

## **On leprosy and elephantiasis / by H. Vandyke Carter.**

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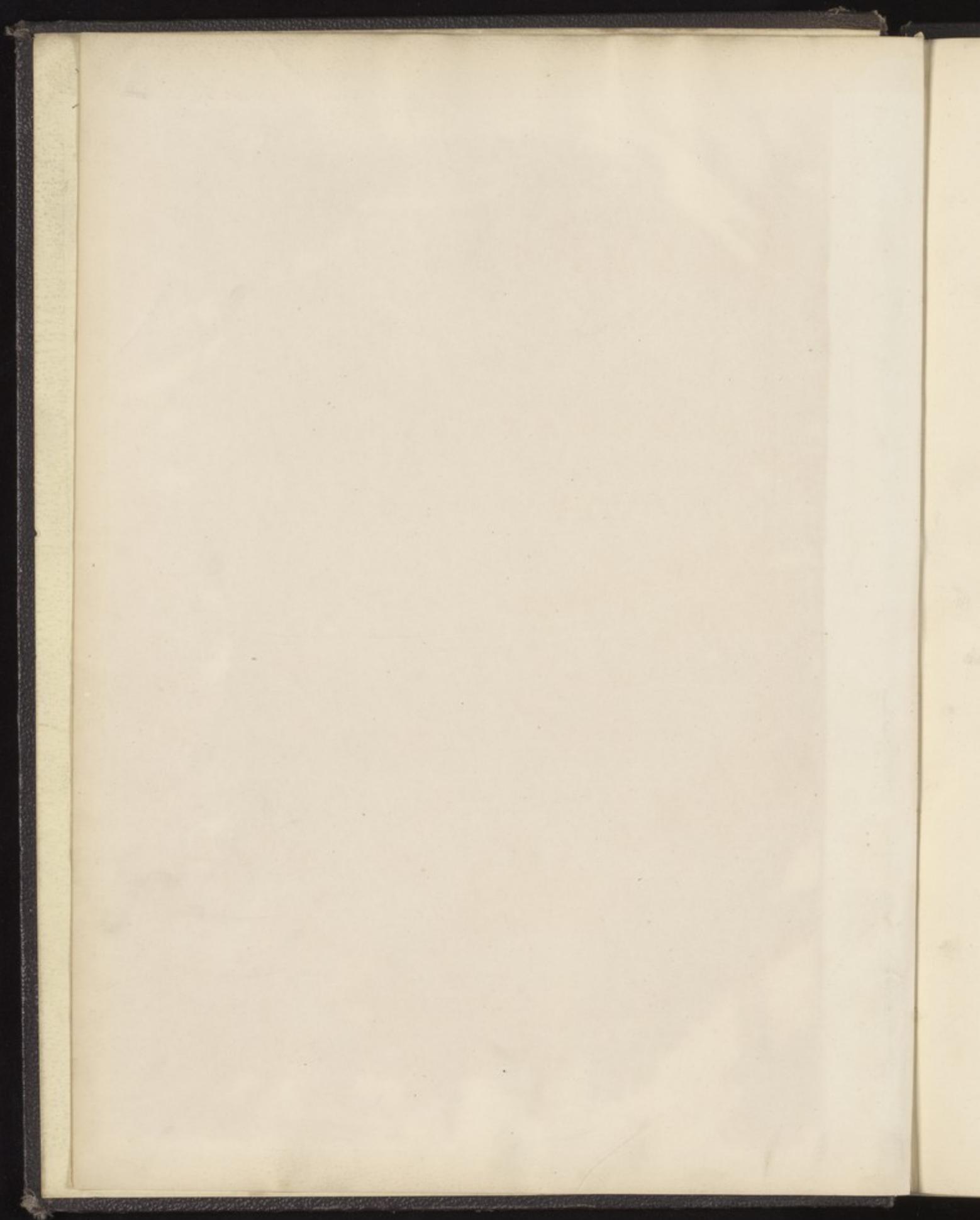
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ON

# LEPROSY

AND

# ELEPHANTIASIS

WITH PLATES

By H. VANDYKE CARTER, M.D. *London*,  
H.M. INDIAN MEDICAL SERVICE.

PUBLISHED UNDER SANCTION OF THE SECRETARY OF STATE FOR INDIA.



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PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY,  
FOR HER MAJESTY'S STATIONERY OFFICE.

1874.

L E T T E R S

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## PREFACE.

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THE intention sought to be fulfilled in the following Memoir was two-fold. First, I desired to have published in England certain drawings and other materials respecting Leprosy, &c., which I had already collected, and which appeared to me of sufficient interest to engage more general attention than was otherwise possible. Next, and hardly less important, I wished to bring to notice, on behalf of India more especially, the valuable facts and opinions regarding the leprous disease, which have been elicited in Norway, and with which it was my good fortune to become acquainted during the last autumn. Already, indeed, some part of this information has been communicated in my *Report on Leprosy and Leper Asylums in Norway, &c.*, which was presented to the Secretary of State for India in Council, in November 1873; and hence to that Report I may now refer, as containing a fuller account of the State treatment of leprosy by segregation of the affected, than will be found in the following pages, where much repetition has necessarily been avoided. But all that relates to the nature, characters, and medical treatment of the great malady itself, was reserved for the present Essay; and I trust that the newer matter which is now for the first time put into English, will prove to be both interesting and valuable as aid to further inquiry in India. I have spared no effort to make known all that I had collected upon these subjects; and, once for all, would remark that the present Memoir is intended to be suggestive rather than exhaustive, with regard to the important topic on which it treats.

The supplementary observations on ELEPHANTIASIS refer to a subject which, of itself, is not devoid of considerable interest.

Having in all places mentioned the sources of information, whence much material in addition to my own was derived, it remains to observe that while the text of this work is original,\* the foot-notes contain a commentary based upon recent information derived from every available quarter; and whenever possible, I have quoted direct from author or document. Where it seemed to me desirable, I have not hesitated to copy largely; and for translations from the Norwegian, French and German, I am alone responsible. I should here add, that to Dr. Gavin Milroy I am indebted for the use of valuable documents referring to Leprosy in the West Indies, and not a few facts of importance have been derived from Dr. Milroy's very interesting Report on Leprosy and Yaws, &c. To Dr. Tilbury Fox I am indebted for free access to papers

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\* See the Transactions of the Medical and Physical Society of Bombay. New Series, vols. vii. viii. and xi. (1926.)

bearing on the subject of the 'great malady,' which were collected from various parts of the world, in response to the "Scheme for obtaining a better knowledge of Endemic Skin Diseases, &c.," which two years since was drawn up by Dr. Fox and Dr. Farquhar; and I only regret that the limited time at my disposal, has impeded larger use of these instructive memoranda.

In conclusion, I look forward to the time when India will become not only a field of study for two of the greatest plagues of man—leprosy and cholera; but also a constant source of thorough and practical knowledge respecting these and other indigenous maladies, to cope with which is part of the duty of a large section of her Imperial Executive Staff.

London,

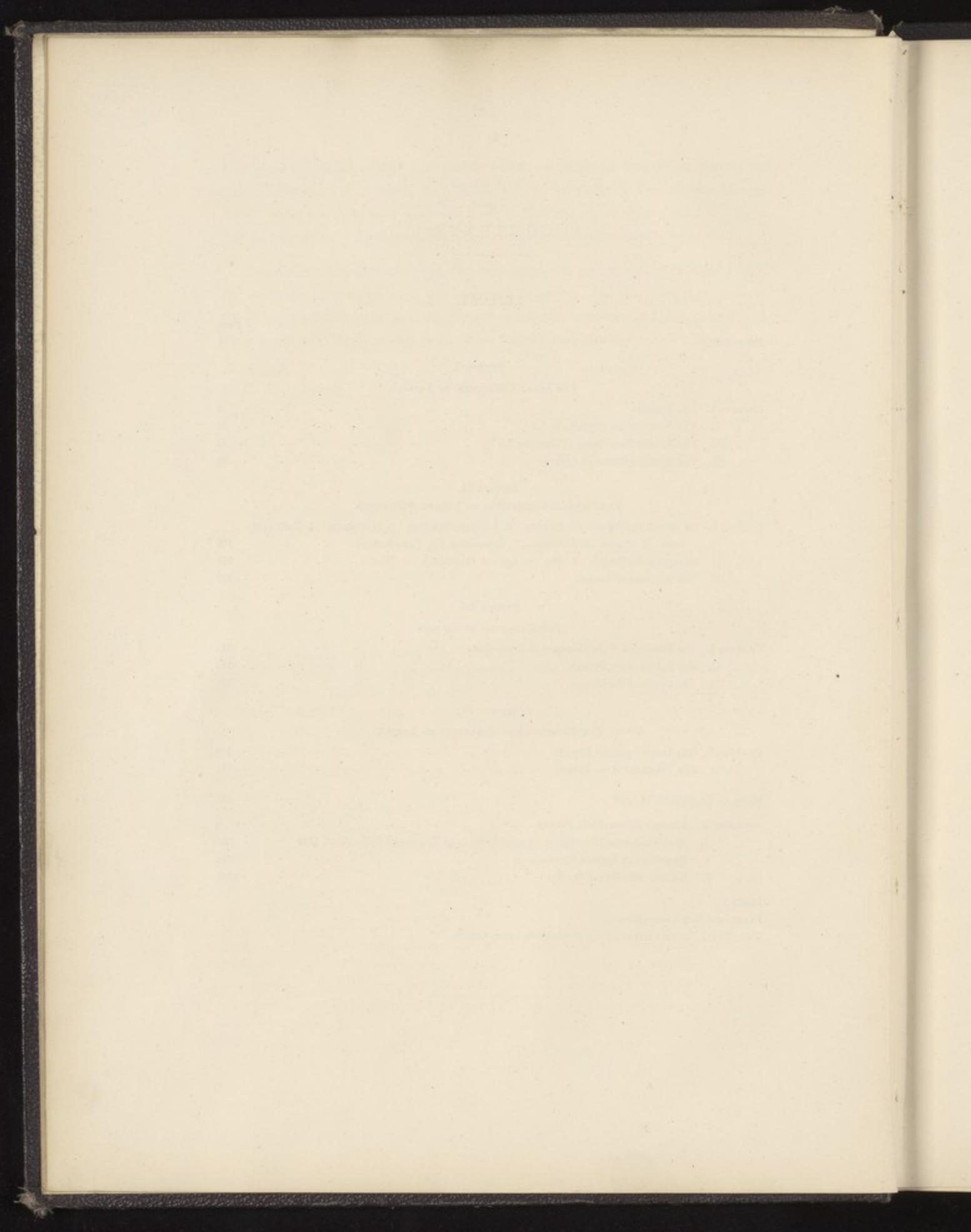
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## INTRODUCTION.

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It is neither a short nor easy task to describe such a many-sided disease as leprosy; and I should not have attempted the present compilation, had it not become very apparent to me that this affection is essentially the same, in the two widely diverse countries of Norway and India.

As regards the carrying out of the work, I have maintained a division of the subject concerned, which many years ago (1862) seemed to me to be the most correct; and I have here separately considered the Eruption, Nerve-affection and Tubercular skin-deposits peculiar to leprosy. Then the Morbid Anatomy of the disease is described; and having thus passed in review the local characters of the complaint, I proceed to furnish its general characters, as regards first the malady, and next, its subject or the leper considered as an individual. A summary of Diagnostic features is added.

The Pathology of leprosy—embracing prevalence, nature and causes of the disease—is shortly discussed; and here, more perhaps than in other parts, I have been impressed, on the one hand, by the poverty of information which was accessible to me, and, on the other, by the admirable adaptability to such facts as are already ascertained, which the theory of the chronic infection-nature of leprosy has presented to notice. This malady has always shown specific characters too decided to warrant extreme views of its nature; and in it, the dyscrasic character seemed to be sufficiently well marked. Yet the circumstance that robust and seemingly healthy men and women will abruptly exhibit signs of leprosy, long since struck me as a very remarkable one; and finding, as I did, that the nerve-disease is predominant and that visceral lesions are not apparent even in advanced cases of leprosy, it was not unnatural to conclude that evidence of such original dyscrasia was wanting. And in one sense I was probably right, for admittedly, the contamination of the system appears to be not a primary but rather a consecutive event. That the lymphatic glands are, like the same in scrofula, specifically affected, I had also ascertained; but not being in the way of current ideas of pathology, I had not, in distant India, applied this fact, as others in Europe are now applying the similar data for scrofula—in explanation, I mean, of systemic infection of the frame. Hansen of Bergen, who studied in Germany, has, however, made this application of phenomena; and since Danielssen inclines towards the new view, I need not hesitate to do so. There remains still to adapt the extra-ordinary nerve-affection of leprosy, and the attempt has been made by assuming that ‘nerve-lepra’ is, after all, hardly a specific affection; for both Virchow and Hansen consider the leprous nerve-disease to be mainly akin to ordinary, or traumatic ‘neuritis.’ Even if this view be allowed, there yet remains the fact of the nerves being so especially implicated in leprosy; and in virtue of my own observations, I must hold this feature as a fundamental one. But as far as the order and course of phenomena, and their probable cause, are concerned, the hypothesis of a nature in leprosy like to that of scrofula, syphilis—and I had almost added pyæmia, small-pox, &c.—seems to offer by far the best clue to their comprehension. Perhaps the vehicle of infection is essentially of the same order. Meantime, I am aware of the consequences of these admissions—the hereditary nature

of leprosy must be limited to an innate proclivity or predisposition to disease. I had always regarded as unsatisfactory Virchow's definition, preferring to regard such predisposition as a germinal state of the 'fons et origo mali,' and being rather disposed to adopt the theory of pangensis with reference to this subject; but for a while, at least, the question may be re-opened in anticipation of its further elucidation by study of the particulate contagia, and by synthetic experiment.

The subjects of prognosis and treatment then follow; and the latter I have endeavoured to consider in some detail, but under much pressure of time. I wish it could be said that practical physicians, like Danielssen and Boeck, had to pass onwards a large faith in the value of therapeutics, as applied to leprosy. But it will be long before abated ideas on this head filter through to the inexperienced, and especially to the Oriental mind; and it may yet be almost vain to say that by no known drug, inwardly administered or outwardly applied, a peccant substance seated in the midst of the tissues can be specially reached, or if reached, destroyed. The doctrine of the elective affinity of drugs for the blood or tissues, seems to be less firmly seated now than formerly. Respecting leprosy, I have endeavoured to express the probable facts of the case, and would not for a moment intermit therapeutic effort; only this should be rationally, and not empirically conducted. Under the former head I should not include the excision of leprosy glands, with the same object as is done in scrofula; still there is, in such operation, the idea to be kept steadily in view, viz., the presence of a 'materies morbi,' which it is desirable to effectively get rid of. The value of collateral and more general measures of treatment in leprosy remains undisturbed, and search for true remedies is yet our imperative duty.

Lastly, I have to mention that the terms and definitions here employed, have not been chosen without consideration. 'Elephantiasis' is a name which is now unsuited to leprosy. 'Lepræ vere' is an expression which was doubtless intended to be but temporary. The *λεπροι* (plural) of Hippocrates probably did not refer to true leprosy; but I have long had an impression that the earliest form of leprosy which became known to the Greeks, may have been the eruptive, or eruptive and nerve-form, which is yet the commonest in the East (whence their malady came), and that this was the reason of the word *Lepra* being at first retained in connexion with leprosy. Afterwards, this disease may have become more severe (*i.e.* tubercular) in its course through colder climates; and hence the term '*Lepra*' was abandoned and '*Elephantiasis*' substituted, as being more appropriate.

Regarding the several phases of leprosy as needing discrimination, I propose to designate them as follows:—

*Species* - *Lepra* (Arabum).

*Sub-species* - 1. *Lepra leprosa*. *Syn.* *L. maculosa*.

2. *Lepra nervosa*. *Syn.* *L. anæsthetica*; *L. levis*, &c.; *L. non-tuberculosa*.

3. *Lepra nodosa*. *Syn.* *L. tuberculosa*.

1. Is the Eruption. 2. The Nerve-disease. 3. The cumulated form or Nodular skin-disease.

That there is justification for the use of these terms appears from considerations like these—the eruption of leprosy is not a mere macula or spot, but rather a characteristic skin-affection; the nerve-disease is, as a symptom, highly specialised; and the leprosy nodule is something very different from any form of 'tubercle,' in its contents. That it is desirable to separate the latter term from connexion with leprosy, past experience has abundantly shown; and late researches again point to the same requirement, for the suitable discrimination of allied disorders.

## SECTION I.

### LOCAL CHARACTERS OF THE DISEASE.

#### CHAPTER I.—THE ERUPTION OF LEPROSY.

IN giving marked prominence to the eruption of leprosy, I have been led by observation alone. This striking feature, although comparatively unnoticed by most later Western authors, was at one time correctly distinguished by the Arabs and by some Greek writers; and, I may add, is almost solely referred to in the Mosaic and ancient Hindoo descriptions of leprosy. It is so far as I can decide the 'Baras' of the Arabs, the 'Leuke' of the Greeks;\* and by either of these denominations it might now be known.

Thus, at a very early period of my inquiries, I became aware of a difference in the signs of leprosy as seen in the East and in the West; and then learnt that a part of this difference was

\* As to the precise signification of these two terms, the inquirer will, on taking a wide view, find that neither their derivation nor first meaning have been always recollected or carefully preserved. The term 'white spot' must, I suppose, have had its origin amongst a people more or less dark-skinned. Now, so far as may be judged, there has for ages prevailed in the East an innocuous chromopathic affection, which is distinguished by a blanching of the skin, very striking indeed to the eye, and well-meriting the name of leucoderma. Many former writers, and, as may be seen in the Leprosy Report of the Royal College of Physicians, many surgeons in India at the present time, have considered this affection to be the 'baras' of the old Arabian authors. On the other hand not a few ancient authorities have distinctly stated that 'baras' is an early form of true leprosy; and I have, as these pages testify, ascertained that there does occur in this fatal malady, a skin-eruption exhibiting an aspect more or less 'pale' on a dark skin. Leucoderma is, indeed, seen to be occasionally associated with leprosy, that is to say, with loss of feeling and spontaneous mutilation of the extremities; but the instances are far too few to warrant the supposition that the two affections were ever identified as one. It may, however, have

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so happened, or possibly the true pale leprosy eruptions have been mistaken for these mere pigmentary spots; and that hence arose a confusion of terms, which needs to be dispelled. Thus, the Arabs sometimes mentioned 'baras' as having an affinity with 'juzam'; calling some forms of the latter by the name of 'black baras' (Paulus Egineta). Robinson, the surgeon who first introduced the term 'anæsthetic' into connection with leprosy, thought that the discolouration of the skin described by him, may have been the 'baras' of Avicenna; and Winterbottom, who saw leprosy on the West coast of Africa, regarded 'baras' as its worst form, and 'juzam' as the milder. It would be impossible, perhaps, to offer a better illustration of the perverted meaning, which words may in time acquire, than is afforded by the instance under consideration. With respect to the term 'Leuke,' which belongs to Europe rather than to the East, it would be easy to show that its meaning, too, has varied considerably. My own opinion is indicated in the text, and it is because of the manifest need of better precision than now obtains that I have ventured to separate and distinguish the eruptions of leprosy, as one form of the Lepre vera, namely, as '*Lepra leprosa*.' Synon. 'Baras,' 'Leuke,' &c.

certainly due to a greater prevalence, in the former, of certain eruptions on the skin, the like of which, however, as I have lately ascertained, are by no means absent in the West.\*

In order to treat this subject in a methodical manner, it will be necessary for me to observe:—

1. Those alterations in the skin produced by vascular or secretory changes, are not here included in the class of leprous eruptions; hence is eliminated '*Lepra Græcorum*' or Psoriasis.
2. Although such changes in the skin as are due simply to impaired nerve-influence, do strictly belong to leprosy, yet they will be most suitably treated of under the head of leprous nerve-affectations, and amongst the signs of '*Lepra (Arabum) anæsthetica*.'

\* The skin eruptions described and figured in the large work of Danielsen and Boeck (1848) are referred almost solely to the tubercular form of the disease; the only spots mentioned as happening in anæsthetic leprosy being certain pale discolourations, of size from one to four inches, of very irregular form; slightly benumbed and scaly, not constant, but when present, characteristic. At a subsequent date however (1862), Danielsen amended and supplemented this imperfect account; and he has published descriptions, illustrated by three large plates, of the eruption in the anæsthetic form of leprosy. I will, therefore, first state what is now mentioned as regards this form, and afterwards describe eruptions of the tubercular variety. The earliest sign of milder form of leprosy may be one or more faint spots, of a brownish red tint, little elevated above the level of the sound skin and attaining, perhaps, the size of the palm of the hand; they are commonly permanent, remain unchanged for many years, other symptoms then supervening; but usually they increase in size, become more raised, and acquire a deeper tint. They blend with neighbouring patches, so that large surfaces of the trunk or limbs become involved; and, then, their originally circular form is less evident. After a time, the patches become extremely tender to the touch, an itching sensation and a slight scabiness attends them. Then they lose their feeling, especially in the centre, which becomes depressed, and thus an annular aspect is acquired; the interior portion being pale, harsh, and dry, and the hairs upon it blanched. Enlargement of the patches takes place, chiefly, by additions at the circumference of pre-existing spots; and I may here add, that this is also partly the case in India, the individual patches attaining only a certain—perhaps—definite, size.

From this account there becomes apparent an evident correspondence between the Indian and the Norwegian observations, and in comparing, for example, Plates VI. and VII. the general similarity referred to will be readily noticed; and it is even more apparent when Plates II. and III. are seen together. Danielsen also states that the spots may first appear as a localised and undefined flushing of the skin, which disappears on pressure, returning however with a deeper hue.

In almost all cases, I may here mention, the spots are said to be allied with symptoms of general malaise, resembling those of dyspepsia, hypochondriasis, languor, &c., and it is usually the case that when the eruption comes out, these bodily feelings subside. Subsequently to the spots, bullæ make their appearance; with anæsthesia and other marks of this particular variety of the disease, such as nerve-affectations, paralysis of the facial muscles, destruction of the fingers and toes. The lymphatic glands corresponding to the patches of skin, which are the seat of eruption, become swollen and tender. In these descriptions Danielsen has clearly referred to the anæsthetic form, the majority of eruptive patches which in the early work were regarded as belonging to the tubercular form; and in that he is doubtless more correct, because the spots are not commonly or necessarily followed by nodules or tubercles. Some confusion, however, still remains even in his work; and not less perplexity is apparent in the remarks of other observers in different parts of the globe, who have mentioned the concurrence of leprous spots, patches, or blotches, &c., as being one of the early signs of the tubercular as distinguished from the anæsthetic form. Such instances belong, in fact, to the convenient category of 'mixed' leprosy; and when they are in future described, it would be better, in mentioning these spots, to add a notice of their prominent characters.

Except in Dr. Danielsen's fine Monograph, I have not seen anywhere, illustrations of the characteristic eruptions of leprosy. My own figures must have been in Bombay at about the same time as Danielsen's at Bergen, and, of course, quite independently.

Lastly, in neither of the Norwegian works to which I have referred, is there any illustration of the acute or febrile eruption of leprosy, whether tubercular or anæsthetic; yet this I, last year, ascertained at Bergen to be (sometimes at least) remarkably like the more chronic eruption under notice, as will be seen on inspection of Plate VIII.; and on reference to the description in the text under the head of 'tubercular' leprosy.

3. Alterations pigmentary or degenerative, are not here in question, although some of these are not unconnected, perhaps, with sources or sequences of leprosy; hence certain spots known as 'morphœa,' &c.; and, as well, the so-called 'white leprosy,' (leucoderma) are hereby eliminated.

4. There remain the changes which are due to growth or deposit in the skin, of the leprosy material; and of these there are two categories:—

a. Deposit localised and accumulated within small areas; and so leading to the production of 'nodules' or 'tubercles' (*Lepros tuberculosa*), or sometimes of 'infiltrations' or wide 'indurations,' so-called.

b. Deposit diffused and more scanty; apt to spread, and though chronic, yet of limited duration. The eruptions coming under this head are those which are now referred to (*Lepros leprosa* auct.).

That a rigid line of demarcation is to be drawn between these two last, or indeed between them and the first-named, is not, however, to be supposed; but this subject and the like, bearing on the connection with other leprosy signs of these spots, will be subsequently discussed. The fact that there really exists a distinct form of skin-disease in leprosy, will also be more readily demonstrated after that appropriate cases have been recorded in detail.

One other preliminary observation remains; namely, that while it may not be strictly correct to altogether exclude from this place, the form of acute febrile eruption happening in tubercular leprosy; yet, since the introduction here of this remarkable affection, would interfere with a seemingly natural series of chronic and commonly non-febrile eruptions, such acute form may, for convenience sake (and with the reserve now implied), be more suitably described under the heading of 'Tubercular' leprosy. In the final chapters of this Memoir I shall treat of the inclusive malady, as a whole.

It is now proposed to consider in succession the local and general characters; the course, complications, and the nature of the eruption in leprosy, so far as hitherto determined.

