, or *likwoerthingsot*, and latterly *spedalskhed*. In Norway, it is often spoken of as *arvesygen*. The Anglo-Saxon term for leprosy was *hreoƿ* and *licpræwer*.

Amongst the synonyms of anæsthetic elephantiasis of the Greeks occur the following terms:—*lepra alopecia medii ævi*, *l'elephantiasis alopecia des sauvages*, *la lepra articulationum*, *la lepra Arabum anaïsthetos*, *la lepra mortificans*, *la lepra Græcorum squamosa*, *le leuke*, or *vitiligo alba* of Celsus, *la baras*, *la leuke vulgaire*, *le limafalls siki*, *la lepra phlegmatica*, *le zaraah*, *la lepra rheumatica*, *la spinoplaxia indica*. In the West Indies, *joint evil*.

The following synonyms are used for tubercular elephantiasis (Greek):—*la lepra elephantia et leontina medii ævi*, *la lepra tuberculosa* or *nodosa*, *la lepra Arabum tuberculosa*, *l'elephantiasis orientalis*, *legitima*, *leonina*, *tuberculosa*, *le cancer totius corporis*, *le koldoveik*, etc.

The Coptic term for leprosy is *on seht*; in Palestine it is called *jazam*.

There are several terms now commonly used to express the chief types of leprosy. The form which is characterised by leprosy infiltration in the skin is generally known as tubercular, or tuberculous, or tuberculated leprosy. For this form Leloir proposes the name *Lèpre systématisée tégumentaire*. The form in which the disease is localised in the nerves is variously known as anæsthetic,

non-tuberculated, and nerve leprosy. To this latter form Leloir proposes the name *Lèpre systémathisée nerveuse*. (Cases in which the symptoms of both types are combined are termed cases of Mixed Leprosy.) In this work we have, for the sake of simplicity, employed the terms Tubercular Leprosy for the first variety, and Nerve Leprosy for the latter.

[In the following part of the *Appendix* we give a brief summary of the information on certain points which has reached us whilst the book has been in the press.]

CULTIVATION OF THE LEPROSY BACILLUS— EXPERIMENTS IN INDIA.

IN the *British Medical Journal*, June 6, 1891, Mr. Kanthack and Surgeon-Major Barclay, members of the Leprosy Commission, published a paper, written in India, in which they state that they had apparently been successful in cultivating the bacillus lepræ. Working with aseptic precautions, they dropped portions of leper tissue into three tubes of nutrient bouillon. One was contaminated; two they considered remained pure. Three days afterwards cover-glass preparations from these two showed bacilli, which they believed to be identical with the bacilli of leprosy. They inoculated with the bouillon culture a glycerine-agar tube, and on the fifth day they found in it a small slender bacillus, which they considered to be the same bacillus as that grown in the bouillon. It did not retain fuchsine with the same tenacity as the bacillus found in the tissues, but morphologically and in other respects they considered that it resembled closely the bacillus lepræ. The other bouillon tube gave the same results. This bacillus was re-inoculated from the agar cultivations on gelatine and glycerine-bouillon tubes, in which it grew, forming a greyish white pellicle as before, in a week or ten days. It did not grow on potato. They considered that their bacillus was a pure cultivation of the bacillus lepræ for the following reasons:—(a) the manner in which the material was obtained excluded contamination from outside; (b) two cases under exactly the same conditions gave absolutely identical results; (c) in the original tubes, free bacilli, which undoubtedly were leprosy bacilli, were found, and these gave rise to a growth on agar-agar, which, chemically and morphologically, agreed with the bacillus of leprosy with the slight differences stated above; (d) cultivations on gelatine and glycerine-bouillon were still more convincing.

The same authors published a further article in the *British*

Medical Journal for June 20, 1891, in which they enter more fully into the staining qualities of their bacillus.

'On returning,' they remark, 'to our gelatine cultivations the following was observed:—As described in our first communication, after inoculating a gelatine-peptone tube the first thing noticed is the formation of a characteristic skin floating on the surface of the liquefied gelatine. The gelatine liquefies quite uniformly and slowly. The liquid gelatine under the pellicle is "stringy" and "mucoid." When the growth is two weeks old an opaque whitish sediment will be observed at the boundary line between the liquefied and non-liquefied gelatine. On removing material from this sediment it was found so mucoid as to be removed with difficulty. Heating the cover-glasses carefully, and staining them according to Ziehl's method, we found that all bacilli retained the stain most beautifully. The same result was obtained with all the tubes examined, amounting to over twenty.'¹

About the same time that Mr. Kanthack and Mr. Barclay wrote this independent communication to the *British Medical Journal*, a communication was received by the Secretary of the Leprosy Investigation Committee from Dr. Beaven Rake and Dr. Buckmaster, to the effect that they also had independently succeeded in cultivating the leprosy bacillus (vide *Journal of the Leprosy Investigation Committee*, No. 3). Further and fuller communications have been received from these gentlemen, who consider that they have cultivated the leprosy bacillus by two different methods; first by inoculating fluid obtained from a blister over a healthy part of the skin of a leper with fluid from a blister over a leprosy tubercle. From what they consider to be a pure cultivation of leprosy bacilli in this tube, they transplanted the culture first to bouillon, and then to gelatine and glycerine-agar. By the second method, adopting aseptic precautions, they allowed small portions from the centre of a tubercle to fall into bouillon. Agar tubes containing cultures of the supposed leprosy bacillus were sent to London, where they have been examined by several bacteriologists. As it is understood that the bacillus found in