## A.—LOCAL SIGNS.

### 1.—DESCRIPTION OF THE ERUPTION IN LEPROSY (*LEPROSA AUCT.*).

*Arrangement and narration of Cases.*—Any one who at the present time, and on a suitable scale, studies leprosy in the East will soon learn to recognise certain forms of 'eruption' of the skin, as constant attendants on the disease. As matter of observation, these spots present characters sufficiently varying to warrant some such simple arrangement as the following:—

- (1.) A characteristic, if not typical form, consisting of moderate sized, isolated, circular and serpiginous patches scattered over the body, and probably of not long duration.
- (2.) In other cases, a very large extent of skin has become implicated, possibly by extension and blending of patches like the above; and of longer standing.
- (3.) Again, wide-spread, yet defined, peculiar discolourations of the cutaneous surface, which are not merely chromopathic, but present a method in their character and distribution. Duration also chronic.
- (4.) Or, numerous and more indistinct pale blotches; also widely scattered, and not due to mere absence of pigment, or to simple obstruction of nerve-influence. Duration chronic.

Each of these several varieties will now be described at length, and illustrated by cases; and by such sketches taken from the life as I was able to make.

The drawings which I made in India were all from the darker-skinned castes of native patients, but I have witnessed in Brahmans and others of light-coloured skin precisely similar eruptions; the resemblance then, too, being still more considerable to leprosy skin-affections seen in the pure European, *e.g.*, in Norway, at the present day.

The following preliminary remarks should, in this connexion, be carefully noted:—

1. Eruptions in the *pale* skin of Europeans, Parsees, Mussulmans, and some Hindoos\* are at first of a darker hue than natural; afterwards this tint may subside, and a whiter colour than natural ensue.
2. The *dark* skin of most natives of India renders the spots in question, lighter in tint than the sound surface around them; and the darker the skin, the more marked the difference. Afterwards, the patches do not turn 'white,' or indeed often greatly paler than the sound skin, when this is less dark than usual.
3. It may hence be inferred that the eruption in leprosy has of itself a special tint, which is due not so much to added pigment as to increased vascularity, and the actual reddish or brownish colour of the leprosy deposit itself. At different stages the hue of the latter varies, becoming deeper with time, prior to final changes, and while it is dark when compared with white skins (so-called), it seems more or less pale by the side of the brown or black skin of most tropical residents, since its presence entails local removal of the normal dark pigment abounding in the rete mucosum. At a subsequent period, when congestion has subsided, and the neoplasm has undergone those alterations leading to its disintegration and absorption which commonly supervene, the hue of the integument over the affected spots will, as a rule, be lighter than usual, because of destruction of the cutis vera at such points; yet it is sufficiently obvious that much variety of appearance may consist with an essential uniformity of morbid process.

I now proceed to particulars, taking the spots in order as above arranged, and subjoining the clinical records appertaining to each variety.

(1.) The eruption first named has the following characters:—Patches or spots of a circular or annular form, size  $\frac{1}{4}$  in. to 3 in. or more in diameter; edges raised, of a pinkish hue, generally free from scales, slightly cracked or wrinkled; centre depressed, pale, dry, glistening; a tendency to spread and join, so as to cover larger spaces. The centre of the patches is insensible, often completely so, and always in the older ones. Their appearance is not preceded or accompanied by any general symptoms, or even local signs of irritation; there is nothing like hyperæsthesia at the commencement. The patches commonly occur about the shoulders (front) and hips (back), behind the elbows, and in front of the knees; on the face, the temple and cheeks are frequent positions, sometimes where the branches of the fifth cranial nerve emerge; the trunk and limbs are often affected in a perfectly symmetrical manner, and there is always a strong tendency to such an arrangement. The eruption begins as a small reddish flattened elevation of the whole skin, giving the impression of a tubercular character to it. Squamæ, discharge, and scabs are absent; even a furfuraceous desquamation of the cuticle is by no means common. The hairs on the patches are few and atrophied, but seldom blanched; the function of the glands of the skin is suspended or diminished; blood readily flows on puncture of the surface. In less marked cases the distinction of margin and centre is apt to be obscure, but anæsthesia is always present in the latter.

\* The Creole and Mulatto, the Chinaman and Malay, the Arab, Siamese, Madagassee, and numerous

other pale-skinned races of men, might be added to this list with abundant propriety.

## CASES IN ILLUSTRATION OF THE ABOVE.

CASE 1.—Mhowjee, a Mussulman, *ætat.* 50, a woodman; comes from near Rajcote (sea coast). Numbness of the feet was accidentally discovered about 12 months since, and spots appeared near the elbows, &c. Is strong and in fair health. There is doubtful redness and numbness of the cheeks; the lobules of the ears are benumbed. On the trunk, front, and back, are to be seen numerous small spots or patches, varying in size from 2 lines to 2 inches in diameter, and mostly of a round or oval form; the smaller consisting of mere light reddish elevations of the skin; the larger of distinct circles, the centre of which is depressed and of a pale yellowish colour; the margin broad, raised, light red; at a glance they have something the appearance of 'wheals;' the surface is rather rough and dry; the hairs grow scantily, but when present are by no means invariably white. On the shoulders, outer side, and back of the arm, especially about the elbow; also on the outer side and back of the fore-arm may be seen similar spots; on the nates a few are present; none on the thigh, but some on the front of the leg; there is also an undefined light tint about the knees. The spots are numerous; they are all benumbed, especially the centre of the older ones. There is slight but evident *anæsthesia* of the dorsum of the hands and feet, without any distortion of the latter. No kind of uneasiness accompanies the eruption of the spots; he never has fever; denies an hereditary or syphilitic taint. (Dispensary patient, No. 55.) See Plate II.

CASE 2.—Tah Mahomed, Mussulman, *ætat.* 53, a pensioner, comes from near Nassick (Deccan); two years sick. On the body is an eruption of circular patches, the centre of which is pale and comparatively depressed (sometimes really below the level of the skin); the margin broad, raised, defined, of a purplish hue; the cuticle is entire over both, wrinkled and dry. On close examination the hair follicles are found to be distended, the hairs frequently absent or atrophied, not blanched. The diameter of these patches varies from  $\frac{3}{4}$  in. to 3-4 inches; they are present on the nose, temples, cheek (right side of face), helix of both ears, neck, shoulders, arms, and fore-arms; on both *mammæ*; there is one exactly on the middle line behind, others on the nates, right thigh, leg, and foot, and also on the opposite a few; they first appeared on the right thigh close to the knee, on the inner side, and the patch there is still the largest; one spot is just below the attachment of the *ligamentum patellæ*; the most recent (15 days?) is on the opposite thigh; its diameter is about 6 lines, colour reddish-purple; it is raised, with a mere trace of a central pale part; no tenderness, but loss of sensation. At a short distance these patches have a whitish glistening aspect, which is attributable to very thin, dry flakes of cuticle, or to a similar state of the general surface, without distinct scales being apparent; their number is about 20, and they are all without exception quite benumbed in the centre; being sharply pricked, blood exudes.

About the time the patches first appeared (two years since), he accidentally discovered that the right hand was weak and benumbed; the two inner fingers are slightly atrophied, and remain a little flexed when at rest, their palmar surfaces, especially of the first phalanx, wrinkled, shrivelled, and of a purplish tint; also the whole length of the inner third of the palm of the hand is shrivelled slightly and livid, the difference being perfectly clear to the eye; these parts are benumbed except close to the wrist, and also the dorsum of the two fingers beyond the first phalanx; their temperature is notably diminished. The whole hand is weak, and the *interossei* are atrophied, particularly of the first space. The *ulnar nerve* of the same side, about an inch above the elbow, forms a firm and tender swelling running upwards for about two inches, which, when pressed, causes pain in the fore-arm and starting of the two inner fingers; this swelling was first noticed about the time of the numbness; it cannot be confounded with enlarged lymphatic glands. General health fair; never has fever; is married, and has a grown-up family and grandchildren, who are all well; knows of no taint of leprosy in his family; has had syphilis on more than one occasion, many years since. (Dispensary patient, No. 41.) See Plate I.

CASE 3.—Rajal, Mussulman, *ætat.* 30, a weaver. Six months since 'wheals' began to appear on the body passing into light-coloured raised patches, with reddened edges and depressed centres; they are present in the abdomen, back, shoulders, back of arm and fore-arm, and also on some of the fingers; within the last 12 days fresh spots have appeared on the forehead and face, exactly where the three branches of the fifth cranial nerve emerge. Ears unaffected. There are indications of slight facial paralysis (*r. side*). The old spots are perfectly *anæsthetic*; the new ones less so;

none are particularly tender; their appearance gives the impression of a gelatinous-like effusion; at first red and shining, afterwards lighter than the sound skin, becoming depressed in the centre. General health fair; a short time since had fever; manner heavy; no hereditary taint known. (Dispensary patient, No. 33.)

I had selected three other cases as illustrations of this form of eruption, but it will not be necessary to detail them; two are of long standing and accompanied with anæsthetic leprosy.

(2.) The transition from isolated to blended patches is a natural one, and in some cases, at least, it is only a question of time, evidence of it will be found in the following case:—

CASE 4.—Chinapa, a Hindoo, ætat. 50, comes from near Mangalore (coast). The disease is of upwards of 30 years standing; it commenced with anæsthesia of the left foot; the eruption followed, and a few years since the hands became affected. Health tolerable; is intelligent; denies syphilis. The face is not affected in any way, nor is anything to be seen on the front of the trunk; on the back, including nearly the whole of the left shoulder, and encroaching on the right side, extending as high as the nape of the neck, and reaching downwards to the level of the last rib, is a discoloured patch, the surface of which is uniformly lighter and redder than the sound skin, and appears dull and dry; the edges are wide, defined, broad, and lighter coloured towards the patch; on the opposite margin at the juncture with the skin, numerous isolated, flattened, red, or purplish tubercles are seen covered by the thinnest cuticle (only in the smaller patches amounting to anything like a scale); isolated tubercles may also be seen at a little distance from the edge, and others in the middle of the large patch, where probably sound skin has become inclosed. There is clear evidence of a primary circular or annular arrangement, especially in the new spots. One is present below the large patch described above, about the size of a rupee, and oval in form; already the centre is depressed; the edges irregularly tuberculated. Quite recent spots may be seen on the right fore-arm, as commencing by a cluster of flattened, light-red tubercles, a line or two in diameter; then spreading the centre subsides, acquires a darker reddish tint, while the lighter raised margin extends. Perspiration is deficient on the affected surfaces, and the hairs stunted, sometimes white, but usually black. Sensation is more or less deficient in the patches, except the most recent of all. The hands are benumbed and distorted, particularly on the left side; the left lower extremity is benumbed below the knee, and the foot is nearly destroyed. No general or local symptoms precede or accompany the appearance of new spots. He states that his mother's brother had leprosy; other relations and children unaffected. (Dhurumsala, No. 62.) See Plate IV.

CASE 5.—Deojee, Hindoo, ætat. 45, comes from near Herni (coast); has been 18 years sick. There was first a patch on the nates; the hands and feet only recently affected. On the face are light-coloured patches; there is numbness also, and the ears are benumbed; the eruption on the trunk (back) consists of large, irregular, but often rounded patches, measuring five or six inches across and more or less blended; their colour is a uniform light red, and the surface is slightly raised, but after attaining a certain size, the central part acquires a dark colour, like the sound skin, but the supple smooth appearance of the latter is wanting. In these patches the raised margin is not apparent, as the whole surface is equally affected, except in the oldest ones; no tubercles are to be seen along the edges; the older ones are benumbed, that on the nates completely so; the more recent but slightly. There is anæsthesia of the upper extremities, and slight distortion of the hands, also below the knees; and the great toe of the left foot is destroyed. He never suffered from syphilis; leprosy is said to be in his family, but he is the only one now affected. (Dhurumsala patient, No. 84.)

CASE 6.—Murya, Hindoo, ætat. 30; a ryot, from Ooran (coast); duration of disease four years. It began with numbness of the legs, and an eruption which spread upwards, and soon after the right hand became affected. Face—slight tumefaction and coarseness of skin of brows, cheeks, with diminished sensation; hair scanty or small; lobules of both ears benumbed, and rim of the right also reddish and swollen. Something like thickening of the mucous membrane along middle line of hard palate. Trunk marked with numerous pale, red, raised, level patches of irregular form; the smaller rounded, others are large, and surround the waist like a girdle; on the back and chest are seen discolourations similar to those included under the next head; perhaps remains of old patches. Extremities, upper—similar patches on the shoulders, arm, and fore-arm, with, on the right side, partial destruction of the hand, on which bullæ appear, leaving white scars; the ulnar

nerve is evidently affected. Lower—on the nates, thighs, and legs are other broad, light-coloured, raised, and connected patches, presenting a characteristic appearance; the feet are benumbed, and the toes of one partly destroyed. The centre of the large patches is depressed and pale; rather lighter, drier, and more finely wrinkled than the sound skin; it is benumbed, and the patient himself describes how the patches spreading leave this benumbed surface; but inclosed pieces of sound (?) skin also seem to have lost their sensation in some places, so that, as is very probable, the cutaneous nerves are also diseased beneath the patches. This case is of considerable interest, as exhibiting a form of skin-disease which appears to me altogether characteristic of leprosy. (Hospital patient, No. 72.)

CASE 7.—Rosa, a Portuguese woman, of about 30 years of age, comes from near Bassein (coast). Four months since the eruption appeared on the face, and has since spread downwards to the trunk and extremities; there were no premonitory or general symptoms. She is in good health and intelligent: never had syphilis. The eruption consists of raised, rounded spots of a livid-red colour, and in size varying from four lines to as many inches across; they are very numerous, and blending, nearly cover the face, forehead, and ears; but few on the trunk, and those small and isolated: mammæ normal. On the outer and back part of the arm and fore-arm, and on the dorsum of the hand, others are seen; in the thighs are larger patches, at the back, and about the knee, also on the front of the legs. The spots blend, producing broad irregular markings, and some are in the form of complete rings; the margin broad and raised, the centre small, depressed, and almost resembling sound skin; they impart a peculiar expression to the face, looking at first sight like tubercular thickening. All the spots are unmistakably benumbed, and that to a considerable degree, the skin in the neighbourhood being normally sensitive. There is, however, evidence of nerve-disease in the benumbed condition of the skin of the forehead at the lower part, and of the dorsum of the hands and feet, which are also much bronzed and generally wasted, but no destruction of parts has yet taken place, only the fingers, &c. are thinned and rather stiff; the palms of the hands are yet partly sensitive, but deterioration of structure has evidently commenced. There is a broad, red, thickened line along the middle of the hard palate. The disease is increasing. She knows of no hereditary taint; her husband is dead; no children. (Dhurumsala patient, No. 108.)

This case resembles the last, and it also shows how the eruption may approach, in some of its characters, to ordinary tubercular thickening of the skin, indicating, as I shall have further occasion to point out, the evident connection there is between 'baras' and tubercular leprosy.

Leprous spots of the kind described under this and the preceding head, present, when seen on the pale skin of the Hindoo, a dark reddish or brownish hue, which is sufficiently striking to the eye, and very characteristic.

CASE 8.—A young Maratha Brahman of good family, resident in the Deccan, had had for several months, on the pale sallow skin of the extremities, three or four elongated brown patches, some inches in length, with distinct rounded or crenate margins, firm to the touch and not tender, decidedly elevated above the general surface of the skin, and that, more especially at the edges, rough, dry, slightly scaly or furfuraceous. In the centre of the larger patches had already supervened some atrophy; there was dryness and diminution of colour, sensation, and temperature. The general appearance of the spots was that of firm infiltration of the substance of the skin, attended with thinning of the cuticle. Progress of the eruption very chronic; no general symptoms connected with the spots; some mutual perturbation only; no hereditary taint or exposure to contagion; no anaesthesia of the hands or feet; or other signs of leprosy; general treatment of no permanent avail, and local remedies, when irritant, rather injurious than otherwise. Whether or not the glands in the axilla or groin were at all affected, is unknown, but attention was not drawn by the patient himself to this point.\*

\* Unfortunately I have not kept a drawing of this interesting case, but the appearances which are depicted by Daniëlsen, in Plate X. of his Monograph on Anaesthetic Leprosy, of an eruption on the leg of a Nor-

wegian leper in the early stage of the disease, resemble almost exactly those above described; and even in Plate VII., here reproduced, there is much similarity, especially in the newer spots.

During last autumn, I saw at the Lungegaards Hospital, at Bergen, a young man who had, on the morning of my visit, presented himself for admission, and who exhibited an example of incipient skin-disease so characteristic, that I begged permission to make the sketch reproduced in Plate III., in which will be seen (1) the characteristic position of the main patch, viz., on the back of the arm, near the elbow; (2) its clearly serpiginous character, well defined and tinted (and raised) margin and shrunken central surface; (3) the appearance of other fresh spots is also shown, and here again the accordance with the description in the text is sufficiently striking. With this case before me, I am somewhat surprised that the Norwegian observers have not placed more stress upon characters which seem to me both noteworthy and peculiar; and this the rather, because in all the instances which I saw of the chronic form of eruptions in anaesthetic leprosy, at the Lungegaard's Hospital, the same general features were apparent.\*

Brief notes of the case referred to are the following:—

CASE 9.—*Eruption; early stage.*—The patient was a young man; in good condition, but seemingly depressed, and complaining of pains in the left arm of an aching or smarting character, and, as it seemed to me, rheumatic or neuralgic. On removing the clothes, the appearance of the arm was as depicted in Plate III. The edges of the large patch became slightly franny on exposure to air, a few minute scales might be seen upon them. There are spots upon the face, both on the cheeks and on the chin, of a similar character, having only a somewhat more uniform, raised, red appearance, and on the eyebrows there are small spots, which have a nodular or tubercular aspect. The ear, too, is slightly swollen and red.

There are no marks elsewhere.

Duration of the larger patch, about six months; of the smaller spots, 14 days, at which time he was feverish. He does not admit the existence of leprosy in his family. He comes from a district where the disease is common.

Lastly, the following instance, also from Norway, may be here quoted:—

CASE 10.—*Anaesthetic leprosy.*—Female, age 26; single; duration of disease, one year and nine months. There are reddish patches on the face, especially over the brow, and there are others on the back and front of the thumb, of a paler colour, rounded form, with reddish slightly raised edges, and pale, perhaps depressed, centre. The circles are not always complete, and, in short, there is a close resemblance to the forms seen in India. This is especially the case with those spots situated on the arms and hands, at the back of the elbows and fore-arm; where, too, sensation is diminished. The hands are bronzed, atrophied, and partly insensible, just as seen in India. The feet are less affected than the hands; but the appearances are the same. There is, to the touch, no perceptible loss of temperature. The disease began by weakness, pains in the limbs, followed by spots on the face and thigh, where there are now pallid patches limited by reddish lines, but showing little or no loss of feeling. The temperature of the body as taken by means of a thermometer placed in the axilla has not varied in this woman for months, and this circumstance greatly contrasts with the rise of general bodily heat in the other woman, which is associated with fresh crops of tubercles, and febrile disturbance of the system. No swollen lymphatic glands are to be felt.

\* I may here mention the illustrations of the similarity referred to. During my stay at Bergen I examined, and made drawings of, two patients having leprosy eruptions. Of these the one, an adult female, had patches on the thighs and legs, altogether like in character to the Indian forms, being large, irregular, rounded, and serpiginous, with a slightly raised reddish edge, and a depressed, pale, benumbed centre, &c., &c.; they had commenced a year before, with fever; she had other marks of nerve-disease, and was also affected with lupus on the face, thus illustrating the co-existence of the two complaints; general health good. The

other case was that of a young man, who had a rounded patch on the back of the arm; it was fading, but still retained characters altogether similar to those I have sometimes seen in India. In short, excepting such general differences as must attend the influences of race and climate, or such local modifications as pertain to dark and light-coloured skins respectively, I do not know that it is possible to discriminate between the typical forms of eruption presented by lepers in countries so far separated, in every respect, as Norway and India.

This patient comes from an infected district on the West coast, and it is added that the disease commenced one year and a half after having lived at the seacoast, and there being occupied at the fishery in the winter time: in the spring, when she was going to the mountains with the cattle, she observed that the feet had become painful, and sensitive to cold; and at the same time small reddish-brown spots appeared on the legs. She denies the existence of leprosy in her family, but it is stated that her mother and her brother have suffered from leprosy.

Treatment: Carbolic acid, three drops in water, thrice daily.

Vapour baths, thrice a week.

Cucurb. cruent. No. vj., to the back, once fortnightly.

[Notes taken at the Rigs Hospital, Christiania, August 15, 1873.]

(3.) A more frequent appearance than either of the foregoing is a light discoloured state of the skin in the form of large patches, the surface of which may present hardly any other changes beyond those of colour and sensation; but the often rounded form (particularly when small), defined and slightly raised, reddish margin, and dry, shrunken, anæsthetic centre—characters sometimes common from the very first and imparting an aspect, which to an experienced eye at once reveals the nature of the disease—clearly connect this form of eruption with the preceding; it seems, too, highly probable that the cutaneous affection in leprosy is of a specific character, although this may not be very evident in all its modifications as ordinarily seen.

CASE 11.—Harri Sangla, a Hindoo, ætat. 30, native of Chiploon (coast). Twelve months ago he found the left foot to be benumbed, and soon after spots began to appear on the body. Never had syphilis, and is in good bodily condition. The entire expanse of the forehead, the whole of the left cheek and a part of the right, are of a light colour, although the skin is otherwise unchanged in appearance, except in the left cheek where it seems rather flushed and puffy; here sensation is particularly diminished, but also lessened in the other parts, and lobule of right ear. On the nucha is a reddish patch; in front of the trunk are two large circular, almost white patches with defined edges, level, slightly spotted, and supple surface; a much larger single patch of less regular form and definition, but otherwise identical, is found on the opposite side to these, and scattered about are a few white spots; numbness exists in these places, particularly in the larger one. On the shoulders, arms, back of elbows, and outer side of fore-arms are numerous, often large, patches, of somewhat irregular form, but frequently rounded, of light reddish tint, dry and roughened surface, edges not perceptibly raised; in some round spots the centre is darker than the defined broadish margin; they are not quite symmetrical; some of them (*e.g.* on the shoulder) have an appearance not unlike (1), are slightly raised at margin, depressed and pale in centre. There are patches on the dorsum of both feet, where the skin is thin and shiny and coarsely wrinkled, an appearance different to that of other spots: over all these places sensation is deficient, and sometimes absent altogether, while the intervening skin of sound aspect is sensitive as usual. The fore-finger of the left hand is benumbed, dry, and shrunken. On both nates are large coarse patches, having a light reddish margin and darker centre; also in front of both thighs, knees, and legs are similar ones extending, on the left side to the dorsum of the foot, which is partly destroyed; there is anæsthesia of the patches, and of the skin supplied by the musculo-cutaneous nerve. No hereditary taint. (Dispensary patient, No. 65.)

CASE 12.—Rama, a Hindoo, ætat. 55, from near Poona (Deccan), seven years a leper; first were present anæsthesia and blisters on the toes, afterwards the hands were attacked, subsequently the eruption appeared. He never contracted syphilis and denies an hereditary taint. There is numbness of the ears; on the trunk are large light-coloured patches, those on the front are not raised, those on the back are, and show a tendency to form circles, or rings; here sensation is diminished, it is absent in the flattened (and older?) patches, where, too, the surface is dry and harsh; the hairs grow nearly as usual. Upper extremities—small patches of both kinds may be seen, benumbed and of circular form; the hands are much deformed, especially the left; the lower extremities are similarly affected with patches, numbness, and distortion. The new spots appear to arise by isolated round small marks. (Dhurumsala patient, No. 82.)

CASE 13.—Elia, a Jew, ætat. 26, from Cochin; duration of disease five months. On the back (left side), in the loins is a large irregular patch of a light red colour, defined edge, doubtfully

raised in parts darker in the centre, and quite benumbed; other small patches of a rounded form and light red colour, all more or less benumbed, are also present; on the arm and fore-arm are two or three such, and a similar number on the leg and thigh. Their size at first is not quarter of an inch, and they spread in a serpiginous manner. No other signs of leprosy; he probably never had syphilis, and denies an hereditary taint; looks strong and well. (Dispensary patient, No. 76.)

CASE 14.—A boy (Hindoo), *ætat.* 10 years, from near Ooran (coast), states that about five years since the disease began. There are numerous light patches on the trunk where the skin is dry, harsh, and glistening; others on the face. The eruption is mostly a simple discolouration; the smaller spots do not show either pimples or tubercles; but are frequently rounded; the larger have, on the extremities, a distinct raised edge; tubercular thickening is present in all the large patches, to a small extent, giving in some places the idea of a cicatrix from a burn, or cheloid bands. On the face, however, are distinct raised reddish configurations, placed on a uniform light discolouration of the skin, which invades almost the whole mark, leaving some places, *e.g.*, one half of the upper lip free; hairs little affected. Sensation is wanting in all these discoloured places, and also in the limbs, except the palms and soles. The father of this boy died in the Dhurumsala of leprosy, five years ago. (Dhurumsala patient, No. 103.)

I have notes of other cases which, like the first and last of these, seem to indicate a close connection between the several forms of eruption, and also with tubercular thickening of the skin; and of many others presenting the kind of eruption now under notice; two, in old women, are very much alike; but those above given may perhaps afford an adequate conception of the appearances.

(4.) In not a few instances, however, the character of the eruption remains obscure, even from the first; it is evidently something more than a mere change of colour, for there is a 'method' in its commencement and extension, and yet it cannot be said to be either tubercular or papular. Perhaps the occurrence of this form is quite peculiar to leprosy, and it may indicate an extreme degree of modification of those previously described. Numbness more or less marked is usually present, but I have noticed its absence in spots on the face, occasionally. A few illustrative cases will give the best idea of this form of eruption.

CASE 15.—Changi, a Hindoo female, *ætat.* 25, comes from Bancote (coast). There have been spots in the body for 12 years; they first appeared on the left fore-arm; at present a few, rather indistinct and the size of a rupee, may be detected on the face; all over the shoulders, front and back, on the chest, abdomen, and loins, and extending onwards to the extremities where they become fainter, are light discolourations perfectly distinct to the eye, even on her pale skin; they are generally large, and defined at the spreading borders, but towards the extremities pass insensibly into a colour resembling that of sound skin, portions of which probably yet remain within the circumference of the patches; the free edge often shows a circular disposition. The more recent spots are decidedly circular in form, or occasionally oval; on the back, they show the faintest red edge, slightly raised, then a broad light surface, and finally, in the centre the colour may be almost white; the surface presents rather a coarse appearance, the clogged hair-follicles being visible, as elongated dots; most of the hairs are white, thin, and short, as seen with a lens. There is marked *anæsthesia* in all the patches. The hands are benumbed and partly distorted, and the cuticle is apt to peel off the numbed surface. Otherwise well-formed and in good health; her paternal uncle had leprosy and was in the Dhurumsala; is married and has children, but her husband has driven her from home on account of this disease. (Dhurumsala patient, No. 7.)

CASE 16.—Tulsi, a Hindoo female, *ætat.* 20, from Shapoor (Concan), like the last patient, a shoemaker by occupation, has for eight years been the subject of leprosy. It appeared by two spots on the cheeks which spread over the face; then others came on the trunk. No general or local premonitory symptoms: general condition good. There is no distortion of the face but numbness of the cheeks, chin, forehead, and ears: hairs intact: on the front of the body, on the back, shoulders, and hips are large patches of a light colour, irregular form, and not raised above the sound skin; they are defined, but have no raised edge; there is sometimes a narrow red margin, but no trace of tubercles or pimples; they probably begin as small white points; the

newer ones are round with a reddish edge, and a little raised; their surface looks rough and dry, perspiration being deficient. In these patches sensation is impaired, and sometimes absent. The discolouration has invaded the upper extremities which are everywhere benumbed, and the two inner fingers bent, with atrophy of the *interossei*: the lower extremities are similarly affected; numbness everywhere, but no distortion of the feet. There is no hereditary taint, but her father married another woman before her mother, who had leprosy, and died of it; a girl was born of this marriage a year before the appearance of leprosy in the woman, and is now living and well; her own sister, a few years younger than herself, is affected in a precisely similar manner, and there is a younger one yet well; has no brothers. (Dhurumsala patient, No. 13.)

The similarity of these cases is too striking to be accidental; it is probable that they are fair examples of a well-defined form of eruption; I might add several others by no means dissimilar, and also mostly females.

In connexion with these, rather than in the first set of cases, should perhaps be placed certain examples of scanty, small, isolated white spots occurring in leprosy patients, which may be one mode of commencement of the larger patches, or else modifications of those described under (1). The two instances I have seen were remarkably alike in *all* particulars; one may be detailed.

CASE 17.—Chinaya, a Hindoo, *ætat.* 20, from Managalore; a tailor by trade. About seven years since a small white patch appeared at the right elbow, and spread around; its extent is now visible, but not entirely defined, its character serpiginous; a similar spot came on the chest, near the left mamma, and recently another on the right side; on examining the two last, they are found to be composed of small white tubercles clustered in a circle, the centre of which is slightly depressed and rather darker, though less so than the sound skin (which is unusually fair for a native, and fine and supple); the diameter is nearly an inch. It would also appear from his account that another recently appeared on the right hand, where now the anæsthesia exists, but traces are barely visible; the older patches are quite insensible. The right hand has lately shown all the appearances indicative of disease of the ulnar nerve, and there is some tenderness with probable enlargement of the latter, near the elbow-joint; the hand is so weak that he cannot feed himself. The disease is in the family, his maternal aunt being affected; he is a fine strong-looking young man. (Dispensary patient, No. 50.)

## 2.—NUMBER AND DISTRIBUTION OF THE SPOTS.

The more characteristic patches occupy places of selection—perhaps localities unprotected or exposed to irritation—such as the back of the trunk, the shoulders and nates, the back of the arm and front of the thigh, the elbow and knee, back of fore-arm and front of leg; in the face I have sometimes thought that the places where the branches of the fifth cranial nerve (trifacial) emerged were preferred localities, including in them the temple-region. Other localities of the body than the above (which are also predisposed to ‘tubercles’) may as well be affected. The eruptive patches are frequently, but not invariably, symmetrical. Their number is seldom considerable in this chronic form of complaint; and, at first, the spots emerge separately or in very scanty numbers.

The mucous membrane of the mouth, &c. is probably very seldom implicated;\* and also places where the cuticle is thick, as in the palms and soles. Level skin changes on the back of the hands and feet are not usually due to this eruption, but to abstraction of nerve-influence.

\* The following note of Hansen is important:—I have seen one case of the anæsthetic form, in which simultaneously with an eruption (the patches in the skin being much elevated) there occurred a precisely similar affection of the throat and upper air-passages; there was a uniform turgidity and redness of the

mucous membrane of the pharynx, epiglottis, aryteno-epiglottidean and vocal cords, and there was a remarkable correspondence with the contemporary skin-eruption; subsequently a mere harshness of the voice remained. Appendix, page ix.

## 3.—CHRONOLOGY.

Under ordinary circumstances, this is very difficult to determine with accuracy, because it commonly depends upon the uncorrected statements of patients. The question here is, which is the prior, the eruption, or a local nerve-affection, such as numbness of the fingers and toes, or of some portion of the cutaneous surface, which is also by preference (as I think), the seat of eruption? Perhaps there is no rule; certainly, there is none yet elicited. Spots of the kind mentioned above, may be the earliest noticed sign of leprosy; but, as will be evident on perusal of the cases quoted, in the majority of instances, anæsthesia co-exists, and it may have preceded the eruptive signs. That the nerve and the skin-affection are at least intimately associated, has long been my opinion; and perhaps the varying predominance of the former may account for the different aspects assumed by the latter. This is a point for future study.\*

## 4.—COURSE OF THE ERUPTION.

Its commencement as a small, defined pimple—flattened tubercle, one may say—has been clearly illustrated in the cases above described, and in the plates copied from them. The typical spot is not very vascular, not inflamed or hyper-sensitive; and it very early shows the serpiginous character with depressed centre, which is so remarkable.

The patches have a tendency to spread centrifugally; when meeting they largely blend, some gyrate remnants of one or other sometimes, however, persisting on the larger surfaces thus formed. The diameter of the latter varies considerably; but it is not necessary to enter into details on points like these. It would seem that individual patches do not attain a larger size than spots of three or four inches in diameter; when fresh ones form in their neighbourhood, and next join on.

The great patches naturally spread more slowly than the smaller, and after a time the encroaching margin subsides; but so long as a distinct, raised, red edge, even if narrow, persists, so long continues the process of lateral extension of the patch. On the other hand, as soon as distinction between margin and skin becomes faint, or disappears, then it may be said that growth by spreading is diminishing, or has ceased, and this is the first step to final subsidence of the whole. This tumid, advancing margin I have not commonly found to be more sensitive than healthy skin; but other observers have here remarked the existence of hyperæsthesia.

Lastly, the older spots may attain the appearance of mere pallid discolourations of the cutaneous surface; whether the normal aspect may, also, not be resumed, seems likely, yet in such cases some loss of feeling persists, and there results the phenomenon of a large anæsthetic surface, which differs but little from the healthy in its visible properties. The excretory functions of the skin are less interfered with than might be anticipated, but usually all secretion is diminished; and often the apertures of the glandular ducts are stretched or dislocated. The hairs become shrivelled or fall out; they do not necessarily change colour.

I have not found it practicable to use the aphemetric compass as a means of testing tactile sensibility, for patients speak vaguely; and changes of temperature would be difficult to correctly estimate, but they tend, it is known, to a lower range than normal.

These remarks have reference solely to the patches of eruption; but I should add that, as a rule, in all cases there sooner or later follows on some sign of 'anæsthetic' leprosy. The 'tuber-

\* That certain sufficiently well-defined eruptions may attend nerve-lesions is well-known; and for a short list of them, and for some other remarks on this

subject, I would direct attention to the following section on 'anæsthetic leprosy,' at page 36, and to the references therein mentioned.

cular' form, in India at least, rarely supervenes upon this 'macular'; but I have seen the event—if thickening of the rim of the ear and some tumefaction of the cheek are to be regarded as marks of its occurrence. Fresh spots appear long after nerve-disease has become established, in a more marked form than as simple maculae.

#### 5.—COMPLICATIONS.

In addition to what is seen, there is to be noticed the characteristic feature of altered sensation, and 'tubercles' may afterwards make their appearance. Ordinary skin diseases are common in lepers.\* 'Hyperaesthesia,' or increased tactile sensibility of the skin, is not observed in the majority of cases in India; it has, however, been noticed, but how far then due to mere vascular congestion, &c. is not determined; in Norway, however, it is described as sometimes being acute and persistent for months. This state must, one would suppose, be a veritable neuralgia. There are degrees of it, to be tested by corresponding degrees of pressure, &c., and there is doubtless corresponding lesion of the subjacent nerve-filaments, belonging to the supplying cutaneous main branch.

'Anaesthesia,' or defective sensibility, is the most characteristic dynamic feature of the spots; it commonly supervenes in a gradual manner, and may become very decided: according to the European observers it is often, at least, the natural sequence of hyperaesthesia. I must refer to the examples above cited, for minute details as to the chronology and degree of this loss of feeling in the leprous spots. Once complete, the deficient sensation is probably never restored; if incomplete, it is not necessarily beyond repair.

Not to be confounded with the above, is the co-existence of benumbed surfaces due to implication of sub-lying, cutaneous nerves. The cases I have narrated will show how frequent the conjunction; and in the course of time it is inevitable, because the skin-eruption is but part of a series of local changes, which always and often to a very wide extent, includes destruction of cutaneous nerve-conductors.

Leprous 'nodules,' or tubercles in the skin, are very seldom indeed associated with the eruption, at any stage of the latter, and the circumstance is noteworthy. I have, however, seen

\* As to complication with other skin diseases, I may remark, first, with reference to India, that there occurs a frequent affection known in Bombay as 'gajkaram' (properly 'gajá-charma' or elephant-skin), 'dadar,' 'dínah,' 'maigham,' &c. which resembles psoriasis or squamous lepra; thus, large, rounded, scaly patches, accompanied with local irritation and sometimes a thin discharge, are seen particularly around the lower part of the waist and groins, and as well in other parts; this is certainly not connected with leprosy, though mentioned as such by old Hindoo authors, who, like their successors in Europe, included many skin diseases under the latter head. Again, often in natives, both healthy and leprous, are seen palish, furfuraceous spots, often clustered and common about the neck, &c., which are also innocuous (being a species of pityriasis): they are popularly known as 'sibbla.' Other common skin-diseases are, as herpes, eczema, scabies, &c. are frequent; but the squamous eruptions are not; perhaps the habit of the people in using water so freely, and the influence of climate,

may account for this. Syphilitic eruptions of various kinds are often seen—papular, scaly, tubercular, but I have not found difficulty of diagnosis to hence arise. Popular names for the patches in leprosy, and probably for other spots also, are 'Nitah,' 'Chattah,' a red and white kind being distinguished. 'Sruma' is the common Maratha name, and there are reckoned three kinds, viz., those attended with a sensation of itching, of burning, or free from irritation: it is regarded by some with suspicion. In other parts of India the terms in vogue are different; and I find not a few alike which bear a different signification in various provinces.

In Norway, I noticed that skin diseases were plentiful amongst the lepers; and it has been stated that pityriasis, prurigo, and lichen are common in cases of anaesthetic leprosy.

Further remarks on the ancient confusion of skin-eruptions, with leprous affections, are reserved for a future page.

tubercles on a surface which had probably been the seat of a leprous patch; and I have above remarked that similar regions of the body are liable to both events, as well as to simple loss of feeling. These conjunctions of phenomena are, to me, the indications most to be watched in future.

'Ulceration' is very rarely seen on the patches.

Those superficial lymphatic glands, which are directly connected with the leprous spots, are apt to be permanently enlarged under febrile disturbance attended with changes in the patches; they may be tender as well, and their afferent vessels also implicated.

#### B.—GENERAL SYMPTOMS. PRODROMATA.

From what is to be ascertained in India amongst patients attending at dispensaries, or the cases commonly seeking refuge in hospital, it did not appear that there are any decided precursory or attendant general symptoms, in connexion with the patches of skin-eruption, but I admit that the sphere of study was imperfect as regards a point like this, because so little is to be seen of the early, or the entire, course of the affection by the surgeon himself; and the statements of patients may be defective or erroneous. Others and the Norwegian physicians especially—better situated for inquiry—are, however, decidedly of opinion that not seldom there occur premonitory symptoms in 'anæsthetic' leprosy (to which form the skin-eruption under notice has hitherto been by them referred), and under that head I shall offer some remarks with reference to this subject. It will now be sufficient to remark that, probably, the advent of these spots is always attended with some gastric or febrile disturbance of the system in general; but that this state is either unheeded or forgotten by the patient. Successive crops of leprous spots at later intervals may also be thus attended, but the phenomena is rare in India.

Although no 'acute' form of skin-affection belonging to the category under notice is known to occur, yet the febrile eruptions happening in the course of more severe leprous disease may greatly resemble in appearance the typical chronic outbreak above described; and this circumstance is of great significance, as I shall afterwards, in discussing the pathology of 'leprosis,' endeavour to show. See, for comparison, Plate VIII.

#### C.—DIAGNOSIS (a.) AND PROGNOSIS (b.).

(a.) The typical form of eruption as seen in the East, and as described above, is a chronic, indolent, persistent, and spreading spot which is early attended with numbness. It could not be mistaken for any of the more ordinary vesicular, squamous, or papular eruptions; and all possible doubt would disappear with the advent of anæsthesia. Indeed, the concurrence or the sequence, of this symptom, is a chief diagnostic mark; but the aspect of the spot itself is hardly less characteristic. In the instance of the simpler pale maculæ or patches, some doubt may be allowed if numbness be obscure; but the position and form, and the negative distinguishing characters of the patch will aid diagnosis; the common attendant of numbness in other parts, would remove all doubt.

For further illustration of this topic, I may quote the following few passages, taken almost at random, from various sources which have been consulted; and I would also refer to Section D. on the nature and analogues of the eruption in leprosy.

*Paulus Egineta* (Trans. of Syd. Soc., vol. 2), who writes of leprosy and psora together, points to the irregular figure of the latter as a principal distinction; the shape of leprous patches being orbicular; and without putting undue stress on this remark, it seems to me worthy of notice.

In a modern French work (Gibert, *Mal. d. l. peau*, 1860), I find a good deal of information collected together; it is there stated (vol. 1) that from ephelis, pityriasis versicolor and the syphilitic patches, these leprosy spots differ in their light or reddish colour, numbness, and steady if slow advance; there is no pruritus or desquamation. A case is mentioned in which a spot upon the cheek of a child from Brazil, afterwards a confirmed leper, was regarded first as a *nævus*, then as a pityriasis.

An early and good observer in Bombay (Mr. Lisboa, *Boy. Transactions*, vol. 2, 1853-54) remarked that syphilitic blotches are scaly; they are not raised and they differ in colour; syphilitic tubercles are also scaly; the history of the case will aid diagnosis.

In Cochin, Day (*Madras Quart. Journ. of Med. Sc.*, vol. 1), who has given an excellent account of leprosy as seen on the Malabar coast, writes that the diagnosis from ephelis or liver spots, which are very common, is made by the presence of anæsthesia, and thus also from syphilitic blotches (whose copper-colour is no guide here); "the tawny, insensible blotches in anæsthetic leprosy cannot be mistaken for syphilitic ones;" there is more difficulty, he adds, in distinguishing between the tubercular venereal eruptions and the tubercular leprosy, but in the former the hair does not fall off or loss of sensation occur; although in both, exalted sensibility may at first be present; in leprosy, however, loss of feeling follows, and there is thickening of the nose, ears, and face.

Barbadoes (*Rep. R. C. P.* p. 29), Dr. Goding observes, "the 'yellow spots' alone do not necessarily constitute leprosy or are followed by it. They must co-exist with a rough, elevated, or swollen condition of the parts; and if anæsthesia be also present the diagnosis is the more certain. Generally the earliest indications are found at the elbows and knees; and I have always made it a point when the facial signs admitted of a doubt, to examine those parts, and if the symptoms were present there, at once to declare the nature of the disease." The reference here seems to be rather to a mixed form of leprosy, but the marked preference of the characteristic spots under notice, for certain parts of the body, is very properly insisted on by this independent observer.

(b.) *Prognosis*.—Since the eruptions under notice belong to leprosy, being one of its occasional, or in the East, one of the commonest phases at an early stage of the malady, it is evident that the remote fate of the patient cannot but be regarded as a very serious one. What indeed the final result may be, of any decided initiation of leprosy within the body, is a subject which is not yet so fully understood, that in particular instances it is possible to predict a more favourable event than common. So various, indeed, is the course of the malady, even under circumstances seemingly identical, that no certain opinion can usually be given in individual instances, and with reference to terminal events; but as to the more immediate prognosis, there are signs which may correctly be regarded as favourable, in the reverse. Thus, when the eruption is limited and decidedly chronic, the spots little elevated and their margins ill-defined, lymphatic glands not implicated, no other signs of disease, and a fair state of health, then the indications would be in favour of no fresh outbreak happening for the present. But should the patches be spreading, numerous, turgid, or tender, and the associated lymphatic glands also swollen; should there be general disturbance of the system, or other signs of leprosy elsewhere, then the prognosis would be unfavourable as regards the future; because, not only is the amount of infecting material increased under these circumstances, but it is also more diffused, and hence the greater liability to relapse and exhaustion of the patient.

It has been said that the 'maculæ' may constitute the sole sign of disease, even during the whole of life; but I am not acquainted with such instances. It cannot be too strongly insisted upon, that the natural history of leprosy is like that of tuberculosis or (perhaps) unchecked syphilis; and in a person showing the true leprosy spot, even of the kind under notice, a perfectly favourable prognosis could not, in my opinion, be given, even after an interval of freedom from fresh symptoms of 5 to 10 years, it may be, or even a longer interval.

## D.—NATURE AND ANALOGUES OF THE ERUPTION IN LEPROSY.

*Preliminary Observations on the existence of a distinct Eruption*:—I am quite aware that objections may be raised to the view that the form of skin-disease above described, is characteristic of the great leprous malady. Thus, it may be said that its visible characters are neither fixed nor peculiar, that it does not occur at limited areas or definite stage, or, indeed, at all invariably. Further, the suggestion may be advanced, that here is only one or other of the commoner skin-eruptions (to which this form could well be relegated), happening in a leprous subject.

To remarks of this kind, I would respond as follows:—The patches have certainly seemed to be peculiar to lepers, and physicians in all ages and in all regions have mentioned (under general terms, it is true, but still sometimes with enough precision), some sort of skin-eruptions as peculiar to leprosy, which is fairly comparable with that form now defined and illustrated. The character and course of the spots in question are, I think, peculiar; and certainly the ordinary presence of anesthesia is not to be detected in common eruptions happening in lepers. It is known that true leprous material exists in the skin, in the very places occupied by the spots; and this fact seems of itself, to be decisive of the nature of the latter. The superficial lymphatic glands corresponding to the patches of *lepra leprosa* become infected with leprous matter, just as do those which correspond to ordinary 'tubercular' deposits. Lastly, an invariable sequence, so far as I am aware, of the leprous eruption, is well marked disease in one of its other unmistakable forms; and this notable conjunction is, alone, decisive of the specificity of the lighter skin-affection under notice.

As to the circumstances which determine that, in one instance leprosy shall commence as an eruption on the skin, in another instance as localised anesthesia, and in a third as a cutaneous deposit, copious and strictly limited, I can only add that we have here so many consequences of the quantity of morbid material—scantiest in the nerve, somewhat more abundant in the eruptions, and so on; but an order of this kind does not concern, I must remark, that of chronological sequence. The illustrations which follow will, it is thought, serve further to establish the main proposition, that, namely, of the real existence of an eruption in leprosy, peculiar to this disease.

*Minute anatomical characters of Lepra leprosa*.—I was not able during my investigations in Bombay, to fully investigate this subject. In fact, the opportunity of examining with the microscope, the successive stages which this eruption presents, are necessarily very rare; since the period of the disease in which these spots abound, is by no means a fatal one. From inference, based upon observation, I conclude that the lighter 'infiltrations' of the skin described under the head of 'tubercular' leprosy, are essentially alike, in anatomical characters, to the newer patches of *lepra leprosa*, and reference, therefore, may be made to the description and illustrations (*see* Plate XIII.), further on.

Danielssen has, however, described at length certain skin-changes, as occurring in 'anæsthetic' leprosy, which it is easy to see belong to the eruption under notice. I shall therefore append some of his remarks, and as well an observation of Hansen's.

Previously, however, the following observation may be transferred from my earlier account of leprosy; it refers to a later stage of the patches.

*Morbid changes in the Skin*.—These have not been thoroughly ascertained. No doubt a deposit in and below the cutis is the cause of the elevation of the surface of the skin, impairment of sensation, and (partly) change of colour, when these are present. On one occasion a *pale* discoloured patch (third variety), which was much less evident after death than before, was minutely

examined, and it was noted, after comparison with a similar section of sound skin taken from the neighbourhood, that the pigment in the cuticle was less abundant, and it and the cutis atrophied: sweat-ducts smaller than natural ( $\frac{1}{100}$ — $\frac{1}{200}$  in. diam. to  $\frac{1}{14}$  in. normal), much less clear and surrounded by a deposit marked with clear small cells; the same kind of deposit was also scantily seen about the hair follicles, and occasionally in the meshes of connective tissue near to the cutis, sometimes branching as if enveloping a blood vessel: nerves (?) were seen in meshes, and then, approaching the surface, suddenly becoming taper-like, but free from deposit around them: hairs small and few, and sebaceous glands very scanty. These alterations of structure would, to a great extent, account for the symptoms.

Danielssen writes as follows:—Shortly after the appearance of the patches the skin and fatty tissue seems somewhat swollen and congested. Under the microscope the capillary network of the corium is seen to be considerably distended, and its vessels irregularly enlarged; and this is especially apparent when the skin has first been prepared with chromic acid and glycerine. When after a certain period the spots become decidedly elevated above the level of the sound skin, still preserving their well-marked tint, the capillary vessels are found to be yet more enlarged. In the corium, below the papillary layer, are to be seen crowds of cells belonging to the connective tissue, tumid, fusiform and reticular, and some of them being considerably enlarged and furnished with two or three nuclei and with several nucleoli. In some of these enlarged cells nothing is to be seen but a great number of nucleoli . . . the intercellular tissue becomes encroached upon . . . it would seem as if the cells of the connective tissue burst and allow their nucleoli (granular contents) to escape . . . I have never been able to see if these nucleoli become further developed, but there are many reasons for believing this . . . . . When the patches have become quite white, and sensibility of the surface has been wholly lost, the skin is found to be devoid of part of its adipose tissue, and the corium has an atrophied aspect. The previous tumefaction and augmentation of the cells has entirely disappeared: the sebaceous follicles are constricted; the nerves of the skin are enlarged . . . . .

Hansen identifies the 'cells' thus described with the peculiar leprous particles, which he more clearly discriminates; and, as I have intimated, these cells of Danielssen clearly correspond with those which were seen in Bombay. Hansen remarks (*vide* Appendix A., page vii) . . . . . I have examined patches of eruption present in tubercular leprosy (they are the same as in the anæsthetic form) and found them to entirely correspond, in an anatomical point of view, with tubercles; and in one much developed patch the cutaneous veins were seen to be widely dilated, and with rows of cells along their sides; the papillæ were free . . . . .

Should the 'leper-spot' be afterwards found to include the so-called 'scleriosis' of the skin, Dr. Rasmussen's observations to the effect that morbid changes begin in the lymph-spaces surrounding the smaller blood-vessels, would be applicable here; and a further question would hence be raised, as to a possible connection, in certain anatomical characters at least, between this kind of Elephantiasis (Græcorum), and the other—El. Arabum—which is believed also to commence in the lymphatics connected with the skin. See my remarks towards the close of this work, with the appended Plates and figures; and Edin. Mo. Journ., Sept. 1867.

*Nature of the Eruption, and its supposed Analogues in different Countries of the Globe.*

Anatomical data do not, of themselves, point to what class of skin-diseases the leper-spot should be relegated. They chiefly serve to show that the affection is but part of a malady, widespread in the frame and capable of assuming other phases.

In the present state of knowledge, the best way of dealing with the subject in hand, will be to collect together a number of independent observations, and afterwards from them and from those already recorded above, to draw such conclusion as seems most trustworthy. And the inferences thus established, even if not altogether complete, may be of value with respect to future inquiries.

It is to be understood that the following remarks have been made and selected, solely with reference to that state of the skin in lepers, which is not, by necessity, associated with 'tubercles,' or with changes due to 'abstracted nerve-influence'; although it is frequently, nay commonly,

met with in combination with both these phases of leprosy; because in lapse of time 'anæsthesia' and nodular deposits, as a rule, do supervene. This element of time has hardly been enough regarded, for, as above stated, anæsthesia in other part than the patches may come on after six, eight, or ten years, or, perhaps, even a longer interval: but the subject of the combination of phases in leprosy will be afterwards considered.