¹ In the *British Medical Journal*, August 29, 1891, the authors state that they had sent tubes and specimens to Professors Fraenkel and Baumgarten, who could not acknowledge the identity of the bacilli with the leprosy bacillus, and they therefore consider that they had been misled by the resistance of their bacillus against acids.

these tubes does not correspond in morphological characters with the leprosy bacillus, there may have been some accidental contamination.

The experiments will, of course, be repeated under conditions probably more favourable than those which prevailed at the time the tubes were charged.

Dr. Rake and Dr. Buckmaster have sent to Dr. Abraham two cover-glass preparations of the cultivated bacillus, one by each method, which were shown by him at the recent meeting of the British Medical Association at Bournemouth, and to persons interested in London. We have been privileged to examine these slides. They show ovoid spores, shorter and thicker than the leprosy bacillus as ordinarily observed. The few isolated rods which are visible in the preparations are also thicker than the leprosy bacillus as seen in leprosy ulcers and tissues. Spores are also seen in one of the slides in well-marked chains of streptococcus.

The investigation is still in an early stage, and practical bacteriologists will await with interest the further developments of this research.

PATHOLOGY OF LEPROSY—'GIANT CELLS.'

WE have stated in the text that the structures called by pathologists 'giant cells' had not been observed by ourselves and other observers in tubercular leprosy. Since, however, that part of the book was written, Dr. Abraham has shown us sections of a tuber in which these structures are plainly visible, and has referred us to Plate XXI.*a* in Hillis's book, in which drawings of giant cells by himself are well shown. Being quite satisfied that these so-called 'giant cells' are nothing but the altered coats of blood-vessels, in which the nuclei of the endothelium are usually very distinct, the lumen being filled with a dead granular material, we do not consider the fact of primary importance; indeed, it is only to be expected that a chronic destructive process like that of tubercular leprosy should occasionally lead to slow changes of this kind. The chief interest of the fact lies in its being a proof that this form of the 'giant cell' of authors is not especially distinctive of tuberculosis, or, indeed, that it has any special diagnostic value. [Thoma has also described 'giant cells' in leprosy.]

TUBERCULIN.

DANIELSSEN (*Monats. f. Prakt. Derm.* No. 3, August 1891) reports that in tubercular lepers treated by tuberculin, although no bacilli were found in the blood before the injections, they were found free in the blood after the injections had been made; and the bacilli so observed presented no marks of degeneration, but seemed in every way to be normal in appearance.

CHINA.

THE following additional information has been obtained from China. Our correspondent states that it is within his own knowledge, from personal observation, that leprosy exists in Hang Chung Fu and surrounding district, and that it is within his knowledge, from reliable information, that it exists in a city in the north of the neighbouring province of Si Chüen, and that in that part of China the great majority of cases occur amongst the comfortably-off farming class. The people there do not regard leprosy as contagious, a member of the correspondent's household, an errand-boy, having had tubercular leprosy for six years—although, even in this case, the other Chinese did not eat with him. The correspondent, however, considers such action on the part of the Chinese to be due to their 'loathing the disease as unclean, rather than to avoiding contact to the patient as actually contagious.'

(This letter affords additional proof of the extent to which leprosy is wide-spread in the Chinese Empire.)

VACCINATION IN LEPROSY.

IN the *Monats. f. Prakt. Derm.*, vol. xiii. No. 1, the report of a case is extracted from the *Occidental Medical Times* of a leper who was vaccinated in 1878, who a year afterwards became leprous, and who at present has a large anæsthetic scar at the point of vaccination. This man has healthy parents, and of two brothers and three sisters one had died of tubercular leprosy. He is twenty-five years of age, and has mixed with lepers all his life.

AUSTRALIA.

IN a *Report on Leprosy in New South Wales*, printed by order of the Legislative Assembly, 26th May 1891, seven cases of lepers of European parentage in New South Wales are described by Dr. Ashburton Thompson.

In case 1 the patient frequently purchased vegetables in the markets from Chinamen in Sydney. In case 2 the patient lived on an old gold-field where there have always been Chinamen within his recollection. In case 3 the patient occasionally associated with a leper, now dead. He was present at this man's death, and assisted to place him in the coffin. In case 4 the boy habitually bought vegetables from Chinese traders (in common with nearly every family in Sydney). In case 5 the man is said never to have had any special communication with Chinese. In case 6 the man had lived mostly in country districts, but also for several years in Sydney. In case 7 the patient was the chief and almost only attendant on her brother, who became a leper in 1880, and died of the disease in 1889. The first symptoms in her case began in 1884.

Cases 3 and 7 are, as we believe, good illustrations of the transmission of leprosy by direct contagion.

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