As to my own observations:—On comparison with other skin-diseases, the following remarks may be made. The eruption is not purely erythematous, vesicular, pustular; amongst papular affections, 'lichen circumscriptus' is the one which occurs to me as offering some likeness, but the similarity is merely apparent; amongst parasitic affections 'pityriasis' or 'chloasma,' have also a superficial resemblance; and I would note more strongly the common features of not invariable symmetry, of circular form and centrifugal mode of extension, with serpiginous tendency, and obstinacy of character. Amongst a class sometimes known as the Neuroses, 'Lepra leprosa,' has also its connections in the circumstance of its frequent association with nerve-disease: Thus, 'herpes circinatus,' or more especially certain varieties of 'urticaria,' bear a resemblance not unworthy of notice to some of its forms, and which indeed has been not rarely remarked.

Perhaps, however, it is amongst the 'tubercular' skin-diseases that an analogy would by preference be sought: 'lupus' has more resemblance to some forms of 'tubercular' leprosy, so-called, than to any phase of the eruption under notice; but vitiligo, cheloid, scleroderma, morphea, &c. may not unwarrantably be compared with some phases of the latter; and if one had to choose a place for it in current nosologies, it would be here. 'Lepra leprosa' is not commonly or necessarily attended with a covering of scales, or crust of inspissated secretion: and such addition should be regarded as simple contingencies, due to climate, race, and habits with reference to diet and clothing. I would repeat that leprosy eruptions cannot, in my opinion, be fully compared with the syphilitic; because they do not present the great multiformity of the latter, and because they have positive characters of their own not possessed by these. The clinical history of the complaints is, so far as known, similar only in widest features.

Lastly, as regards comparison with pigmentary changes in the skin, too little is known of the essential causes of such changes, to allow of speculation here. The true leper-spot may end in a pale patch, but there will also be evidence of near or distant nerve-disease, or of nodular deposit. I am disposed to think that all its varieties are connected; and that, therefore, their analogy with variations of pigmentation seen in Europe, has yet to be established in a satisfactory manner.

*Illustrations from other writers.*—Dr. Palmer notes (Ind. Med. Gaz., vol. VIII., 1873), as the result of considerable observation amongst the lower classes of Hindoos, that "the first thing that strikes an observer of skin-diseases in Calcutta is the relative frequency of occurrence of cases which would be called 'Morphea,' 'Keloid' (of Addison), or 'scleroderma,' in London, where such diseases are by no means of such frequent occurrence;" these cases are connected by him with leprosy, and he observes, "whenever the disease is very extensive, and the nerves leading to the part can be felt, they are found to be thickened, and some of the fingers or toes are not unfrequently also contracted." Dr. Palmer quotes one instance of incipient leprosy which he had seen, and here the new spots were said to be like 'morphea' or 'keloid,' being also very sensitive to the touch; while the older patches were compared to 'scleroderma' or 'sclerosis.'

Dr. B. N. Bose has furnished (Med. Reports on Leprosy in the East Indies, &c., Calcutta, 1865) an elaborate and interesting description of several phases of the leprosy disease, and he writes thus (page 107): "In leprosy we have many kinds of eruption, of which those most common may be briefly described as follows: 1st, the *rash form*, beginning with pimples, &c. . . . 2nd, the *bleb form*; these are the bullæ or pemphigus vesicles, well enough known . . . 3rd, the *squamous form of eruption in leprosy*; perhaps this variety of degeneration of the skin is the most frequent or universal in leprosy in tropical latitudes, and from our knowledge of the disease in India we might say that a full three-fourths of the cases ordinarily met with in this country are of this description. Three principal forms of this eruption may be distinguished; viz., in one the patches are of circular shape, the same as in *psoriasis circinata*; in the second they are irregular and cover large surfaces, as in *psoriasis diffusa*; and lastly, in the third, they occur in bands or lines most curiously twisted as in *psoriasis gyrate*." The author then describes these forms in a manner which renders it almost certain that he had before him the same skin-diseases as I have above distinguished; the only marked point of

difference being the perfectly *squamous* character of the eruption as seen in Furreedpoor (inland), while in Bombay (sea-coast), such particular feature was wanting; and upon this point some comments are afterwards made in the text. The fourth heading of Dr. Bose's divisions runs thus:—*The tubercular form of Leprosy*, and there follows a short description of the tubercles.

Dr. T. Beaumont, in Central India (*loc. cit.*, p. 234), refers to the eruptions of leprosy as follows:—1st form, the tubercular disease. 2nd, spots or patches like those described in the text as typical in character; "the margins when not exposed to friction, covered with a minute, white, "powdery disquamation," . . . . "the spots first appears as small papule, very much "resembling those of *urticaria*; these slowly increase in size," &c. . . . 3rd form, large vesicles.

Dr. A. Garden, N. W. Provinces (*loc. cit.*, p. 294), describes an eruption as characteristic of *Leprosy anæsthetica*, some numbness being combined; this eruption is unquestionably of the first kind described in the text. Dr. G. notes "rarely scales or desquamation" on the circular patches.

Dr. Kirkpatrick, Bangalore, in the Madras Presidency (*loc. cit.*, p. 477), writes thus:—"In "the anæsthetic form of the disease the symptoms often commence with the appearance of "somewhat circular patches, most frequently on the skin of the buttocks, thighs, shoulders, or "outside of the limbs, which are of a lighter colour than the rest of the skin, are seldom raised "above the general level, and are generally smooth or covered only with a very slightly furfura- "ceous state of the cuticle; but in some few cases these patches are surrounded with a raised "margin, covered with small scales, and in such instances the appearances are very similar to "those of slight *psoriasis*."

From Ceylon, J. G. (Report of the R. Coll. Physicians, 1867, p. 92) writes—a *second* kind of leprosy is distinguished by circular brown-coloured patches of the skin of various dimensions, occurring in different parts of the body, but more particularly on the trunk and extremities. They are not so much thickened and elevated as the former (*i.e.*, 'tubercles'); exfoliation, distortion, and contraction of the fingers and toes supervene.

In New Brunswick, Dr. Nicholson states (Report, Royal Coll. Phys., p. 1) that both forms of leprosy, as usually discriminated, are characterised by the appearance of yellowish or dark red spots, or patches, on the skin; usually at first on the head, chest, arms, and legs, and from half an inch to four inches in diameter.

In British Guiana, Dr. Reed remarks (*loc. cit.*, p. 42), that 'joint evil' (anæsthetic leprosy) begins with exacerbation of fever, and pains about the body for some weeks, and then the appearance of white or copper-coloured spots, sometimes on the face, but always on the limbs and body. They are slightly anæsthetic, and sometimes, after various intervals of time, fade and become scarcely perceptible. In other cases, a dark red spot, in white and fair persons, often appears on either cheek; numbness of the fingers and toes then ensues, and the little and ring fingers begin to flex or contort.

I may here point out the great concordance of symptoms thus described by Dr. Reed (who like the preceding observer, is mentioned as medical officer of a leper asylum) with those found to prevail in West India. See also Plate I. of this Memoir.

Another physician, Dr. Van Holst, also states (*loc. cit.*, p. 43) leprosy is known both in British and Dutch Guiana. "It is characterised by the appearance of spots or blotches, circumscribed generally by high edges, and either of a lighter or darker hue than the surrounding skin; "sometimes like bumps, as in *urticaria*, at other times in lines or stripes. These blotches increase "in size and number, attended often with an aching of the body; at length, ulcers form, the "fingers and toes drop off, and death ensues" . . . . The earliest observable symptoms are generally the external discoloured spots or blotches.

Dr. R. H. Bakewell, of Trinidad, West Indies (Parliam. Paper, May 1871, page 23), states that the "anæsthetic form of leprosy is characterised by pale yellow patches on the black or coloured "people, and darkish stains in the whites, scattered about the body," anæsthesia &c. co-exists. I find the following case in Dr. G. Milroy's Report on Leprosy and Yaws, &c., dated March 1873, page 32. "A girl, at 15, pale, plump, lymphatic, and somewhat scrofulous-looking, has numerous "large blotches, irregularly circular, over the back, shoulders, and lower extremities. Their margin "is usually reddish, slightly raised, with minute scales or scurf on the surface; the centre pale and "quite smooth. In nearly all more or less anæsthesia, most marked in the pale centre. She felt "the pressure of the needle, but not its prick. Several spots along the outside of the arms

“ particularly around the olecranon, anæsthetic, although the skin scarcely, if at all, discoloured. “ No discoloured or anæsthetic spots on face, ears, &c. On sole of one foot, about an inch back from “ the great toe, is a small circular, superficial ulceration, which supervened upon rubbing off a “ slight crust on the spot; no distinct bulla had existed there, but one had formed on the dorsal “ part of the foot, nearly opposite to the ulcer on the sole. Inguinal glands enlarged. General “ health feeble; is easily fatigued, pulse weak and thread-like. Has menstruated. In 1864 had a “ sharp attack of small-pox; had not previously been vaccinated. First appearance of the leprosy “ spots had been about two years previously; they became larger and more numerous after the “ attack. The mother (a Creole Jewess, father white), had been told by neighbours that her “ daughter had the ‘running ringworm,’ and that it would extend more and more.” No other remarks.

Dr. W. Nicholson, of Antigua, remarks (Rep. R. Coll. Phys. Lond. 1867, p. 20), the *anæsthetic* form is not characterised by tubercles, but by patches of discoloured cuticle resembling  *pityriasis versicolor* in various parts of the body, in which sensibility is nearly lost. When the patches affect the fore-arm or front of the leg, the extensor muscles are paralysed.

In Barbadoes, it is said (*loc. cit.*, p. 29) spots of *vittiligo* on the arms and legs, and here and there on the body, first attract notice. They are of dirty yellow or brown colour; benumbed and formed by thickening of the skin.

Dr. Wong, of Canton, under date January 1873 (in a communication received from Dr. Tilbury Fox), observes in reply to a question,—“the only disease considered as most allied to “ leprosy is a kind of red, tinca-like, erythematous patches, called Hung-wan-heut-sin, blood- “ coloured ring-worms. If they are curable they go by that name, and if incurable, are considered “ as leprosy. Morphœa alba and whitish patches, with more or less anæsthesia are regarded as “ varieties of the disease.”

In Madagascar, leprosy presents its usual characters; thus Dr. Davison (Report of the R. Coll. of Physicians, London, 1867, p. 220), the first stage of tubercular leprosy is characterised by the appearance of spots . . . “the patient probably discovers accidentally a small patch of “ his skin presenting a tint different from the rest of the body. Such spot may be seated any- “ where, very frequently about the back or shoulders. It may be of any shape, but it is generally “ oval or circular, and varies in size from that of a sixpence to the palm of the hand. The first “ change in the colour is to a light brassy tint, which, as the disease advances, becomes more “ distinct. The texture as well as the colour of the skin soon is affected. It becomes cracked, “ fissures running across the spots in all directions.” As Dr. Davison regards as the following stages of this disease, the advent of tubercles, and the occurrence of ulceration or falling off the members, it is evident that what is known as anæsthetic leprosy is not by him specially distinguished from the more striking form or the tubercular; and the spots above described clearly belong to the former or milder affection.

Mr. R. McKibbin, Surgeon to the Queen's Hospital, Honolulu, in a communication through Dr. T. Fox, and dated January 1873, observes:—“Severe and troublesome psoriasis is met “ with in the anæsthetic form of leprosy, as also another eruption which I have never seen else- “ where, nor ever exactly described. It is an erythematous, or rather an erysipelatous, thickening “ of the skin, and appears in large oval or circular patches (though not always this shape) over the “ face, trunk, arms, and thighs, often many inches in length. I have seen it involve the whole “ fore-arm. These patches are of a deep purple colour, sometimes raised quite one-eighth of an “ inch above the adjoining surface, and are anæsthetic. As this eruption frequently yields to “ treatment and gets nearly well, leaving only a slight discolouration, I am inclined to consider it “ more syphilitic than leprosy, and only mention it as one of the most common eruptions met “ with in the early stages of the disease, which, with some dry, coffee-coloured or yellow patches, “ varying in size and distributed over the face and body generally, constitute the ordinary “ symptoms of this form of leprosy.”

#### *Appreciation of the foregoing Observations.*

The ordinary skin-disease now named as those to which the typical leper spots may, from simple likeness in appearance, be compared, are either of rapid course, or, if chronic, far less uniform than here. The points of resemblance, indeed, seem to rest only upon such features as

mere physical characters, position, &c. all of which are either contingent, or depend upon general influences operating under wide conditions within the frame. Valid specification of any skin-eruption will have to rest upon other grounds than these. Thus, there are dynamical features, and the association of phenomena to be taken into consideration; and when this is done for the instance under notice, it will, I think, become evident that the leprous spot is not the same as erythema, urticaria, morphœa, or the like. For convenience, then, at least, it should be distinguished as a characteristic form, and its typical characters have already been sufficiently indicated: they may be summed up as follows:—

*LEPRA LEPROSA.*—*A characteristic eruption occurring in lepers, and consisting of benumbed patches, in which are combined the outward features of erythematous, tubercular, and some entophytic skin-diseases; but in which are not seen vesicles, pimples, or pustules. Squamæ are commonly absent and thereby—as well as by the attendant anæsthesia—Lepra leprosa is distinguished from Lepra Græcorum, or Psoriasis. Its adæcent is accompanied by hyperæmia; its course is chronic, but is liable to exacerbations (sometimes distinctly febrile in character), and its termination is seldom by complete resolution. It is an early symptom of leprosis; and is commonest about the elbows and knees.*

*Note on 'Morphœa.'*—Using this designation as now accepted in England, it stands for a skin-affection very rare in occurrence, but certainly offering appearances not unlike those exhibited in my Plates, and especially in that one taken from a Norwegian leper.

The following points may be noticed as bearing on this subject; in favour of the similarity implied, are the slightly raised, red, or lilac-tinted vascular rim, of varying breadth; the somewhat depressed centre, pale, or even white, shrunk or contracted, and insensible to touch; the long persistence of the spots and their tendency to spread, add, too, their occurrence in the course of cutaneous nerves, e.g. the supra-orbital on the forehead. On the other hand, there is an absence of the circular form and serpiginous tendency which I have noticed in *lepra leprosa*; this latter eruption often appears on the limbs, and preferably near certain joints; is very persistent and does not subside, as does morphœa; is common in males, and, more especially, is sooner or later attended with anæsthesia and wasting of the fingers or toes, &c., or with 'tubercles' on the face. The loss of feeling in morphœa seems to be due to simple compression of the nerve-filaments actually involved in the patch; that of lepra is associated with special nerve-disease. (See Plate IX.) Morphœa has been defined as hypertrophy of the corium, and as due to fibro-cellular hyperplasia, and as a kind of scleriosis; lepra could not thus be spoken of.

Yet writers of eminence have been disposed to admit a connexion between the two skin-affections: they are, it is said, allied affections. Kaposi, indeed, in the new work of Hebra on skin-diseases (Translation of the New Sydenham Society, vol. IV., p. 156) includes Morphœa amongst the signs of *lepra maculosa*. Without discriminating its several varieties, this 'mark,' or 'form' unquestionably appears to resemble the 'Leuke' of the Greeks, which was said to some times end in true leprosy; and, as is well known, amongst the inhabitants of colonised South America the more serious malady, is, in imitation of home usage, known by the generic name of Morphœa.

All these facts and statements are in favour of a real connexion between 'Morphœa' and 'Lepra leprosa.' But, on the other hand, let me observe that their anatomical or structural concordance has not been made out; it is even likely that it is wholly different. And, again, the clinical features of the two complaints are quite diverse. English and Norwegian physicians agree in regarding morphœa as a strictly local disease. I have never known the spot above described as peculiar to lepers, to remain long unattended with other marks of true leprosy.

If it be asked whether Morphœa may not be a relic of true leprosy, which once devastated Europe; one would reply, where is the anatomical and clinical evidence bearing on this subject? The general statements of Kaposi, interesting as they are, seem to me to be either unsupported by proof, or else the few illustrations adduced are insufficient for purposes of demonstration. In short, the European complaint must now be studied afresh, with special reference to the signs of true leprosy in this work (as, indeed, elsewhere) shown; or, as the alternative, the opinion of the Norwegian observers should be regarded as final.

*Historical Notices and Identifications of the Eruption in Leprosy.*

A very cursory inquiry into the history of leprosy (particularly as it shows itself in the East), will elicit the fact that a cutaneous affection was early recognised, as connected with this disease: thus the *Leuke* of the Greeks (Vitiligo, 3rd species, of Celsus) was a light-coloured spot, having a depressed surface, on which the hairs were white, and which when pricked exuded a colourless liquid: it was considered incurable and very destructive in its course. Hippocrates and Galen state that it sometimes passed into Elephantiasis (Græc.). Under the term *Baras* the Arabs also recognised a similar eruption, and further, the spots are noticed as insensible: "the disease is seated not only in the skin, but in the flesh and bones, and often terminates in leprosy." Bateman, Good, Adams, and others have endeavoured to identify this skin-affection, but with no great success, because the 'eruption' of leprosy was barely known to them. Bateman, indeed, who seems to me the most acute and accurate of our modern authors, thought he recognised in the description of anæsthetic leprosy by Robinson this *Leuke* or *Baras*, but, as I think, the data were inadequate for satisfactory comparison. The difficulties of identification reside not so much in what we now observe, as in what the ancient authors described; and it is not imputing to those belonging to our own profession a special blame, that they confounded things which differ; for, according to modern critics, few old authors treating of matters of fact or history, are to be wholly relied upon. Names of diseases have been employed in a very inexact manner, losing their value both by having their application extended from perhaps a single affection to a whole group (of which a better example could not be afforded than the word 'lepra'), or by being transferred to a wholly different disease (and no better illustration could be given than the use of the same word by certain translators). The following table expresses the result of my inquiries; finding it impossible to satisfactorily identify the terms formerly used, I have placed them in such a manner as to indicate where the confusion exists—the brackets serving to show the two affections indiscriminated by the corresponding names which are specified.

TABLE OF SYNONYMES.

| Names.<br>MODERN.      | Psora,<br>and other<br>skin-diseases. | Leprosy.                                 |                               |   | Elephantiasis.                   |
|------------------------|---------------------------------------|--|-------------------------------|---|----------------------------------|
|                        |                                       | Eruption.                                | Anæsthesia.                   | Tubercles.                                  |                                  |
| GREEK.                 |                                       | Alphos, Melas.                           | Leuke.                        | Elephantiasis.<br>Leontiasis, &c.           | Unknown to them.                 |
| TRANSLATORS OF ARABS.* |                                       | Morphœa alba, nigra.<br>Albaras nigra.   | Baras.<br>Albaras alba.       | Lepra.                                      | Not mentioned.                   |
| ARABS.                 |                                       | Behak, white and black.<br>Beres, black. | Beres<br>(white).<br>(Berek.) | Jezam.<br>Da-al-Asad<br>(Lion-disease).     | Da-al-fil (Elephant<br>disease). |
| MOSAIC.                |                                       | Boak,<br>Berat Cecha.                    | Berat lebena (?)              |   |                                  |
| HINDOO (Marathas).     |                                       | Shvet-kusta.                             | Guleet-kusta<br>Sunbahiree.   | Rueta-kusta<br>Rueta-pittia<br>Maha-viadhi. | Ras.                             |

\* Stephanus Antiochensis, the translator of Haly Abbas, is an exception, he more correctly terms Beres, *Lepra*; and Jezam, *Elephantia*; this was an approximation to a right precision.

The various kinds of eruptions seen in leprosy are, as I have said, intimately related; and so much so, that they may be regarded as modifications of one specific form, rather than generic group. It is freely admitted that they present several points of affinity to some other skin-diseases, but even supposing them to be specifically the same as one or other of these, the modifications they have undergone in that great constitutional malady, are yet characteristic or pathognomonic. It will be afterwards seen that it is with 'lepra' (after Willan's limitation of the term) that most salient characters agree, such as the absence of local irritation, circular form, raised tubercular edge, serpiginous tendency, and especially the disposition to appear around certain joints, as the elbow, knee, &c.; and this striking fact seems to afford an explanation of the discrepancies formerly attending the use of the term lepra, as well as of its first application to signify elephantiasis (Græc.) or leprosy.

There are several curious, almost anomalous, skin-affections yet noticed in Europe, which are possibly also connected with this leprosy group, and the same impression has occurred to some of our best authorities: their synonymes I believe to be often fanciful, but there are, I think, sufficient grounds for separating lepra from other 'squamae,' and even for classifying it with kelis, lupus, elephantiasis (Græc.) as they have done, if not for ranging the whole as "diseases arising from special internal causes." My own observations tend to show that lepra (Græc.) and the eruptions noticed in leprosy (in the East, its birthplace), are essentially related to each other; the former being possibly a modification of the latter, attributable to decay of type, climate, or constitutional peculiarities; and, as was above remarked, it is not improbable, in the opinion of some observers, that lupus, vitiligo, kelis, morphœa, &c. are similarly related.

On comparing leprosy as it now appears in the East and some parts of the tropics, and in the West (in recent as well as former times), the most striking differences will, I repeat, be found in the frequent presence of a peculiar 'eruption' and the comparative rarity of those 'tubercles' in the skin, which are the cause of the huge, mis-shapen distortion of the face, ears, &c., so generally associated with the modern idea of the disease. I refrain from speculation on this interesting topic, but we may suppose that the former of these differences, partly explains why the Greek translators of the Arabian authors were led to make use of the term *lepra*—already employed to designate a badly defined class of skin-diseases—in interpreting the *Baras* and *Jezam* of the Arabs (both varieties of true leprosy commonly accompanied by a cutaneous eruption), and thus to introduce much confusion in the meaning of this term. The mistake (if wholly a mistake it were) was not unnatural, more particularly as in their days *leuke* was probably classed along with lepra: and, besides, an elephant-like distortion of size is not frequent in Eastern leprosy, and therefore the Greek word for leprosy (*i.e.* Elephantiasis) would be generally inapplicable; not to mention the fact that the Arabs had already their *Da-al-fil*, or elephant disease, meaning thereby a totally distinct affection from leprosy. Admitting the force of these remarks, we ought not so severely to blame these translators as has been done: they endeavoured to express, too forcibly indeed, the common features of leprosy as known to the Arabs, but unfortunately they adopted a word already employed in a different and too indefinite sense.\* It is singular to notice, however, that this term 'lepra' held its ground, so that subsequently elephantiasis, leontiasis, &c. came to be regarded as species of lepra; and in quite modern days it was similarly understood by both Heberden and Cullen, who pronounced lepra (leprosy) to be very uncommon, or unknown to them.

\* "Leprosy abounds; sometimes it assumes the blotchy and not dangerous form called 'Baras;' sometimes it is the hideous 'djedūm' under which the joints first swell, &c." Palgrave's *Journey through Arabia*, v. 2, p. 3, 1865. I would observe that

the word 'baras' was originally, at least, meant for the milder (the so-called anæsthetic) form of true leprosy; and that this type of the complaint (including *l. leprosa*), was that probably first of all known to European physicians.

In further elucidation of this topic, I now proceed to make a few remarks on the similarity of some modifications of lepra Græcorum and the eruption in leprosy, more especially as regards the two first varieties described above. These remarks chiefly refer to the absence of 'squamæ' or scales in the former; a peculiarity so striking as to considerably diminish the precision of Willan's definition. Rayet, and Cazenave, and Schedel have noticed this, in Paris: the former states, "I have moreover observed lepra under another form, that, namely, of arcs or circles a few lines in diameter, red, prominent, devoid of scales and bounding surfaces of various extent occasionally as much as five or six inches across, the skin of which had either a yellowish cast, or appeared perfectly healthy," it generally occurred on the trunk, but also on the fore-arm and hand. Cazenave and Schedel say, "It (lepra) sometimes appears with very different and very remarkable symptoms. Thus, for example, the eruption deviating from its ordinary course appears in the form of small red circular points, which unite at their edges, and by their eccentric arrangement acquire an enormous size: the patches are not covered with scales, or if they happen to be so, and these fall off, they are not renewed:" instances are mentioned which seem to me very similar to those described under the 2nd of the groups above distinguished. It is true neither of these observers notices any diminution of sensation in the patches, so characteristic of the true leprosy-spot, nor anaesthesia of other parts, as commonly accompanies it here, and I admit this omission is important, but the force of the observation remains, that lepra (Græc.) is not always a scaly, but sometimes rather a modified tubercular skin-disease; and this feature alone will serve to partly assimilate the characters of 'Baras' as described above, and of 'Lepra Græc.' or Psoriasis.\*

#### *The Leprosy of the Jews.*

Whether this were really a variety of the disease known as leprosy at the present day, or not, is difficult to determine: in the Mosaic account it is described as a series of affections of the skin, which would lead us to suppose it was similar to leuke or baras, and the diagnosis was made to depend upon appearances not unlike those of leuke; the white glossy aspect, depressed surface, and blanching of the hairs being the most striking. The probability of the Jews becoming tainted with leprosy during their residence in Egypt, where the disease is known to have prevailed, and the general belief of antiquity, are also in favour of this view: and it may be further urged, that we are not to look for a scientific description in the Mosaic records. After making every allowance, however, the proofs of identity are not satisfactory; for putting aside the fact that more than one skin-disease is certainly included in the account in Leviticus, ch. xiii., and the otherwise inexact application of the term leprosy to inanimate objects, we find no reference to loss of feeling in the spots, or in the hands and feet, or to distortion and destruction of these parts, or to any of the symptoms of tubercular leprosy. The mode of distinguishing leprosy spots is also peculiar, depending upon changes they may undergo in the course of one, two, or three weeks; this would hardly assist in the detection of the eruption of leprosy as we now see it, for its progress is so slow that months elapse before any change occurs. Such are the chief grounds on which it might be argued that the disease was really not leprosy at all, but a collection of inveterate cutaneous eruptions, most arising from neglect of personal cleanliness, and to be remedied accordingly; while others, perhaps, scaly and tubercular, were rather constitutional. I should, myself, have

\* I have not attempted the bibliography of this subject; and would just remark that mild leprosy seems once to have been called (by Hjaltelin of Iceland), *psoriasis leprodes*, and that Frank had (according to Hebra), once used the term *leprosa* to

indicate a form of *lentigo*, which he regarded as being truly leprosy. My own observations claim to be independent rather than novel, and it is evident that the views here advocated are hardly likely to be new.

come to this conclusion, if I had not found in other ancient accounts of leprosy the same confusion and omissions, making it almost impossible to arrive at satisfactory results. It is worth notice that the Jews are now seldom affected with leprosy; I have seen only four cases, and no deaths from this cause have happened among the Jews in Bombay, during the 12 years preceding the year A.D. 1860, or during the last five years.

*"Kushta, or Leprosy, as known to the Hindus."*

This is the title of a valuable article by H. H. Wilson (Vol. I. of Trans. Med. Phys. Society, Calcutta, 1825), briefly referred to here as showing that the manner in which the subject was treated by Hindoo authors is similar to, but more precise than, that of Moses. Eighteen varieties are distinguished, seven chief, eleven of less importance, the distinction being founded on the "appearance and discolouration of the skin, and other incidental modifications." Some of the former are no doubt identical with the eruptions now seen, and described above; and amongst the latter it is easy to recognise others now known by the same name, although not of a leprosy type. Of these last or secondary forms, the species first mentioned is "ekakustham," also called "gajacharma," or "elephant-skin." This I conclude to be the scaly disease before referred to as popularly named "gaj-karam:" thus the Hindoos, like the Arabs and Greeks, had an "elephant" disease. Amongst all three nations, however, the idea to be conveyed was different, and consequently the diseases indicated of a perfectly different nature. In all these 18 varieties I find no reference to anæsthesia either of the spots, or the extremities, &c., nor any marks, beyond the attendant eruption, of either anæsthetic or tubercular leprosy. This seems strange, for we cannot suppose so wide-spread a disease to have quite changed its characters in the course of a few centuries; how is this total absence of allusion, even, to the most striking and peculiar feature of leprosy to be explained? Slowly indeed has plain observation been liberated from the trammels of traditional methods and inveterate preconceptions! The Hindoo is an improvement on the Mosaic, the Arab upon the Hindoo, and yet perhaps the best and most precise: it is reserved for the moderns to make the next step, aided by means of investigation till now unemployed, though not yet perfected.

*White Leprosy; Leucoderma; Albinism.*

There is a very striking and well-known blanching of the skin, which in the dark native produces a curious and rather repulsive appearance; I mention it here, because of the suggestion that it is the kind of leprosy, of old sometimes called 'snow white,' and the force of the simile cannot be denied, for the albinism is so complete, though of a somewhat chalky or deadened hue, as to equal the whiteness of the fairest European. The hairs of the head, &c., and the eyes are unchanged, and the functions of the skin uninterfered with. Cases are not uncommon; I have before me notes of 10, of which four are females (three Parsees), of adult age, the age of the men is generally less: in two cases the affection has existed for about 25 years without any impairment of health, in others for 10 years, and in once since infancy; I have seen very young children marked with it. The most frequent position at commencement is the hand, next the foot, face, penis, &c.; the spots are often perfectly symmetrical; they begin by minute white points, and spread so as to invade the entire surface; constitutional, and usually, local irritation are absent.\* In two cases it seemed hereditary, and in two or three connected with leprosy which is worthy

\* I may here remark that the native Hindoo or Mussulman names of the complaint are very unde-  
(9936.)

fined; thus, in Western India, this name is "Kod;" elsewhere the term is "Baras;" in Sanscrit "Charak."

of notice: a syphilitic taint is generally not observed. One instance may be related as presenting some unusual features.

15. A Mussulman, ætat. 28, from Mandavie; a wood-seller. The following parts are affected, —lips, within the nose, inna canthi: front of sternum, both elbows, front of fore-arm near the wrist, palm of hands, dorsum, knuckles, and fingers: whole length of shins, soles, and dorsum of feet: scrotum and inner part of the thighs. The spots are level, and white, irregular in form and size; the hairs on them white, and surface rather dry, though otherwise healthy; they are quite symmetrical, except the one in the sternum, and largest on the hands and feet; they are still spreading. It is ten years since the first appeared: some recent spots are reddish in colour, raised, the seat of itching sensations, and when scratched blood exudes; the glands in the axilla are inflamed. He is in good health and condition, but complains of the heat, and burning in the eyes. No spots are to be seen in the mouth. He states that his elder brother is affected to a much greater extent than he, and his paternal great grandfather had spots on his feet. There is no taint on the mother's side. He has no children.

*Black Discolouration of the Skin.*

This is worthy of brief notice, and is not very unfrequent. The colour may be compared with that of plumbago, or it may be bronze-like. I have short notes of seven cases, in which it has only occurred on the face, usually on the forehead or the cheek just below the orbit, sometimes in the course of the branches of the fifth pair. The functions of the skin are not affected. This curious disfigurement is not connected with a syphilitic taint: once it appeared in a patient tainted with leprosy, and I should remark that a bronzing of the hands and feet, face, &c., is common in lepers, where anæsthesia and tubercles exist; this fact may have given rise to the term 'black leprosy,' the worst form of the disease. The Hindoos have besides a white leprosy, which is probably Baras. In the Mosaic, Arabic, and Greek authors, we also find the terms white and black in constant use.

## SECTION I.

## CHAPTER II.—ANÆSTHETIC LEPROSY.

I now come to the consideration of a series of phenomena, which has no parallel, that I know of, in any other disease affecting the human frame. It is singular that the oldest known malady of man, should, in this manner, be so distinctive. Nowhere else, do we find such frequent and marked structural changes in the *superficial nerves* of the body, as in leprosy; and I cannot resist here mentioning, the deep impression on my mind, which was produced at the close of a careful dissection of the cutaneous and other nerves of one side of the body, in a young leprosy subject (one of several, similarly examined), when taking a general view of the morbid appearances, then so openly displayed. Being thus guided by what was, to me, virtually a real discovery—for I had no previous intimation of what to expect, and had thought to find changes in the deep-seated viscera and nerve-centres, where, however, all proved to be healthy in appearance—I was naturally disposed to lay especial stress upon the ‘nerve-disease’ in leprosy. Nor under wider experience, has this inclination greatly subsided.

The place which the type of the leprosy complaint now considered, occupies with reference to other phases, will be afterwards discussed; and I here submit the original text and cases bearing on ‘lepra nervorum,’ as emended and enlarged by the addition in foot-notes, of the researches and opinions of other observers.\* After, will be offered a few supplementary remarks on the

\* In justice to the English writer who, as I believe, first introduced the denomination, now universally known and admitted of *anæsthetic leprosy*, I append a long quotation. Jas. Robinson, Surgeon of the Hosp. for Insanes at Calcutta, very early discriminated the chief varieties of leprosy, and wrote thus (Med. Chir. Trans., Vol. X., London, 1819):—“There are two distinct varieties of the elephantiasis; one variety exhibits the following symptoms. One or two circumscribed patches appear upon the skin, generally the feet or hands, but sometimes the trunk or face; rather lighter coloured than the neighbouring skin, neither raised nor depressed, shining and wrinkled; the furrows not coinciding with the lines of contiguous sound skin. The skin thus circumscribed skin is so entirely insensible, that you may, with a hot iron, burn to the muscles, before the patient feels any pain. These patches spread slowly, until the skin of the whole of the legs, arms, and gradually often the whole body, becomes alike devoid of sensation. Whenever it is affected, there is no perspiration, no itching, no pain, and very seldom any swelling. Until this singular apathy has occupied the greater part of the skin, it may be rather considered a blemish than a disease; nevertheless, it is most important to mark well these

appearances, for they are invariably the commencement of one of the most gigantic and incurable diseases, that have succeeded the fall of man; and it is in this state chiefly, though not exclusively, that we are most able to be the means of cure. The next symptoms (which occur in some patients 12 months, but in others not till after five or six years) are the first which denote internal disease or derangement of any function. The pulse becomes very slow—50 to 60 per minute, not small but heavy as if moving through mud; the bowels are very costive, the toes and fingers numbed as with frost, glazed and rather swelled, and nearly insensible. The mind is at this time sluggish and slow in apprehension, and the patient appears always half asleep. . . . there are cracks and fissures in the skin, with ulceration and absorption of the fingers and toes; . . . finally, diarrhoea or dysentery supervene.” . . . This Robinson considers “a distinct variety of elephantiasis and from its most striking symptom would name it *E. Anæsthetos*,” it is not viewed as leprosy, but as a kind of elephantiasis, as the terms were then employed: tuberculated spots sometimes supervene, but are by no means connected with, caused by, or necessarily subsequent to this disease.” Here we have depicted ‘smooth’

general characters, diagnosis, and nature, &c. of this form of the leprous disease; with the addition of such illustrations as may suffice to point out its true character and bearings. The arrangement followed will be the same as that adopted for 'lepra leprosa,' under the last heading.

#### A.—LOCAL SIGNS.

##### 1.—DESCRIPTION AND CASES OF ANÆSTHETIC LEPROSY.

The complaint and examples now alluded to, are those—numerous enough yet not, perhaps, so common as instances of the other phases of leprosy—in which the earliest or most marked feature, is simple and local deprivation of nerve-influence, with its attendant consequences.

Impairment or loss of the tactile sense is the prominent character of this phase of leprosy, and, in the earlier stages, the first symptom noticed: it is, moreover, a very common attendant on the two other phases; and it is, therefore, the most constant feature of the disease, at least in India, and the most significant. Inability to appreciate differences of temperature, and other kinds of irritation, forms part of this symptom; but the 'muscular sense' is impaired, if at all, only when paralysis comes on, and that is neither invariable nor marked, even in advanced cases. The explanation of these facts indicates the special seat of disease, viz., the cutaneous nerves proper, in their course above the deep fascia; or else the nerve-trunks of compound function where they approach nearest the surface, and then probably only the sensitive or cutaneous element, as will appear further on. Conjoining to this striking peculiarity, the circumstance of the two other phases of leprosy being skin-affectations, it might be inferred that the proper seat of the disease is the cutaneous system, and to this conclusion, my own observations seem to point.

leprosy, the 'glossy' fingers, and the general apathy of the system (only now as a consecutive event), which subsequent writers have largely insisted upon.

Under the title of "The history of a case of "Anæsthesia," Dr. J. Yelloly had previously described in a most graphic and discerning manner, the symptoms presented by a well-marked case of anæsthetic leprosy occurring in a European planter who had long resided in Jamaica, but was a native of Scotland. The perusal of this account leaves no doubt, in my mind, as to the nature of the case; although doubtless on account of want of other experience, this was not detected. *Medico-Chirurgical Transactions*, Vol. III., London, 1812.

Some particulars are the following: "The case presents an example of loss of sensation in the upper and lower extremities, independent of paralysis." The man enjoyed good health. Three years before he had slept near an open window, and on awakening "found his feet and ankles perfectly numb, but without any sense of pain, and without the muscular power being at all affected" . . . "soon afterwards, he felt a numbness with a tingling pain in the little finger, such as occurs in a part which is said to be asleep; and, by degrees, finger after finger became affected, until the whole of both hands was in a considerable degree insensible." The local physicians thought there was here a scorbutic taint, but of

this no signs could be seen. . . . The hands are of a somewhat purple hue; of late there has been a slight loss of substance in them, the power of motion exists little impaired, still, without looking at what he is holding, he is apt to let it fall (i.e. the 'guiding sensation' defective in the skin (and muscles?) must be supplied through vision, H. V. C.); he cannot feel touch, or pressure, but yet perceives a blow on the hand; he cannot discern temperatures; the prevalent sensation is one of slight coldness, external warmth elicits this; . . . (extreme cold finally produces a sense of warmth, but it is not clear how far this may be due to reaction in adjoining healthy parts, H. V. C.) . . . his hands are never free from blisters, the least irritation, specially of heat, produces vesication; the skin heals well; the loss of sensation is found by experiment to extend down through muscle to periosteum and bone, or to a depth of about half an inch over the thumb. The patient has no fever. Electricity and galvanism have been employed without benefit, also mercury, &c. There are not mentioned any permanent spots upon the skin.

These observations, it is right, in my opinion, to record in this place, because they show that English physicians, at home and abroad, had long since made known the prominent features of that leprous nerve-disease, which I am now endeavouring to further illustrate.

The symptoms readily arrange themselves into three groups, answering to the early, established, and terminal stages; and in this order will be now referred to, each category being illustrated by cases taken from my notes.

*Premonitory and early stages.*—It there be any symptoms which are strictly premonitory, I have never seen them, but such are mentioned by experienced writers; their descriptions, however, have sometimes seemed to me to be based not so much on direct observation, as upon inference, or on a supposed analogy of leprosy to the eruptive skin-diseases. Some of the ancient Greek authors remarked that the disease is not to be detected, until it has already made its appearance by visible and unmistakable signs; and such is my own opinion, but it is given with diffidence, being the result of a somewhat scanty experience.\*

\* Many years since Boeck (Norsk Mag. for Lægevid, 1842) recorded the results of his examination of lepers in both north and south of Europe, and with reference to this point observes (p. 149) the anæsthetic form of leprosy (called by Boeck *E. glabra*) may also begin with prodromata, yet it would seem that they are not so frequent here as in the 'tubercular' form; amongst 42 attacked here I only found these early signs in nine patients. When they do appear they are almost the same as in the other form, namely, oppression of the frame, languor, weariness, disposition to sleep, or there may be a feeling of chills, either over the whole body or in only one part. Sometimes the disease makes its advent in a manner, which would lead one to suspect a rheumatic affection. The duration of these prodromata varies exceedingly—from some days to two years, which is the longest time for any of them which I have observed. Boeck then adds, the special symptoms, too, make their advent in a manner not less irregular at first than subsequently; whence there arises a difficulty in describing them, just as is the case with tubercular leprosy. The first sign of this form of disease is a *Pemphigus solitarius*

I have introduced this long quotation for the purpose of showing that even close observers elsewhere have, like myself, not detected any invariable or fixed mode of approach or outbreak of the disease.

Danielssen at a subsequent period (Monograph, 1862, p. 1) remarks:—The anæsthetic form which always maintains a chronic course, commonly does not develop itself until after a series of general symptoms or precursory signs have taken place during a variable period of time. These precursors are sometimes so insignificant that they are disregarded, whilst in other cases they are so severe that they not only strike the patient as something altogether new, but may often cause him to keep his bed. They are at times chills followed by flushes, at times a persistent feeling of icy coldness of the body, accompanied by oppression and an indescribable disposition to sleep; sometimes sharp pains running through the frame like the shifting pains of muscular rheumatism, or a grievous headache, distaste for all kind of food, cardialgic pains, pyrosis, foul tongue, thirst. If these

prodromata have lasted for years, as may happen, the wan and sallow visage bears the marks of profound distress; but if, as usual, these precursors are of short duration, they exert little or no influence upon the physiognomy. If the prodromata have been insignificant, or in the event of there being none at all, the patient is often much astonished to find in some part of his skin one or more pale spots of reddish-brown tint, slightly elevated above the level of the sound skin and attaining sometimes the size of the palm of the hand. If the precursory signs have been marked enough to entail upon the sufferer a constant sense of indisposition and inaptitude for the common affairs of life, it may happen that in the course of some days, or even during the night, these spots will appear over a wide surface, as for instance, the greater part of the back, the chest, the thighs and arms, which seem to be their seat of predilection. After such an eruption as this the general indisposition may subside slightly or altogether, and the patient become altogether well again . . . . .

Again, I quote largely and this time to show the nature of these precursory signs as interpreted by an experienced physician. Still I venture to remark first that they are most variable in degree, and next, that they are wholly like either common dyspepsia and hypochondriasis, such as one might expect to occur amongst people living on unsuitable diet, &c., or like rheumatism, such as is inevitable amongst fishermen and others living under the condition of peasants in Norway. The whole series of phenomena bear to us the aspect of aggravated indigestion with urticaria, and like eruptions; and so far it may be admitted the illustration is in favour of those who insist upon leprosy being due to bad food, &c.; but in a clinical aspect the interpretation is open to further consideration, and this will be afterwards entered upon.

I do not find that medical men in other parts of the world have made any advance on the conclusions of the Norwegian physicians; on the contrary it has rather seemed to me as if the latter had preoccupied the minds of other observers when an enumeration of these precursory symptoms were being taken down from the words of the patient. Yet that severe dyspepsia, malaise, and the like functional disturbances

Of the disease at an *early stage*, I have seen several instances. It has been stated by some writers, that hyperæsthesia is a common attendant at this period, but my experience hardly accords with theirs; for in anæsthetic leprosy this symptom has certainly been absent, if we may trust the assertions of the patients themselves; and it happens that in the earliest cases I have personally examined, it has been wanting.\* I have, however, seen considerable tenderness in parts of the face where a puffy, flushed appearance seemed to indicate

of the system may occur in connection with the advent of this local nerve-affection, need not be disputed. Perhaps some of the more marked instances occur in European subjects, other than Norwegian, &c., who have become lepers abroad. Thus an Irishman wrote to me his experience several years ago:—"I remember having had three distinct attacks of the complaint. The first came on in the latter end of the year 1847 (this was in Western India). I had suffered a good deal from sickness of the stomach, with a feeling of faintness and loss of vision whenever I stood in one posture for any length of time, the slightest movement of the body giving instant relief. One morning after waking from sleep I became conscious of a numbness of feeling in the little finger of the right hand and extending along the arm to the elbow. I thought it had been caused by my laying on the arm during the night, and took no further notice of it at the time, but finding it to continue, I applied for advice and was recommended to use friction with stimulating liniments to the arm. The sensation never returned, but on the contrary, gradually and entirely left." This man was a soldier in the Bombay Artillery.

Notwithstanding that amongst the natives of India, any general symptoms strictly premonitory of leprosy (in this form) are seldom noticed, yet I should add that two careful observers have described the following symptoms as common amongst hill-men or tribes inhabiting the lower Himalayan ranges in districts very widely apart; thus J. N. (*loc. cit.*) at Amritsur, a lethargy of body and mind with a great tendency to sleep, great debility, tendency to copious sweats, intolerance of the sun's rays, tenderness of the spine, weak sight, &c.; and Dr. J. M. Coates, at Chumpanan, near Nipal, writes (Bengal Report, p. 270):—"Though many of the attacks are ushered in by dyspepsia, I do not look on it as a predisposing cause . . . as to the fevers which are most frequently given as the cause, it is remarkable that they are never complicated by liver, spleen or anæmia, otherwise quite a common thing here; no organ seems to suffer but the nerves, as indicated by throbbing of the head and spine, profuse perspirations bursting out at irregular intervals without any exertion on the part of the sufferers, or any exposure to the sun's rays to account for them . . . Facts of this sort might serve to support the view of an essential connexion between malarial maladies and leprosy were they often to be noticed, but see the remarks further on.

\* My defective experience must, it seems, be supplemented by the more full knowledge of others; and I gladly avail myself of the following aids:—

In the *Ind. Med. Gaz.*, vols. II. and III. (1867-8), under the signature of J. N., is an elaborated description of this form of leprosy based upon personal observations in N. India, the patients having, it seems, been chiefly hill-men attending a dispensary near Amritsur. The author examined for several months, the lepers coming before him, and formed a theory as to the nature and seat of the disease, upon which not only a plan of treatment was founded, but which I think has somewhat biased the semeiological results of his inquiries. Amongst the *subjective* signs of anæsthetic leprosy are named mental hebetude as one of the earliest symptoms, drowsiness almost pathognomonic; all the faculties of the mind seem to come under a benumbing influence . . . these symptoms commonly diminish and may disappear altogether: the special senses are little or not at all affected: amblyopia, asthenopia, photophobia, diplopia are mentioned: there is no altered reflex action; local sensation is impaired, formication, pricking sensations, &c. increased on pressure, as in walking and grasping in the hand; a sense of heat or when the thermometer is low, a sense of cold; deep-seated pains in the body, constant, chronic; in every case there is lateral pain . . . I shall again recur to this interesting communication.

Boeck speaks of pemphigus as often the earliest sign, yet observes that perhaps the most common of all the early symptoms is morbid sensitiveness of the skin, especially of the fingers and toes, seldom of the face: it varies extremely in degree, there being either a mere disagreeable sensation excited by pressure, or very acute suffering: "one may witness tears falling down their cheeks when they move about only a few steps;" its duration is very various, namely from a few months to several years. Deep-seated pains may also co-exist.

It thus becomes sufficiently evident that local neuralgic pains, entirely corresponding to the nerves known by autopsy to be commonly diseased, are one of the earliest and most marked signs of this phase of leprosy. I have not, however, been able to gather evidence of an acute form of this nerve-affection; nor do distant parts of the system necessarily suffer. The variations in site, course, or direction, &c. of the hyperæsthesia depend on the particular nerves affected; its degree or intensity upon the amount of local derangement produced by the leprosy deposit.

the onset of 'tubercular' thickening; and I have been informed of an instance where the same was present in the lobules of the ears, which are supplied by a nerve very often found diseased. Tenderness has also a few times been found in the hands, &c., when the cuticle overlying the digital nerves was much thinned, but these cases are rare and of some standing; and the signs named, are simply natural consequences of impaired nerve-influence. Local sensations of pricking, shooting, burning pain are often present in the fingers, toes, &c.; sometimes there is a susceptibility to cold, and a feeling of heaviness and weakness, with tremor, in the part. Similar sensations running upwards in the course of the great nerve-trunks of the extremities as far as the elbow or knee are frequently felt, being either spontaneous or excited by slight pressure, &c.; if local tenderness co-exist, it is greatest at certain points, as on the side of the neck (*n. auricularis magnus*) above the middle of the wrist or bend of elbow (*median nerve*); or behind and above the inner condyle, and at inner side of wrist (*ulnar nerve*); behind the inner ankle (*posterior tibial n.*) or along the inner side of the leg (*long saphenous n.*); sometimes, a distinct enlargement of the nerve is perceptible to the touch in these places. Such local symptoms are often increased at night.\* General aching wearing pains in the limbs, &c. are occasionally complained of; and I have also noticed an excited state of the system, with tremulous movements of the extremities, but this appeared to be the result of depressing emotions, &c. rather than of implication of the great nerve-centres. Fever is not a constant attendant on leprosy in India, but it will cause temporary exacerbation of the symptoms in connexion with leprosy, the so-called 'elephantoid fever' had come before my notice in Bombay.† Many patients have expressed themselves not so well in the cold season, as at other periods of the year.

The following cases are intended to illustrate these remarks; in some the disease is first appearing, in others a fresh part is being attacked. As a matter of convenience, the upper extremity has been selected for illustration.

\* The deep-seated pains of the body are described amongst lepers in Norway, as varied in kind and degree, but as most severe, as adding greatly to their sufferings, and even compelling them to keep in bed for months together.

A writer in India (*J. N., loc. cit.*) has also laid particular stress upon these symptoms; he states that the pains in question are constant, increased on movement or pressure; oftenest felt in the legs or fore-arm, and referred to the bones or joints themselves: "there is absolutely no case without what may be called latent pain, i.e., pain which may be elicited at any moment by pressure or exertion; the patient free from this symptom may be pronounced free from the disease itself. Pain may be elicited in almost every part of the body." Sensibility of the liver, precordia, spleen is to be found, and that of the liver is sometimes very exquisite; but the most characteristic is the pain between the knees and ankles, after walking. Tenderness on pressure of the spine is an important diagnostic point; cannot be accounted for, but is probably due to disease of the envelopes of the cord rather than to the cord itself; the region between the shoulder-blades is found to be very sensitive to pressure, or sometimes the sacro-vertebral

junction, and only in these spots or the intervening ones. The patient does not feel this pain of himself, it is elicited by firm and steady pressure . . . . .

I am not sufficiently acquainted with facts of this nature, nor is it easy to understand their rationale when regarded in connexion with leprosy; pains of various kind and degree resulting from special nerve-disease I have above referred to, but the complaints here pictured seem to me either neuralgic or rheumatic; possibly syphilitic, or due to malarious cachexia, and not essentially related to the leprosy disease. They are altogether different, in my opinion, to the shifting, shooting, cutting pains due to disease of individual nerves; and more especially by their defined location and varying duration are these last to be distinguished. See below under 'Diagnosis.' To describe the great variety of altered tactile and common sensations, which may be detected in leprosy parts, would needlessly occupy time and space.

† This remark applies to other phases of leprosy; but it is susceptible of modification, and I shall recur to the subject of 'fever' in leprosy further on. Several writers on leprosy in the tropics, have observed a conjunction of the two species of 'Elephantiasis' commonly recognised.

CASE 1.—Anæsthesia of ten days' standing, dorsum of hands and feet affected. A Parsee, ætat. 30, a carpenter, living in Bombay. On the dorsal aspect of all the fingers and thumb, also on the back of the feet, near the ankle, is well-marked numbness of the skin (the first symptom noticed by the patient) with a coarse dry wrinkled appearance, but no change of colour beyond a slight reddening: over all these places the cuticle comes off in thin flakes; there is no kind of local irritation, or unusual sensation, and no impairment of muscular power. In the hands the numbness is greatest over the knuckles and does not extend so far as the ends of the fingers, a circumstance readily explained by the anatomical distribution of the radial and ulnar (dorsal branch) nerves on the back of the hand. There is no general disturbance of the system, or fever: no hereditary predisposition or any apparent cause for these symptoms: health good. (Dispensary patient, No. 44.)

CASE 2.—Anæsthesia of one month's standing—the median nerve affected. A Mussulman farmer, ætat. 42, from Broach. There is numbness without marked alteration in appearance of the tips of the thumb and two next fingers, on their palmar surface (right hand); when they are irritated, pain is felt along the middle of the fore-arm as far as the elbow, in the track of the median nerve, and the same effect follows jarring of the elbow or irritation of other parts supplied by the median nerve: there is no local tenderness in the course of the latter, but at night flexion of the fore-arm causes such uneasiness as to interfere with sleep. The tips of the fingers have not their temperature altered. For upwards of a year the middle cutaneous nerves of both thighs have been affected; the anæsthesia began near the knees. There is no hereditary taint, but he has had syphilis: health good. (Dispensary patient, No. 41.)

CASE 3.—Anæsthesia of the hands of a month's duration—both surfaces affected. A Hindoo, ætat. 26, a carpenter, native of Bombay. About a month ago when lifting a carpet bag he experienced a feeling of numbness in the hands, extending up the fore-arm, similar to that caused by pressure at the elbow (several other patients have used the same simile, some compare the feeling to the creeping of ants: since that time the numbness has increased and extends to all the fingers. He positively asserts there was no previous exalted sensibility in the hands, and at present no tenderness in the course of the nerve-trunks can be detected. Left hand—outer part of palm (median nerve) and dorsum (radial nerve), including the thumb and corresponding fingers, are quite benumbed, and a slight though perceptible change of appearance is already visible, the palm and fingers having a purplish hue and looking smooth and dry, but not yet shrunken; muscular power intact. Right hand—is in a similar state, only sensation partly remains in the ball of the thumb, &c.: small blisters, accidentally caused, have appeared on the outer side of the forefinger. The legs and feet have long been benumbed (two years); on the left side everywhere below the knee, the skin being shrunken and bronzed, and scars of sores are seen in the sole where pressure is greatest; there are no bullæ; on the right side the extent of anæsthesia corresponds to the distribution of the external saphenous nerve, and the skin is here, too, dry, bronzed, and shrivelled. He denies hereditary taint and syphilis; is in fair health. (Dispensary patient, No. 80.)

CASE 4.—Incipient anæsthetic leprosy. A Mussulman, ætat. 35, a drum-beater, native of Mahim, near Bombay. Symptoms of five weeks' standing. There is considerable numbness of both surfaces of the hands and fingers, limited above at the wrist: the skin of the palm is dry and shrunk and the cuticle is here desquamating in thin flakes; temperature not perceptibly changed: the dorsum of the feet, including the lower and inner part of the leg, in front, and the soles especially, are also benumbed; the skin is affected in a similar way to the hands. Muscular power and muscular sense (?) are so much implicated that he can hardly stand on his feet or feed himself: the movements are tremulous and slow. No tenderness of the nerve trunks, or other marks of leprosy, no premonitory symptoms, or local sensations except debility, twitching, and aching pains. Is in poor health and of intemperate habits: formerly suffered from syphilis: denies an hereditary taint. (Dispensary patient, No. 85.)

The local sensations are frequently so slight as to pass unnoticed by the patient, the numbness being then the first symptom observed; and this is often discovered by mere accident, *e.g.*, the fingers or toes are not uncommonly scorched unawares; one man found he could not

feel the bridle he was holding, &c. Many, perhaps most, lepers are unaware of the extent and degree of numbness of the skin, which may be present, because their attention has not been drawn to the part from previous excited or altered sensations in it; and for a time, at least, no visible change may be apparent at the benumbed spots.\*

There is no computing, indeed, how long absent or deficient sensibility may remain unobserved; for it is well known that persons who are deaf, or devoid of the sense of smell, may be unaware of the fact during the greater part of their lives.

It will be remarked that the pricking, creeping sensations and the attendant anæsthesia commence at the peripheral terminations of the affected nerves, extending *centrad*, and that the local tenderness and swelling of the latter, if present, are generally noticed simultaneously.† The chronology of these systems is of much interest, but unfortunately the data are not always to be relied on. A case which I carefully examined, presented an apparent exception to one of the above statements, for while the palm of the hand (except the inner side) was benumbed, the tips of the thumb and three inner fingers were still sensitive to the prick of a pin: I could not be sure of any difference between them and the tips of the opposite fingers, which were benumbed, though otherwise hardly changed; yet such limited variations as these point only to corresponding variety in place or degree of the leprosy deposits.

The foregoing instances will also serve to show the earliest changes the benumbed skin undergoes; these are briefly a dry, flushed, shrunken and mummified appearance, the cuticle being evidently atrophied and smooth, though shrivelled; it occasionally shows a tendency to desquamate. In dark skins a bronzed tint is very common. There is no evidence of elevation of temperature, but rather a tendency to the reverse. Perspiration is generally deficient or absent on the benumbed surface, and sometimes over a large extent around. Except the bronze tint which is less common there, the skin of the palm shows these changes best.‡

\* I am unable, having unfortunately left my original notes in India, to enter so fully as I could wish, into the extent and distribution of the anæsthesia of the skin in this form of leprosy; but the cases cited will serve to convey a correct idea on these points. In Virchow's Archiv, Vol. V., 1853, are some diagrams by Dr. W. Griesinger, of Cairo, showing the distribution of the benumbed surfaces in the upper and lower extremities of four patients, carefully examined for the purpose of ascertaining this point; and as this experience greatly resembles my own, I may observe that the areas corresponding to those of the cutaneous nerves of the fore-arm and back of arm, not always including the hand itself, are most of all affected. In the lower extremity, the front part of the leg and thigh, and almost always the back of the foot itself, are benumbed. Other corresponding parts, as the shoulders and nates, are also very frequently attacked. Compare this statement with my list of nerves actually found to be diseased, in the section of 'Morbid Anatomy.' And also, I add, compare with the sites most frequently the seat of 'tubercles' and 'eruption.' The whole of these local connexions are, to me, very instructive indeed.

† It is needless to quote from others illustrations of these statements, because opinion is agreed thereon, and local symptoms proceed *parsi passu* with local

morbid changes. More precise data than are afforded by disease, are needed to enable us to judge of the true chronology of the phenomena; and such data experiment upon animals has furnished for us.

‡ I have let this statement remain unaltered, because it serves to express, in a brief way, the changes which are seen in many cases of leprosy distinguished by the presence of confirmed nerve-disease; but there are variations of appearance in the signs of suspended nerve-influence, which call for further notice in this place. I have already said that the skin presents in lepers, at least three sets of changes—those, namely, due to nodules or tubercles; those due to eruption; and changes resulting from impaired nerve-influence. Now each of these series has its own peculiar signs, corresponding to duration or extent of the spots appertaining to it; what the tubercles show will be afterwards mentioned, what different appearances the eruption presents have been above described, and what result from varying deficiency of nerve-influence it is proposed to briefly consider in this place. It is not incorrect to say (as has been said) that the skin may be to a great degree deprived of tactile sensation, without presenting visible changes of appearance; and the explanation of this seemingly anomalous fact is complex; first, tactile and with it nutritional, nerve-influence is not entirely suspended; next, the trophic

The following cases further illustrate these, and the next succeeding phenomena, one of which is the appearance of the bullæ or vesicles. The hand is taken for example as before. Nos. 9 and 10 are of special interest, as proving a close relation between local nerve-affection and the superjacent eruption (Baras); the specific character of the latter being thus again demonstrated.

CASE 5.—Symptoms of a month's duration, or longer—tenderness in nerve-trunks considerable—further local changes. A Hindoo, ætat. 45, a trader, native of Bombay. Anæsthesia appeared on the palmar aspect of the fourth finger left hand, spread to dorsum and also to the little and middle fingers; a slight degree of numbness is present in the inner margin of the palm, which already is a little concave, indicating some degree of atrophy: the little finger has lost its flexibility and the fourth is swollen, stiff, and superficially ulcerated. Since 15 or 20 days, there have been pricking and shooting pains in the fore-arm and inner side of arm: there is also decided tenderness at the middle of the fore-arm above the wrist and the front of the elbow, but especially behind the inner condyle, also along the course of the median and ulnar nerves as far as the armpit, firm and tender cords are felt in the position of these nerves. The pain is so great when the arm is bent or compressed that he cannot sleep. There is no tenderness over the spinal column in the neck. He had syphilis many years since: no known hereditary tendency: no other part affected: there were no premonitory symptoms whatever. He has long suffered from

nerve-tubules (if such there be) are not affected; or, there are really considerable molecular changes in the skin, which are not, or not yet, visible to ordinary inspection. An appreciation of these points would here occupy too much space; and must therefore be relegated to other opportunity.

In the majority of cases, however, the skin is not only numb, but also altered in appearance; and for an independent description of the changes which are seen I could hardly do better than refer to Robinson's account of Elephantiasis Anæsthetos, as quoted in the first footnote of this section. I may also refer to Boeck's early investigations: he giving to Bielt the credit due, as I believe, to Robinson, of applying the term 'anæsthetic' to leprosy, himself objects to the denomination, because loss of feeling is common in the 'tubercular' form of disease, and because it may be wanting in the other (*i.e.*, in the eruptive phase as here distinguished), whence Boeck would choose the specific term 'glabra' for the so-called anæsthetic phase of leprosy as then commonly understood; and he defends this suggestion of 'smooth' leprosy on the ground of the name not only being the counterpart of 'tubercular,' but because it has a positive character of its own in the "smoothness of the surface, which exceeds the normal; all wrinkles are as it were unfolded, and the first glance at the patient justifies the denomination." It will be evident enough, I think, that Boeck here refers to the atrophic changes in the skin which he had correctly noted in his cases, and which is the same as that described before by Robinson, and since, by many observers in India and elsewhere. J. N. (*loc. cit.*) observes that the skin is always affected, but not in so striking a manner as is supposed; there are patches of discolouration, varying exceedingly in extent and position; these probably coincide with anæsthesia, but it is not certain that the anæsthesia may

not exist without them . . . . one form of 'lepra leprosa' is then referred to, and next the writer observes . . . far more important than any change of colour is the universal change of texture of the skin, which invariably accompanies the disease; its elasticity is lost, the skin becomes thick, harsh, dry, horny, with malformation of the nails; at other times the skin is excessively relaxed, flabby, wrinkled, oedematous . . . . Respecting these last-named changes, I have regarded them as due rather to a cumulation of influences, such as faded spots, suspended nerve-action, collection of secretion and of dirt; to exposure to varied weather, perhaps the additions of ordinary scaly or vesicular eruptions, the result being a state of the integument, which is commonly seen in lepers, which has been termed 'elephantiasis,' but which is after all no necessary attendant on the anæsthetic, or, indeed, any form of leprosy. Here, as elsewhere, the amount of localised change which occurs as a consequent of suspended nerve-influence, depends very largely upon the external influences to which the enfeebled part is exposed; thus, the more unfavourable to comfort and general well-being these influences are, the more the unnerved part will suffer, and *vice versâ*.

An illustration, both pictorial and descriptive, of the changes which occur in the hand (*eg.*) of lepers, may be seen in the case of Tah Mohummed, recorded at page 7, and illustrated in Plate I, fig. 2, which shows the state of his right hand from disease of the ulnar nerve at the elbow. I shall recur to this subject, and will here only remark, that my observations directly connecting nerve-disease and certain changes in the skin, as they were quite independently made, seem also to be the earliest recorded in full; they are amply corroborated by the results of nerve-injury and of experiment.

dysentery, and is thin, but tolerably strong and very intelligent. Afterwards it is noted that perspiration is scanty in the left arm (this symptom has been found in other cases), and that the skin of the hand is becoming darkened and shrunk. (Dispensary patient, No. 47.)

CASE 6.—Disease of the ulnar nerve of three months' standing—marked diminution of temperature. A Mussulman, *ætat.* 25, from Hindoostan. Above the inner condyle of the arm is an elongated swelling, visible even to the eye and tender to touch; pain and tenderness extend also as far as the axilla; pressure on the swelling causes shooting pain and spasms in the two inner fingers of the hand. Here is seen slight atrophy of the inner side of the palm, slight flexion of the two fingers, with some thickening of the ring finger; on the dorsal surface is a light-reddish patch, probably the result of a caustic application intended to remove the numbness there. The skin of the palm—inner half—presents a slight flushed tint and shrivelling, extending to the fingers, the innermost of which seems a little atrophied: these parts are of a decidedly lower temperature than the rest of the hand, judging by the feel only: they are completely benumbed. The whole hand is weak, the interosseous spaces collapsed, particularly the first one (the adductor pollicis muscle supplied by the ulnar nerve being paralysed), and the thumb is much weakened. There is decided atrophy of the inner side of the fore-arm: the hand is displaced somewhat outwards as if the flexor carpi radialis muscle were acting without an antagonist. History—there was first a pricking sensation (as if asleep) in the little finger, followed by numbness in it and the next finger; soon afterwards the swelling at the elbow attracted attention, there being great pain and tenderness shooting along the fore-arm, which prevented his sleeping; increased numbness and weakness followed, but the symptoms now progress very slowly. Is in fair health and intelligent; denies syphilitic and hereditary taint. (Dispensary patient, No. 471.)

CASE 7.—Disease of the ulnar nerve. An adult Parsee, who for a year and a half has shown symptoms very similar to the last case: the skin at the inner side of the palm (right hand) is thinned, red, and shrunk, the change being very apparent indeed on his pale skin; there is twitching of the small muscles supplied by the ulnar nerve: on the latter just above the elbow is an elongated tender swelling. The hand is very susceptible to cold, and the temperature, at the inner side is slightly reduced, judging by the feel. The patient formerly attended the Dispensary, but the disease was not then detected, being mistaken probably for inflammation of the lymphatic glands at the elbow, but the hand was already implicated, for poultices, he states, were ordered: there is no clear evidence, however, of hyperæsthesia now, or in the history. (Dispensary patient, No. 70.)

CASE 8.—Anæsthesia of a year's standing: bullæ, or vesicles. A Mussulman, *ætat.* 45, from Baroda. There is numbness of the dorsum of both feet and both hands; and slightly of the lobules of both ears, which are rather reddened. In the hands the tint seems darkened; the anæsthesia is limited precisely to the dorsum, and does not extend to the ends of the fingers (this part being supplied by a branch from the palmar digital nerves). The feet are much bronzed, particularly the left one where the disease began, and numerous small bullæ or vesicles appear on the sides and tips of the toes, he states, in a perfectly spontaneous manner: the size of some is almost minute. The anterior tibial nerve is probably less affected than the musculo-cutaneous: the sole of the left foot is benumbed, and there is tenderness behind the inner ankle. He never had syphilis, and knows of no hereditary taint. (Dispensary patient, No. 77.)

The case of Tah Mohammed narrated at page 7, is also an excellent illustration of the early stage of anæsthetic leprosy. See as well that of the patient named Chinaya, page 13.

CASE 9.—Identity of seat of the eruption and the nerve-affection. An adult Mussulman, Rutnagherry (coast), complains of numbness of the right arm and fore-arm over the extent supplied by the two internal cutaneous nerves, also of the palm of the hand and little finger where supplied by the ulnar: this he first discovered by accident about a month since. Around the elbow and above, the skin has a pale appearance limited by an indistinct but defined margin, which is gradually spreading upward: here the anæsthesia also ends and pressure at this spot, over the ulnar nerve, alone causes shooting pain in the course of the latter. Other pale patches are found at the knees, of longer standing. (Dispensary patient, No. 82.)

CASE 10.—Baras attendant on the local anesthesia and disease of ulnar nerve. Nowrojee, *setat.* 15, a carpenter, living in Bombay, in good health, but unable to work on account of the left hand being weak or tremulous, and stiff. There is already atrophy of the palm, and the appearances so characteristic of leprosy have begun to show themselves. The skin near the wrist, on the inner side, is shrunk, dry, and dusky, and quite benumbed. On the inner, front, and outer surfaces of the fore-arm up to beyond the elbow are two large patches of baras of a perfectly typical character and most striking to the eye: they are quite benumbed. The ulnar nerve at and above the elbow is greatly enlarged and very tender; pressure on it, as he observes, causes twitching and shooting pains running downwards to the inner fingers. The dorsum of the hand is not benumbed except over the little finger, and here there is a pale red tint generally indicating the eruption, indeed it is evident that the large patches of baras began at this spot upon the benumbed surface and they have spread upwards over the course of the internal and external cutaneous nerves. The history of the case shows that the pricking pains and numbness were first noticed in the hand (and this only two months since), about the same time pain and tenderness at the elbow, and a short time afterwards (three or four weeks) the eruption made its appearance, at first on the dorsum of the inner finger. Great weakness and atrophy of the hand followed with quick spreading of the eruption upwards. No fever. (Dispensary patient, No. 83.)

These two cases, and I could mention others, offer conclusive evidence of the close relation of disease of superficial or cutaneous nerves, with a characteristic form of skin disease.\* The last one is remarkable for the rapid progress of the local symptoms, depending upon extensive and acute nerve-disease.

Thus it will be seen, that wasting of the deeper seated tissues and of the muscles supplied by the diseased nerves, with atrophy, flexion, and stiffness of the fingers and toes; frequently a marked diminution of temperature: discolouration, vesicles and superficial ulceration, are the chief phenomena which succeed the anesthesia. The distortion of the hands is peculiar, the palm being narrowed and flat, the dorsum rendered concave; the first phalanges are drawn backwards, and the two next, flexed, stiff, and claw-like, are also much wasted.† The ball of

\* In anticipation of illustrations and other remarks, which will be given further on (*see* page 51), I may here observe, that as a direct consequence of nerve-lesions (some of them, as it happens, occurring in the hands and feet, whence a fitter comparison with the pathological phenomena of leprosy), the following defined skin-eruptions have, at different times, been noticed:—Erythema, Roséola, Acne, Herpes, Urticaria, Eczema, Pemphigus, and even Psoriasis. I need not now refer to the whitlows, sub-cutaneous effusions, &c., which are also known to result from injury to the median and ulnar nerve; but mention the above as an illustration of the opinion so long since intimated in the text, namely, that leprosy may of itself give rise, not only to atrophic changes, but to a distinct form of eruption of the skin. The pathological instance is, indeed, a complicated one, because there is a simultaneous specific deposit in the skin; but then my rejoinder would be, the suggestion that even this superaddition may be to some extent, a result of nutritive disturbances, due to the same derangement of nerve-influence.

† This peculiar deformity is capable of being produced in several ways: thus, it may be due either to paralysis of some muscles and the unopposed tonic action of their antagonists, to spasm of certain

muscles, or to their shortening in consequence of disease and wasting. A deformity precisely similar in kind and degree may be seen after mechanical injury to the ulnar and median nerves; and evidence to this effect will be given under the heading of 'General Pathology.' As regards their course and extent, these changes in the position of the fingers or toes come on slowly; the digits may, at first, still be freely moved by aid of the unaffected hand, or by the assistance of another individual; but, after a time, the distortion becomes even temporarily irremediable, and it proceeds to an extreme degree. The attendant atrophy of the hand is, as well, extreme; and the tense, projecting tendons seem, with the bones, alone left of all sub-cutaneous parts.

Anatomical explanation of the deformity is not so simple as may, at first sight, appear. Duchenne, in his *Electrisation localisée*, fig. 88, page 327, has given a figure of the hand remarkably like that of a leper; and his explanation is to the effect that the first phalanges of the fingers (taking the hand, for an example) are drawn back by the unopposed extensors, while the second and third phalanges are forcibly flexed by the unopposed flexors in the fore-arm; all the interossei and the lumbricales, and, as well, the short muscles in the palm of the hand being

the thumb subsides, and a marked depression exists where the first interosseous muscle should be; and as might be anticipated, muscular power of the hand is diminished, but it is not lost until the muscles themselves have probably become wholly changed. In the fore-arm, paralysis is less apparent, and then is mostly seen on the inner side where the two muscles supplied by the ulnar nerve are placed; I have often noticed a wasting here, indicated by a straight or concave, instead of the usual convex outline. All these changes may occur in a few months, or they may be delayed for two, three, or more years, depending, no doubt, upon the degree of nerve-disease, and also the general condition of the patient. The bodily health is not yet necessarily affected; patients in favourable circumstances still retaining their vigour, with the exception of this curious blight in one or other of their limbs.\*

The disease has now reached a *confirmed stage*. The function of certain parts is seriously affected by impairment of their nutrition. As 'bullæ' continue to appear they may be noticed first. Their most frequent seat is the fingers and hand, toes and feet, but I have seen them

paralysed. This author attributes to the interossei and the lumbrical muscular slips, the office of flexing the first phalanx, but of extending the two terminal phalanges; and hence when even the ulnar nerve alone is paralysed from injury (an event of which I have not yet seen an instance recorded in full) much distortion and weakness of the hand must, of necessity, follow. Thus, the two inner fingers will be drawn toward to the palm, by the unopposed flexors; whilst the two outer fingers will be kept extended by the still effective lumbrical muscles, which are supplied by the median nerves. The general weakness and wasting of the hand, are, of course, due to palsy and atrophy of the *interossei* and other small muscles in the palm normally supplied by the affected ulnar nerve. The ingenuity of this explanation is obvious; but I need hardly say that Duchenne's view of the action of the *interossei* and *lumbricales* are not those commonly accepted. I do not know how far the small and feeble lumbrical slips attached to the two outer flexor tendons, would be able to hold the fingers so fairly straight, as is shown in the hand at fig. 1, Plate I., and I think we should not, in the leprosy hand, ignore another factor, which may be stated as follows. The ulnar nerve, in the fore-arm, supplies the inner half of the *flexor profundus digitorum m.*; and when this nerve is so much diseased at and above the elbow-joint (a common event in leprosy) as to have its functions greatly impaired, the corresponding segment of muscle becomes paralysed; hence, that part connected with the tendons of the two inner fingers, next becomes wasted and shortened, and, in consequence, these fingers are drawn towards the palm. Whence the deformity which I have described and figured in the case of Tah Mohammed (see page 7, and the illustrations just named).

The recorded instances of mechanical injury to nerves of the hand, are hardly definite enough for comparison with early leprosy-disease; and, besides, they are commonly examples of hurt inflicted near the wrist, while leprosy-disease occurs chiefly near the elbow. Whence, in the latter case, we have also a

deflection of the entire hand outwards, when the ulnar nerve is alone affected. Lateral deflection of the fingers is rare. The toes are frequently much displaced, laterally as well as towards the sole; and this may be partly due to irregular pressure upon them, during an unsteady walking gait.

\* In order to show how similar are the local alterations seen in Norway, the following extract from Daniellssen (*loc. cit.*) will suffice:—"Besides the loss of feeling, movement becomes gradually greatly restricted; thus, all the fingers become curved, one after the other, the back of the hand falls in, the first phalanges becomes extended, the others, flexed and this makes the palm of the hands convex, the back concave, and the entire hand is sometimes bent towards the fore-arm. The latter, and as well the hand, may, under these circumstances, be subject to so complete an emaciation that it would seem as if all the soft parts beneath the skin had completely disappeared. The skin itself appears thinned; it is without elasticity, dry, shrunk, and often disposed to crack, thus leading to large dry fissures on the back of the hands. Similar phenomena occur either simultaneously or at a later period, in the lower extremities, seldom earlier than in the upper limbs." Respecting the latter part of the paragraph in the text, I also quote the following: "I know some instances where one of the hands has been attacked, and when the anesthesia has been complete, when the emaciation and curvature of the fingers have been complete, and where the rest of the body has been healthy and well nourished, even at the end of numerous years subsequent to these alterations in the hand. There is here, at least, an arrest of the malady at this stage such as may happen with the leprosy patches; and it is possible enough that the disease has disappeared for ever, yet this cannot be said with certainty because observation has not been carried on till the close, and since this anasthetic form follows an extremely chronic course, one might be deceived in this respect."

on the thigh, nates, &c., never on the face; their size varies from a line to an inch in diameter; their number is small, one or two appearing at a time, generally in the night, and their form is irregular; they contain a turbid or reddish fluid, and sometimes are but little raised, as if the effusion were seated in the cutis itself; they usually subside in two or three days, but may burst, leaving a raw surface which, however, by no means invariably ulcerates; finally a white spot may remain if the cutis have been involved; otherwise no distinct mark may be left. I have seen a deep ulcer leading to bone (beneath the ball of the great toe) and around which the skin was benumbed, said by the patients to have begun by a vesicle. Difficult as it may be to explain the occurrence of these bullae on benumbed surfaces, it cannot be denied that many times they appear to arise spontaneously, and hence they have been ranked as the peculiar feature of anæsthetic leprosy; but it is equally certain that they are often absent, and in my experience they have never appeared on a surface not previously anæsthetic, so that their diagnostic value can be but slight. And again, they may often be traced to an accidental cause, as the heat of a fire, or 'biri' (i.e. cigar), friction of the shoes, pressure, or some such slight irritation (unperceived by the individual), as it is probable would induce their formation on a surface, the vitality of which is depressed, and cutis partially disorganised; they occur, too, on parts most exposed to such irritation, as the knuckles, sides and tips of fingers, sole of foot, &c., and finally in appearance there is nothing to distinguish them from other accidental vesicles, only sometimes they seem deeper placed. Febrile symptoms have not been observed to precede or accompany their appearance.\*

\* These 'blebs,' *bullæ*, or large vesicles (which, when single, have been specially named *pemphigus solitarius*), form another of the symptoms of leprosy, whose true character and relations seem to be explicable only on the hypothesis of defective nerve-influence. It is, however, distinctly asserted by the Norwegian physicians that these vesicles rank amongst the very earliest signs of anæsthetic leprosy, and therefore presumably they occur before the advent of anæsthesia in the part where they are seated. I do not find this to be stated in so many words, but understand that the vesicles appear on surfaces not seemingly different from natural.

Danielssen, however, in his later Monograph, describes the pemphigus as coming only on numbed surfaces.

Peculiarities about these vesicles are the following: they are apt to appear at night (perhaps in consequence of irritation experienced during the day); they are very large and often of irregular form; they are often single; they recur on the same spots, and at intervals lasting for years. They are commonest about the elbows and knees, the hands and feet, but Danielssen avers that they may occur in localities where it is impossible to indicate an external cause, such as pressure or irritation.

Some authors have noticed the co-attendance of fever, upon eruption of the larger vesicles.

A very precise statement respecting them is made by Dr. Beaumont, at Indore (Bengal report, 1865, p. 237), from whose interesting report I have before quoted; he describes an eruption in leprosy consisting of large vesicles filled with clear serum, which form suddenly and with little pain or inflammation; on

bursting leave superficial ulcers, which at first heal quickly, leaving depressed, white, shining cicatrices. But they occur on situations the sensibility of which is perfect, frequently a number are developed at the same time; they occur on both trunk and extremities; they heal readily, so long as the parts retain their sensibility. Dr. Beaumont regards these vesicles as different from those which are met with in ordinary cases of anæsthetic leprosy.

My own further experience is not different from what is stated in the text, and I look for a confirmation of the view that these local effusions are solely due to irritation of surfaces, whose nutrition is previously impaired by deprivation of nerve-influence, in the results of experiment.

The termination of the vesicles varies: first, they may dry up, leaving no permanent sign; next, they may leave a circular, ovoid, or irregular-shaped mark, which is slightly depressed, white, and finely dotted, glistening, and void of hair or glands; benumbed, too, it may be, and due to exfoliation of the cuticle in its entire thickness. The superficial or papillary layer of the corium also suffers, whence some shrinking of the surface. The appearance is very characteristic for a time, on account of the glistening whiteness of the exposed corium, with its remnants of rete-mucosum; afterwards, some pigment may be formed, and this peculiarity fades. Lastly, excoriation and true ulceration of the exposed cutis, leading to its entire destruction, may follow, and a more indubitable shallow, puckered, and irregular scar is the consequence. The skin of the arms and legs of lepers are frequently scored with such cicatrices. I should add that around

It may be observed that sub-cutaneous structures, *e.g.*, the bottom of a deep sore, will be sensitive when the cutaneous surface around is benumbed; this I have noticed more than once, and it seems to show that the anæsthesia is, sometimes at least, only superficial.\* Ulcers generally readily heal.†

The frequency of an accompanying eruption ('baras' in one of its forms) has been fully pointed out and illustrated in previous cases. When present it was found to have preceded the anæsthesia rather oftener than follow it, the interval being generally a year or two. In many instances of long standing leprosy it had ceased to be visible, if the statements of patients are to be trusted; and as anæsthesia would probably remain, this may be the explanation of the extensive benumbed but otherwise unchanged surface sometimes noticed on the trunk; it must be acknowledged, however, that the cause of this widespread anæsthesia has not been adequately investigated, and it is probable that the cutaneous nerves are also sometimes implicated, as on the extremities, since the numbness may be wanting in defined regions, as for instance, along the median lines of the trunk, and here alone, or on the front of the abdomen, &c. The intercosto-humeral nerve, I find, is not seldom diseased. Bronzing of the skin of the feet, hands, and face, is common in dark Hindoos and Indo-Europeans; it may be partly due to exposure, but is accompanied by atrophy and smoothness, as well as deficient sensation.

the circumference of the vesicles alone, ulceration may happen, and that in this way, circular or serpiginous, scars arise; in fact, there are many intermediate forms and degrees of this series of changes, which it is needless to farther specify. In the opinion of some observers, the white patches on the skin thus produced, correspond to the signs and marks of leprosy as laid down by the Hebraic and early Oriental writers.

\* On this point my experience was limited; and elsewhere, as in Norway, it has long been known that loss of feeling extends to the deeper-seated structures. Thus, Danielssen states:—The anæsthesia is not limited to the skin alone, it penetrates below, pervades the cellular tissue and all the muscles, and becomes so complete that the patient may endure a burn, which causes even charring, without having the least feeling of it; nay, even largish amputation of these parts of the hands, &c. may be made without exciting feeling . . . . I have myself seen at Bergen large necrosed fragments of bone dragged away without the patient complaining, but I did not examine carefully into this subject, which, however, is one of the greatest interest.

It was sagaciously noticed by Yelloly in his case of 'anæsthesia' (see a previous foot-note), that loss of feeling extended to the deeper parts; for on a surgical instrument being thrust into the thumb right down to the periosteum and bone itself, no pain was experienced; and it has been found after injury of the nerves of the hand, that superficial ulcers, at least, are not tender.

In one of Mr. J. Hutchinson's cases of nerve-injury, an ulcer formed at the tip of the finger, which, it was noticed, was not painful on pressure.

† This is common experience, as regards ordinary ulceration; and with reference to wounds accidentally caused, or such as are the result of surgical interference, it is uniformly acknowledged that healing is neither prevented nor delayed by want of tactile sensations or even common sensation, in the parts. This fact is a very remarkable one. But the common ulcers spontaneously arising, and found on the soles of the feet more especially, do not readily heal; they are in fact connected with diseased bone or joint: says Danielssen—they are cured with difficulty and remain open during the whole life of the patient; sometimes narrowing and secreting but a small quantity of their peculiar humor, at other times enlarging and pouring forth a great amount of ichor. He continues:—so long as the ulcers extend and plentifully secrete, so long the malady seems at least to be arrested, and the health of the patient is good; but if, on the contrary, they close up and their secretion becomes scanty or suppressed, there soon arises a general disturbance of the system . . . . in fact, the disease at once makes evident progress amid febrile re-action, and other signs of general suffering; nay, even death may ensue with brain symptoms . . . . Of all this I know nothing by experience in India.

The spontaneous, or almost spontaneous, ulcers occurring in 'anæsthetic leprosy,' also do not readily heal of themselves; and with reference to this point, Paget's case, so well-known, is of interest, as indicating that irritation of a nerve, may prevent the healing of an ulcerated surface connected with that nerve. In leprosy, the conditions are not quite the same; yet the principle implied is doubtless applicable in this instance.

The progressive interstitial absorption, the most frequent and characteristic mode by which the hands and feet become distorted and partly destroyed, always (like the anæsthesia) commences at the ends of the fingers and toes; and it would seem that the terminal phalangeal bone is very early affected. After its removal the altered nail and pulp are transferred by a kind of involution, as it were, to the second segment of the digit, subsequently to the first, which also not unfrequently disappears, and so destruction proceeds. Striking limitations of this process to one side or its greater progress there are sometimes seen, corresponding evidently to deeper implication of the median or ulnar nerves, or in the foot the inner and outer plantar. My notes refer to remarkable instances in the latter locality; this fact will be again referred to as proof of the real though obscure dependance of nutrition upon nerve influence. In spare subjects, as the Hindoo and Indo-European, the fingers become shrivelled and very slender by absorption, but in the plethoric Mussulman or lymphatic Parsee this may be less evident; they are then, indeed, shortened, and being thinnest opposite the intervals of the joints, the latter appear swollen, or become so from chronic inflammation. The fingers generally are tumid, smooth, and shining. It is in these cases, I believe, that the Pacinian corpuscles will oftenest be found changed; they are seldom so in the dried and shrivelled hand.\* Necrosis of the phalanges is not uncommon; it begins at or near the joints which then become swollen, foul ulcers appear on their dorsal surface, and fragments of bone, or a whole phalanx, are extruded there, but this process, infinitely more unsightly though not

\* The process of interstitial absorption of the bones, which proceeds by a kind of molecular destruction, was not recognised by the Norwegian surgeons at the time of my visit; nor is it referred to in their writings. The account in the text was based on direct observation, but this is not the first time the occurrence has been mentioned. For instance, in the *Bombay Medical and Physical Transactions*, new series, vol. 2, 1853-54, p. 290, Mr. Lisboa (a distinguished graduate of the Grant College) states that in leprosy, removal of the bones may occur by either interstitial absorption or by caries; he inclines to the view of interstitial absorption, "because the bones become thinner, smaller, and smoother, as the disease advances." Other observers (as Day, at Cochin) have recognised the distinctions here implied.

In a subsequent chapter I have described this process in detail, and would also refer to the illustrations for evidence of its striking, if not unique, characters. See Plate XIII.

It is right to add that this mode of destruction of the hard tissues, is not credited by some observers in India. It is said, that marks of a cicatrix can always be seen on the fingers or toes; which is a sufficient indication of the previous existence of an ulcer or abscess. It appears to me that the influence of surrounding circumstances will, in a great measure, determine the occurrence of the milder or more severe forms of bone-disease in leprosy. All writers would agree, I think, that disturbance or abstraction of the nerve-supply, greatly interferes with nutrition of the hard as well as soft parts; and, if there be added, unfavourable conditions of life, cold, harsh climate, and exposure, then 'necrosis' might well be antici-

pated as the more frequent event. Slight local injuries will give rise to acute necrosis.

Having, in the text, noticed the two chief differences of appearance which the fingers may present, in cases of 'anæsthetic' leprosy, I should here observe that the same have been, in some measure, distinguished in Europe, and I may add, in America also, as the result of impaired nerve-influence. The tumid, smooth and shiny finger, is that termed by Paget the 'glossy finger'; such fingers, he says, "appear to be a sign of peculiarly impaired nutrition and circulation, due to injury of the nerves. They are not observed in all cases of injured nerves, and I cannot tell what are the peculiar conditions of the cases in which they are found; but they are a very notable sign, and are always associated, I think, with distressing and hardly manageable pain and disability . . . ." From his other remarks, it would seem that Paget connects these appearances with attendant irritation, perhaps inflammation of the nerve-trunks concerned; and adopting this view, such instances may be regarded as confirmatory of Brown-Sequard's opinions, that nerve-irritation is more hurtful than suspension of nerve-influence alone. This subject is, however, an undecided one; and as I have intimated in the text, another explanation of the tumid and glossy, as distinguished from the small and shrivelled, finger, in attributing the difference to physical temperament. The influence of time and degree of nerve-loss, has yet to be taken into consideration. Messrs. Mitchell, Morehouse, and Keen have made some very interesting remarks on this subject, which will be referred to further on.

more destructive than the first described, is not so prevalent as supposed; the two may co-exist.\* In either case the hand or foot is mutilated, nay, well nigh destroyed; in the worst examples it is doubtful if even the carpal bones remain, and a good part of the tarsus may be removed by the same interstitial absorption, accompanied with no pain, swelling, or sores.

It is not, then, without reason that this variety of leprosy has been named 'articular,' or sometimes the 'joint evil,' 'lepra mutilans'; although the large joints, as the wrist or ankle, are, virtually, never attacked. I notice that the nails are here less frequently deformed than in tubercular leprosy.†

The occurrence of ulcers, sometimes large, deep, and foul, and of local gangrene, may be referred to a combination of accidental causes and deficient nervous influence, aided by exposure and want. That the second of these causes may alone lead to ulceration seems shown by its presence on the lobules of benumbed ears, parts little liable to direct irritation. Absorption of the nasal bones is often seen in advanced cases; it may possibly be connected with disease of the nasal branch of the fifth cranial nerve. In accordance with its con-

\* The statement in the text holds good for India only, as it would seem. Danielsen on this subject writes thus:—When the anesthesia has become complete in the soft parts, the form of necrosis so characteristic of this form of disease soon presents itself. Commonly the fingers or toes are first attacked, and as a rule, only one of them at a time. Generally the patient complains of an acute pain which he refers to the bone itself; and at the same time there forms a swelling of the entire finger. This swelling, which has a deep livid tint, is not very sensitive and very early shows a fluctuating spot . . . there is considerable febrile disturbance of the system . . . the fluctuation bursts, giving exit to a "humor tolerably liquid, viscosus and ichorous" . . . the general symptoms gradually subside. On examining the abscess it is found that the phalanx is both denuded and detached; it is thrown off and the ulcer heals. The second phalanx is oftenest thus affected and the terminal one then becomes approximated to the first, by repetition of this process and its results, the hand, says Danielsen, may come to resemble the fin of an arctic seal. The entire hand or foot may thus be removed.

Acute periostitis of this kind promptly leading to necrosis, is rare in India; but in the severer north latitudes it is not uncommon, and there were several cases to be seen at Bergen last autumn. Another manner in which the extremities suffer is by the formation of abscesses leading to bone over parts most exposed to pressure, especially in the sole of the foot over the great, little toe, or heel, and in this manner are formed the deep chronic ulcers which everywhere seem to be common, and which also entail gradual loss of the bony parts of the foot by a process of continuous exfoliation. The Norwegian observers have noticed that when the secretion from these chronic ulcers is arrested, the system suffers, and that even most severely, with symptoms of pyæmia (?), or suppressed excretion. I have no knowledge of this subject.

(9336.)

The process of destruction of the fingers and toes by a kind of chronic process, is thus described by Coates, in North Eastern India, (*loc. cit.*):—the periosteum becomes detached from the bone and at the same time a general infiltration of the soft parts occurs, by which the member is sometimes thrown to one side: there is no pain, and a cessation of symptoms for a time happens. Next time, the serous effusion and the exfoliated bony scale come to the surface; abscess and an ulcer follow. The pus is of an extremely pale colour and is accompanied by much serum, thin and clear: it has a peculiar and indescribable odour . . . . . attack after attack of this nature succeed each other . . . . . the fragile ends of the fingers and toes may be even accidentally broken off: "some blood and grainy serum come away, and then the part dries up" . . . . .

† This point is one of the few in which it would seem that leprosy and mechanical nerve-lesion do not commonly agree. It has, indeed, been noticed that beside some stunting of growth, an accumulation of scurf takes place under the ends of the nails in lepers; but the peculiar and extreme curving of the nails from side to side, and also in a longitudinal direction, which has been described as diagnostic of nerve-lesion by the careful American surgeons, I do not remember seeing in the diseased subject. Nor have I noted the peculiar ulceration at the roots of the nails which they have pointed out. The most striking instances of curved nails one may see have been the simple result of prolonged growth.

Respecting the 'hairs' upon benumbed and altered skin, it may here be remarked that in course of time they fall out, probably from simple atrophy, and not from that hypertrophy of the lining of the follicle which occurs on leprosy nodules or 'tubercles' of the skin.

stitutional nature, advancing leprosy generally attacks symmetrical parts, both hands and both feet, but less often, I think, both sides of the face; striking exceptions, however, occur, I have twice seen a unilateral affection of the extremities, of the right and left sides respectively. The comparative extent to which the two extremities are usually implicated—the lower the greater—is partly explicable on anatomical grounds; but it is worth notice that men engaged in manual labour are frequent subjects of numbness and distortion of the hands, particularly carpenters; and we may suppose that the exposure, &c. the feet are ordinarily subject to certainly accelerates, may perhaps dispose to, the disease there.

That a cachetic condition of the system is likely to supervene under the circumstances in which most lepers are placed, might be presumed: it may even be concluded that a leprosy taint naturally leads to such a condition, for there is certainly a deteriorating influence at work in the system, and if its effects may be somewhat hastened or deferred, this may be owing to the fact of the textures involved being here more than elsewhere exposed to sources of injury, or capable of adequate protection. General growth and development are not so stunted as in the tubercular form of the disease, but patients are seldom attacked before the age of puberty. I am inclined to attribute to a 'taint' of the latter form the occasional great distortion of the hands, &c., when evidence of nerve-disease seems slight; not that the symptom of mere numbness can be viewed as, by any means, a perfect measure of such disease, although it is the readiest means of detecting its presence. There are, however, other components of nerves besides sensory and motor nerve-tubules, which preside over the nutritive and calorific processes, and are derived from the sympathetic system; and it is not improbable, that these elements may be, most of all, liable to leprosy nerve-disease.\*

The cases that follow will supply deficiencies in these cursory remarks, and also give a more general view of the leprosy state by exhibiting its assembled characters: they have been selected for this purpose.

CASE 11.—Anæsthetic leprosy of eight or nine years' duration. A male Hindoo, *setat.* 25, a ryot living near Panwell (coast). Of moderate habits: never had syphilis. Numbness was first noticed on the calf of the left leg, no premonitory symptoms, or fever, that he recollects; recently sores have appeared at this part and elsewhere. General condition fair, not emaciated or stunted in growth: appetite good: bowels not costive: pulse 66, soft: is tolerably intelligent. No affection of the viscera of the chest or abdomen. On the face, the tip of the nose, the cheek, and the ear, are benumbed (for the last two or three years), the skin is but little changed, looking only a little coarser than usual: throat unaffected. On the trunk is nothing abnormal. Upper extremities—from the shoulder downwards is numbness everywhere, except on the front of the left fore-arm and arm: the anterior and inner surface of the arms and fore-arms are of a rather lighter colour, than the rest, but this is probably not unnatural: the hands are not much affected, but the interosseous spaces and fingers are atrophied, and the skin shrivelled; two fingers are bent and fixed in one hand. Lower extremities—from the hip downwards, anæsthesia is present everywhere without exception, little apparent change has occurred in appearance, &c., but within the last six months some of the toes of the right foot have disappeared; others are swollen, smooth, but not

\* In this passage, I would here observe, are shadowed forth a sense of the great difference as regards the future of the patient, which exists between the anæsthetic and tubercular forms of leprosy. At the time they were written, the views of the pathology of that disease, now elaborated, had not been broached; and to me there was not apparent any other explanation of the wonderful phenomena of leprosy, except that of a skin-affection, mostly, if not

primarily implicating certain cutaneous and superficial nerves of the body. The word 'taint' employed in the text is sufficient indication that it was already known that tubercular leprosy is far the most serious form of the complaint; and at the present time, I should regard the appearance of a tubercular thickening of the skin as evidence of a deeper taint, using that word in the sense of implication of the system.

shortened. There is no apparent complication. No hereditary taint that he knows of. (Dhurumsala patient, No. 10.)

CASE 12.—Leprosy of 16 years' duration. A Mussulman, *ætat.* 35, a porter, from Bancote (coast). Vesicles first appeared on the hands, and numbness was discovered at the same time and has spread up the arm; the feet then became affected with numbness and distortion, but no bullæ appeared on them, and there seems to have been some pale discolourations of the skin soon after the numbness. There is no distortion of the face, which is well covered with hair, but there is anæsthesia of the forehead, cheeks, and chin, but not on the lips. Nothing abnormal in the throat. There is numbness of the skin of the back and front of the body, except along the middle line and sides of the abdomen: no discolouration, &c. is at present visible, but pale patches formerly existed. The skin of the entire upper extremities is very considerably benumbed, without any apparent change: the hands are greatly distorted, most of the fingers shortened and of some only the stumps remain, bent and stiff: some superficial sores are seen. The same is the case with the lower extremities, entire numbness from the hips downwards: the toes are very much distorted; on the left foot the great toe is gone, and others atrophied, &c.: on the right foot some of the smaller toes have almost disappeared, the great toe is much distorted. General bodily condition fair: is intelligent. His father's relations for four generations back have been healthy his mother is well, but her brother was affected with leprosy: his sister is well: has no children. (Dhurumsala patient, No. 58.)

CASE 13.—Distortion of the hands, with little loss of feeling. A Hindoo, *ætat.* 25, a ryot, from near Panwell; the disease is of seven or eight years' standing. First of all there were pale discolourations of the skin which spread widely: at present, is some thickening of the skin of the face, nose, and ears, but sensation is little affected: the hairs remain; on the body are the slightest possible traces of light-coloured patches. Upper extremities—there is atrophy of the hands, the fingers have become smooth, rounded, and whitish in colour; their terminal phalanges have disappeared, the nails remaining as a misshapen mass: he declares he feels readily the prick of a pin in all parts. Lower extremities—from the middle of the legs downwards is perfect loss of sensation in every part, and yet beyond a slight bronze tint, there is nothing abnormal to be seen, the toes being hardly affected at all. Is in fair bodily condition. His father and mother are both living (the latter has since died in the Dhurumsala); both were affected with leprosy in precisely the same way as himself; but a younger brother and sister are yet well: he is betrothed to a leper in the Dhurumsala. (No. 44.) No. 85 of my notes is a similar case to this; with much distortion of the hands, and destruction of the fingers is hardly any impairment of sensation; while the legs are affected in the usual way. In these cases we must suppose only the median and ulnar (main trunk) nerves are affected and not the cutaneous nerves, or dorsal branch of the latter: the large trunks in the lower extremities are differently situated with regard to the cutaneous supply of the feet. It is my impression, however, that they and like instances which appear at first sight exceptional, in the absence of marked or wide cutaneous numbness, belong to the group intermediate between the two chief forms of the disease, a 'tubercular' taint so to speak being present and serving to account for the disproportionate degree of local change. Such is also the following:—

CASE 14.—Great distortion of the hands and feet—anæsthesia incomplete—leprosy of 35 years' standing. A Hindoo clerk, *ætat.* 51, native of Bombay, and in comfortable circumstances. Below the wrists and middle of the legs, such a degree of numbness is present, that he does not feel firm pinching of the skin, or the presence of heat, but the sharp prick of a pin is felt. The fingers are shortened, a little thickened, bent, and stiff; interstitial absorption began at the terminal phalanges: the deep-seated structures disappear, the skin and nails persist and follow in a retrograde direction the diminishing digit: no sores occur during this process. The feet are more affected than the hands, and there is a sore on the left sole. There seems to have been some thickening of the skin of the face and certain spots on the body, traces of which are not now apparent: bullæ appeared formerly on the fingers and toes. No perceptible enlargement of the ulnar nerves at the elbow. He is intelligent and enjoys tolerable health, but there is a drooping of the lower eye-lid and a discoloured conjunctiva which would indicate persistent cachexia: he has been treated with mercury and thinks with benefit. His elder brother was affected in a very similar way to himself. (Dispensary patient, No. 58.) A young man was attending the

same time whose hands and feet were in a precisely like condition, but the anæsthesia was more extensive and all the changes had occurred in the course of three years—a great contrast to the above.\*

*Advanced and terminal stages.*—These by help of the fatal cases in Table (I.) and some of the above, may be as readily conceived as described. Anæsthetic leprosy is less exhausting in its course than the tubercular: there is seldom the prolonged drain of suppurations, a less extent of the body is implicated, and the blighting influence upon growth and general nutrition has not been so marked.

It is unnecessary to again depict the poor crippled leper—an outcast, yet clinging to life—his sufferings susceptible of much amelioration, but exposure and want of mere necessities his too common lot—more than helpless, a very repulsive object, which charity almost loathes to approach. The mental faculties are not directly impaired, the organic functions might be fairly performed and appetite restored; but failing the means, a natural mode of relief does not long delay its appearance and its work.

## 2.—SEAT AND DISTRIBUTION.

The terminal and pre-terminal segments of the extremities of the body, are the earliest and principal seat of the curious suspension of nerve-influence, so characteristic of the anæsthetic form of leprosy. At first one side alone is affected, but commonly and speedily, both sides of the body become implicated. On the face, numbness is not so frequent or marked, as elsewhere. Here, too, the projecting and more uncovered parts are chiefly affected, and the margins of the ears are not seldom implicated.

In advanced cases, large portions of the skin of the trunk, as well as of the extremities, are affected, and this extension may result from either pre-existing leprosy 'patches,' or a wide but as yet anatomically undemonstrated, implication of cutaneous nerve-filaments. Where tangible evidence of this latter kind is procurable, it will always be clearly found, I think, that nerve-disease and anæsthesia proceed *pari passu*, as regards both extent and degree. When our knowledge of individual nerve-areas becomes more defined, I look for complete concordance therewith, in the local marks of leprosy nerve-disease, and the dissections which I have repeatedly made, seem to warrant such anticipation.

## 3.—CHRONOLOGY.

Respecting the true order of time in which these several symptoms appear, not much that is satisfactory is known, because the real chronology of the signs he may see, is not matter of direct observation by the surgeon himself, and it may well be mis-stated by the patient.

Finding it in so many cases to be asserted that loss of sensation is the first symptom which is noticed, and also finding that this symptom may remain for months, the only one detectible by us, I cannot but conclude, that not only is the nerve-affection the essential cause of this

\* In this case there is mentioned a symptom not uncommonly met with, namely, seeming paralysis of the lower segment of the *orbicularis palpebrarum* muscle leading to eversion of the lower eyelid (ectropium) and exposure of the eye-ball, which becomes pale and dry; the caruncula lachrymalis may become atrophied, and there is derangement of the lachrymal apparatus, but it is rare to see ulceration of the cornea or deep-seated inflammation of the globe of the eye. Some facial paralysis, on either side of the face, may also occasionally be seen, with its attendant consequences. Both these symptoms, and as well the

falling in of the nose above mentioned, I have been disposed to attribute to loss of tone and impaired nutrition of parts supplied by the fifth pair of cranial nerves (which are known to be specially affected), rather than to an affection of the seventh pair or facial nerve proper. As, however, the branches of fifth and seventh freely anastomose on the face, it is possible that disease beginning in the sensitive side may spread by continuity of texture to the motor element. The *buccinator* muscle may be directly affected through the fifth alone.

phase, at least, of leprosy, but that it may be a primary affection, strictly local, and of chronic course.

Respecting the last-named point, instances are related of rather quicker progress of the affection, just as 'tubercles' may grow quickly or slowly; but the general character of the nerve-affection has always seemed to me to be the same.

In the absence of much personal knowledge, I have admitted that at the beginning, a state of over-sensitiveness in the skin-areas corresponding to the nerves attacked, may be usual; irritability of the nerve-trunks themselves is unquestionable; but in my experience, the 'neuralgic' pains so much dwelt upon in Europe have not been marked.

#### 4.—COURSE.

The disease begins insidiously, proceeds slowly, and ends fatally, only after several years. Sixteen years, or so, has been named in Norway as the average duration of cases of anæsthetic leprosy, and in India this period may not at times be greatly exceeded. I am not acquainted with an acute form of this phase of leprosy. Suspension of nerve-influence in certain parts of the frame, leads to wasting and death of some structures, to consequent hurt of the system, perhaps the onset of other maladies, and to final exhaustion or more speedy fatal impairment of the body. Serious visceral lesions due to leprosy are, so far as I know, extremely rare; but this subject is further discussed below.

#### 5.—COMPLICATIONS.

Under any circumstances, suspension of nerve-influence is inevitably followed by mal-nutrition and wasting of the parts concerned. I do not here refer so much to motor paralysis as to paralysis of sensory and nutritional nerves; and in this instance impairment of the tactile sense is the most obvious symptom, but it is probably attended from the first with impaired nutrition, lowered temperature, diminished vascularity, &c., only these latter signs are less evident to outward perception.

The skin soon shows the marks described above. They are, I repeat, in essence the same as follow mechanical injury of the nerve. The morbid appearances are not all alike, or consentaneous; and this variety depends partly upon the character of the integument itself. Thus on the palm (*e.g.*) there is thinning and smoothness of the cuticle, apparently increased vascularity and sensitiveness; but soon shrivelling and numbness follow, or a glossy or oedematous state, which is well known to most observers.

On the back of the hands and feet a similar thinning, followed often by a 'bronzed' state, is seen, increased pigmentation as on the face, being here common.

And elsewhere, similar atrophic changes are not seldom apparent. Equally to be noticed, is the occasionally distinct conjunction of nerve-disease and characteristic leprosy 'eruption,' also pointing, as I think, to an essential relationship.

Large vesicles, or bullæ, are common in anæsthetic leprosy, both at the beginning and in the course of the disease. They, too, seem to have their analogue in the 'blebs,' known to follow, in some way, ordinary nerve-injury.

It is only subsequently, that muscular atrophy is found, and I have thought that this was due to extension of nerve-disease from cutaneous branches *centrad*, *i.e.*, towards the main trunk, with consequent implication of the adjoining muscular nerve-filaments. Certainly, muscular paralysis is not a prominent attendant upon leprosy nerve-disease, but rather by its absence or mild degree, conspicuous.

Dropping of the lower eyelid, owing apparently to paralysis of the lower segment of the orbicularis muscle, has seemed to me to be accountable from disease of the motor branches of the fifth, *i.e.*, without necessarily implying loss of power in the facial, or seventh, cranial nerve, and

so with some other forms of facial paralysis, which are, I think, more frequent in Norway than in India. Yet here one may conceive an extension by continuity or through direct anastomosis, of nerve-disease, from the trifacial to the motor division of the seventh pair.

Ulceration of the skin in connection with the bullæ, &c. is not very common; and is then largely due to attendant and unfavourable external influences. Abscess ending in deep ulcer is usually connected with necrosis of subjacent bone; and this symptom is also greatly more common in Norway, where external agencies are severe than in India. The necrosis may be, it is said, both primary and acute; rather more usual in the East, is interstitial absorption of the bones—a process unrecognised in the West. That common sensation in wanting in the deeper-seated tissues is held to be the case in Norway; perhaps only the periosteum being sensitive. This profound insensibility I did not notice in India, as at all frequent; and the greater extent of nerve-disease therein applied, entirely corresponds with other signs that anæsthetic leprosy is a more severe affection in Europe than in Asia. After other kinds of nerve-injury, however, the same deep-seated numbness is present.

Leprous 'tubercles' in the skin are rare on anæsthetic surfaces.

Ordinary skin-diseases may attend this form; I have mentioned those commonly seen in India under the heading of *lepra leprosa*.

The mucous membrane of the mouth, fauces and pharynx is rarely implicated in anæsthetic leprosy; there is, however, said to be here defective sensation and even impaired taste; but no defect of hearing. The nasal mucous membrane is sometimes ulcerated. The uvula may be shortened, tilted forward or laterally deflexed.

The eye-ball and its appendages suffer in an indirect manner, as will be afterwards related.

As to attendant complications, the more ordinary have been indicated above, in the 'cases' and notes;\* and special topics in the connection of leprosy and syphilis, and leprosy and tuberculosis, will be duly commented upon in a fitter place than here; namely, under the head of 'General Pathology.'

#### B.—GENERAL SYMPTOMS. PRODROMATA ; DIAGNOSIS ; PROGNOSIS.

That under ordinary circumstances, there are general symptoms of a peculiar kind, implying disturbance of the entire frame, which precede the advent of anæsthetic leprosy, has not indubitably appeared to me in India, nor have I found such to accompany the disease in

\* Boeck remarked, that ordinary skin-diseases are not nearly so common in the anæsthetic as in the tubercular form of leprosy; eczema impetiginodes is the most frequent, on the legs and fore-arms; and when sensation is not here defective, it is attended with itching, &c. He adds that it seems to stand in some near relation to other symptoms, as he had seen severe pains on the extremities subside on outbreak of this eruption.

I should here adduce the experience of J. N. (*loc. cit.*) who observes:—the cutaneous affections which often accompany leprosy ought to be looked upon as strictly incidental—mentioning lichen, eczema, psoriasis, itch—in ordinary typical cases anæsthetic leprosy is free from all these affections, and down to its very latest stage, shows nothing but the very slight erythematous patches of discolouration above mentioned. Rheu-

matism most certainly often complicates leprosy, and also neuralgia. Syphilis implicates, and may greatly modify leprosy. . . . When the latter is very destructive then it is probably complicated with syphilis. . . .

I shall afterwards recur to the subject of the complication with syphilis, but may here allude to the remarkable statement of Fournier, a French physician (for a first reference to which I am indebted to Fox's work on Skin-diseases, 3rd ed., p. 301), that in secondary syphilis, as witnessed amongst women in hospital, there very frequently occurs such anaesthesia, or analgesia, of the hands and feet, as would seem to very closely correspond in nature, to the more severe leprosy malady; in fact, the analogy so far as it goes, seems to me of the strongest.

its after progress. Yet it must be said that febrile exacerbations, of the kind more frequent in tubercular leprosy, do occur even in the East; while in Europe they are not uncommon. Observers in India have remarked on the frequent attendance of dyspepsia, cardialgia, pyrosis, thirst, and the like; but they have not, as a rule, attributed to these symptoms such paramount importance as the earlier Norwegian physicians. Nor is stress to be laid upon other asserted signs, whether bodily or mental, which are referrible to general debility, or the peculiar circumstances of the leper; here scientific discrimination is to be more rigorously maintained than hitherto, otherwise the old confusion will persist.\*

*Diagnosis.*—Is not certain, until the existence of some degree of numbness is ascertained. That a state of hyperesthesia in a part, should excite suspicion of probable nerve-disease, is only rational, according to the experience of many surgeons; but from undefined general symptoms, even as fully insisted upon by some, I do not think it possible to diagnose one particular form of leprosy—whether anæsthetic or tubercular or eruptive. The best guide to accurate diagnosis, is to be derived from a competent knowledge of this disease, which is so characteristic as early to be understood. *Nerve-disease* is the essence of the complaint under notice.† The vesicles are characteristic.

\* Certain observations cannot here be omitted. Danielsen notices pyrosis, constipation, and finally excessive thirst, as belonging to the leprosy disease; in its later stages the temperature of the body falls considerably, thus, in the hands it may be upwards of 20° F. below the normal, or in the mouth, rectum, or axilla groin upwards of 4° F. Sensation of cold (in the northern clime) is persistent at this time. It is added that albuminaria with œdema, &c., belongs to leprosy; but it is certainly not invariable. The menstrual flux may be irregular, or even be checked; it may be absent if the disease has appeared at a very early age. As to erotic desires (the 'libido inexplibilis') they diminish as the disease progresses: anæsthesia does not spare the genital organs: but there is by no means necessarily sterility in the male.

The following 'objective' phenomena are also mentioned (J. N. *loc. cit.*):—functional derangement of the circulation: coated, furred, or fissured tongue, bleeding from the gums—"a very characteristic symptom,"—&c. The temperature "ranges as a rule a little higher than "in health," it does not appear to diminish with advanced disease. The urine appears to be always normal: no albumen, reaction acid, or neutral: sp. sn. seemed to be a little lower than normal: it had a healthy colour and was free from deposit in 12 cases. The writer thinks that the mucous membranes always suffer: there is thickening and inflammation: bleeding from the nose is common at first; the eyes are red.

† The following memoranda are from the elaborate essay of J. N. (*loc. cit.*) and are here quoted without necessarily implying my entire agreement therewith. As to the general diagnosis of anæsthetic leprosy, the author correctly remarks there are two essential symptoms—anæsthesia and pain; he also enumerates other details, as pain in the back, feeling of warmth, lethargy of body and mind, with drowsiness, feeble or deranged vision, great debility, tendency to copious

sweats, cough, dyspepsia, and palpitations; intolerance, of the rays of the sun, skin flabby or bony; nails are affected, more than in combination with tubercles; blebs, ulcers, &c.; sloughing of the phalanges which come out not off; contraction of tendons, fasciæ, and even periosteum; spongy gums and bleeding from them; deflection of the uvula (Boeck has noticed shortening and tilting forward of the uvula as occasionally seen in lepers); abnormal temperature, that is, somewhat higher than in health (in Norway the temperature is lower than normal). Perhaps the remarks on special diagnosis are more useful; from neuralgia, rheumatism, and rheumatic arthritis; unless the practitioner be on his guard, he may give one of these names to the disease. The pains in leprosy are more constant than in rheumatism, may be traced to the deeper structures, are in some degree symmetrical; are associated with abnormal sensations and are aggravated by pressure, but diagnosis is sometimes impossible. Referring to syphilis, the comparison is made as species of one genus, there is the same harsh, inelastic, ill-nourished skin with ill-developed appendages and scaly diseases; the same general cachexia and muddy complexion; deep, periosteal pains and feverish malaise, and the deposit in tubercular leprosy is essentially the same as in the gummatous tumours of syphilis. The distinction rests in attendant derangements of sensation, &c. As to scurvy, the author remarks that cases of incipient leprosy have certainly been mistaken for cases of scurvy; this may attend leprosy, but the scorbutic symptoms of anæsthetic leprosy are not due to the specific disease, scurvy; patients have plenty of vegetable food and are cured by a certain treatment. (The reference here is to the author's plan of treating leprosy by means of a combination of acetic and carbonic acids; see the Chapters below). Progressive locomotor ataxy—the writer thinks that a com-

*Prognosis.*—Is more favourable than in the instance of nodular leprosy. Fatal results in uncomplicated cases would seem to arise chiefly from exhaustion, or from degeneration of the frame, the inevitable result of the prolonged presence of wasting parts. The advent of tubercles, or even of eruption, would be a sign of extension of disease, because the amount of leprosy deposit is thereby increased.

Slight numbness may be recovered from; but a frequently recurring anæsthesia, like returning 'eruption' or 'tubercles,' I am not acquainted with.

Complete anæsthesia is permanent; and mutilations of all degree are irremediable.

Implication of the lymphatic system, and the threatening of tuberculosis, &c. are indications to be considered with reference to prognosis. See 'General Pathology.'

In itself, anæsthetic leprosy is the more chronic and least hurtful form of the great leprosy complaint.

#### C.—NATURE AND ANALOGUES OF ANÆSTHETIC LEPROSY.

The nerve-affection is as specific as any other leprosy change. It depends upon the presence of the same structural morbid elements, as are found in the skin. That the cutaneous nerves, however, should be so early and largely implicated, is a remarkable circumstance not to be understood, I think, without reference to the external media in which we live.

In the course of dissection, while all the surrounding tissues are healthy, we find only the nerves themselves enlarged, firm, reddish-grey and translucent, or atrophied and pale. The portion of skin connected with the distribution of the affected nerves is commonly, if not invariably, as well affected.

Were it possible to absolutely determine the chronology of the morbid phenomena, it seems to me likely that the nerve-affection would be first; yet if so, all the other phenomena should obviously—from the known influence upon nutrition of nervous force—be regarded not as mere attendants following in sequence, but rather as results compounded, at least, in their origin, or more properly, mainly due to impaired nerve-supply so-called. A modified view may, however, be maintained; and it will, with the whole subject, be again referred to, under the head of General Pathology.

I now remark that the local, limited and specific disease of the nerves of the human body, as presented in one form of leprosy—and that in India, as elsewhere, the more common—is so peculiar and characteristic a phenomenon, that some special attention may well be devoted to it. And the interest of the subject is not diminished from the close analogy which, in its local signs, this malady presents, to the effects of mechanical injury of corresponding nerve-trunks.

parison may here be made; the affection just named not, however, attaining the advanced stage which leprosy shows. This view is based on the author's idea of the spinal cord being affected equally in both maladies, but a divergence in extent afterwards taking place. In leprosy, the motor nerves are not affected; the incito-nutritive filaments alone being involved. I need make no comments on these

interesting remarks, because it will be apparent that either a modified form of the leprosy affection has been seen, or a complete discrimination of it, from commonly associated, general states has not been made. It is to be hoped that this writer will be able to furnish such anatomical data in support of his views, as are needed for their fuller consideration.

I have already described, in a brief manner, by cases and comments, what are the local marks of 'anæsthetic' leprosy; and now offer, for their illustration, the following notes of incidental nerve-lesions, comparable with the purely pathological.

CASES 1 and 2.—*Injuries of the Ulnar and Median Nerves. Early symptoms.*

1. A young woman accidentally divided, at the wrist, the ulnar and median nerves of one hand. Three weeks afterwards, it was noticed that the hand was a little paler and thinner than natural; all the fingers were slightly bent, and she was unable to straighten them, owing, as she believed, to the effort to straighten dragging on the scar at the wrist; she could flex the fingers, but could not oppose the thumb: there were atrophy of the muscles of the hand, loss of sensation, and, on comparative measurement, an average diminution of about 9° F. The tips of the fingers were shrivelled; they were the seat of whitlows or sub-cutaneous effusion, and there was ulceration at the tip of one finger. The ulcer had no feeling in it. The palm of the hand was not swollen, or tender to pressure.

2. A young woman received an injury dividing the ulnar nerve, and probably wounding the median nerve also. Three months afterwards, the hand was glossy and palish red; all the finger nails are somewhat clubbed, and decidedly more curved than natural; loss of sensation to a varying extent in all the fingers and palm, greatest on the inner side; all the fingers are bent towards the palm, but do not touch it; to straighten them causes pain at the scar of the wound; there is great atrophy of the interosseous muscles; there is a small whitlow at the end of the ring finger; the hand feels colder than the other, and on comparative measurements, there is an average diminution of temperature of 4° to 5° F. (Cases under the care of Mr. J. Hutchinson.)

CASE 3.—*Injury to the Median nerve. Signs after seven months' date.*

An adult man received a wound near the wrist, producing section of the median nerve, with loss of sensation and movement in the thumb and two adjoining fingers. History, subsequently, as narrated by himself,—some improvement followed by the end of two months, and he began to resume his work as a tailor. Then, a small bleb appeared on the back of the middle finger, and afterwards spread; another appeared on the tip of the outer finger, and subsequently others; there was some swelling and lividity of the hand. It was noticed that the three digits were stiff; flexed or bent as in leprosy; of lower temperature than the sound fingers (10° C.); ulceration attended the blisters, and there were small effusions of blood beneath the skin. Seven months after the receipt of injury, there was still some want of sensation; coldness of the fingers, and sensitiveness to low external temperatures; he cannot move the fingers freely. These three digits (*i.e.* the thumb and two adjoining fingers) present quite a peculiar aspect; they are thinned, and slightly curved; their pulpy tips are flattened, creased, shrivelled; the index finger, particularly, is flattened and shorter than that of the other hand; the skin and cellular tissues are certainly atrophied, in the entire extent of the last phalanx. The muscles of the thenar eminence form a relief, less pronounced than that of the opposite side; but there is not a great amount of atrophy. The man was now regaining the use of the hand.

Further notes are these: the vesicles, or blebs, may burst and ulcerate; or they may be absorbed, leaving the skin over them in a shrunken state; three appeared upon each digit, and the duration of each was from eight to twelve days. There was atrophy of the pulps of the fingers and thumb. There was local disturbance of the circulation. (Case narrated by Hayem. *Arch. de Physiologie*, Mar. 1873.)

CASE 4.—*Division of the Ulnar nerve just above the elbow-joint.*—Complete and permanent anæsthesia of the integument supplied by it. Inflammation of part of the hand, ending in resolution. Painless unequal whitlow of little finger, with exfoliation of the skin and nail; perfect reproduction of the nail; contraction of three fingers (unexplained). *Particulars of the state of the arm as to nutrition, animal heat, &c., 20 months after the accident.*

The patient was a girl 14 years of age. . . . The whole arm is thinner than the other; the difference being most marked in the lower half of the fore-arm. The hand is very much thinner, and about the little finger, the muscles are wholly wasted, . . . the middle, ring, and little fingers are curved into the palm; the ring finger more than the middle one, and the little finger most of all. She cannot straighten them, nor can they, by force, be bent back into

a perfectly straight position; the attempt to do this gives her no pain, but she says it drags something at her elbow. The flexion of the fingers is not due to paralysis of the extensors, for all the tendons of these muscles start up, when she tries to extend them, and the first phalanges are bent back on the metacarpal bones, but the other joints remain much curved; . . . the lower end of the divided ulnar nerve is felt to be more bulbous than the upper end, being enlarged to about three times the natural size of the nerve. The upper end seems to be more sensitive than the lower.

No decided difference of heat, on the two sides, or, perhaps, the temperature is one degree Fahr. lower on the paralysed side. Sensation was defective in the inner part of the hand, and lower part of the fore-arm.

The integument of the affected fingers looked a little redder than that of the opposite hand, but presented no other peculiarity.

The end of the little finger looked smaller than the other, and its nail was not more than half the size of that of the other hand. She told me in explanation of this, that some two months after the accident, the nail of this finger came off, together with the skin, "like the end of a glove;" a new nail formed afterwards. . . . The whole progress of the whitlow, had been without pain. . . . I must ask attention to the fact, that the new nail thus formed in a part wholly deprived of nerve-influence (at least of cerebro-spinal) was perfect in form although of less than normal size. The girl also stated, that in consequence of having no feeling in the little finger she had several times burnt it, and that the sores always healed well. . . . In the winter season, it is distinctly stated that the paralysed parts were usually much colder than the others. . . . Mr. Hutchinson observes that he cannot explain the flexion of the fingers with the palm, which so commonly follows section of the ulnar nerve; . . . in this case, the contraction did not exist at first, but had, according to the patient's statement, gradually come on during the last six months; she considered that it was still increasing. (London Hosp. Reports, vol. 3, 1866.)

Were I to mark by italics all those points, in which leprous and mechanical nerve-disease resemble each other, there would be few details, indeed, in the cases now quoted not so indicated. It is true that the pathological phenomena, surpass in their obstinacy and extent, those arising from mere physical agencies, and it is also true that the correspondence referred to is not, even so far as it goes, in all respects complete, yet there has already been established, I think, identity of signs enough to warrant the conclusion, that the analogy in question is one of the closest.

Respecting seeming discrepancies, I would observe:—1. That the area supplied by one sensitive nerve may, on occasion, be supplied from a collateral source; and hence that the anatomical and physiological areas of the cutaneous nerves do not necessarily correspond. It is the same as with blood-vessels, and their respective areas. 2. That the effects of simple deprivation of nerve-influence, may be greatly augmented by attendant irritation and inflammation of the nerve-trunks concerned; and as these incidents predominate, so will increase lesions of function and nutrition. Hence, perhaps, the sharper and severer results of gun-shot injury to the nerves; and the varying local symptoms of nerve-lepra. 3. That loss of sensation in the skin is no valid criterion of amount of nerve-lesion, more especially in the case of compound nerves; and it is possible that in disease, the nutritive element may be especially implicated, while in injury it could not be so. Never is the whole nerve-trunk completely disabled in disease; and as regards the sub-varieties of tactile sense, since the means of measuring the normal perceptions of touch, temperature, pain, pressure, &c., are yet wanting, their investigation in anæsthetic leprosy has to be deferred.

During my examinations of leprous nerve-strands no fact impressed me more than that of the limited districts of deposit amongst the nerve-tubes; generally those at the circumference, near the neurilemma were most implicated, but what is the physiological import of this preference, I know not. Only here is ground of fair surmise, in case of apparent contradictions of experience.

## SECTION I.

## CHAPTER III.—TUBERCULAR LEPROSY.

THAT more serious and best known phase of leprosy, which is distinguished by the presence in the skin of nodules, or the so-called 'tubercles,' seldom alone or long exists, without the supervention or co-attendance of either 'eruption' or 'numbness.' When either of these last-named features is present in a marked degree, the form of the disease is said to be 'mixed' or 'blended;' and in such sense this term was, several years ago, independently coined by surgeons in Norway and myself in India. In a strict or scientific point of view, 'mixed' leprosy should stand for a form of 'tubercular' leprosy only, because the presence of tubercles properly determines the true significance of the complaint; but, as a matter of convenience, the term will probably continue in use as meaning a combination of 'tubercles,' with both 'eruption' and 'anæsthesia,' and under the reserve just implied, its employment thus may be sometimes useful for avoiding periphrasis.

I am desirous that the opinions of other observers, and the later views adopted in Norway, should not be obscured by any preconceptions of my own; and it may be, as well, therefore, to still preserve the distinction of authority, at all events until subsequent study shall render clear, the natural varieties of leprosy as presented in different countries.

The preferential attention hitherto allotted to this nodular form, which has thereby become well known to almost everyone, renders it less necessary for me to describe it at very full length in the present work.

In 1861, I wrote:—"About 15 per cent. of the cases I have noted, presented the combined characters of tubercular and anæsthetic leprosy; this series may be called the 'mixed' variety. Signs of the former were visible on the face, of the latter in the extremities; and in both localities, with the characters usual in unmixed examples. It must be added, too, that almost all these cases are either accompanied by a distinct eruption, or began as such; so that the distinction of this 'mixed' variety, is founded only upon the characters which predominate."

My brief remarks on 'mixed' leprosy may serve as introduction to the wider subject of the tubercular variety. I also now add notes of two cases taken at the Rigshospital at Christiania, in August 1873.

## MIXED LEPROSY.

Decided indications of the nerve-affection, accompany the manifest distortion of the features; and in about the fourth part of the whole, are traces of an eruption on the trunk and limbs. The first-named symptoms co-exist with the usual distortion of the extremities: the nails, however, are sometimes converted into mere horny clumps, and the bronze tint is often deep. Tubercular thickening, usually well marked, sometimes seems, as it were, mitigated; and numbness of the altered skin is invariably present on the face, &c., hence it may be presumed, that disease of the branches of the fifth cranial nerve, is more common than in simple

tubercular leprosy. The eruption is present as pale discolourations, having roughened surfaces, frequently benumbed.

In one-third of the cases the disease appeared under 20 years of age; in nearly as many under 30, seldom as late as 40. When commencing early, it greatly checks the growth of the body; two or three patients were lamentable examples of ill-developed humanity. Its duration may extend to upwards of 20 years. The evidence of hereditary transmission is very decided; often on the mother's side. About one-third of the whole were females; a proportion above the average in leprosy generally. A syphilitic taint is uncommon. It so happens that one-half of the fatal cases I have seen, were referrible to this variety of the disease; and to the summary of them in TABLE (I.), I may refer for further illustration of the 'mixed' variety of leprosy.

#### TUBERCULAR LEPROSY.

This form of the disease was most marked, in about only eight per cent. of the cases noted by me; and although its separation from the mixed form, is somewhat arbitrary, yet combined, the two make but a small proportion—much less than seems to hold good in the West, and other tropical countries. Some very striking cases may be seen in the Dhurumsala—a charitable refuge for the infirm; it has been rarer at the Hospital, and still more so at the Dispensary in Bombay.

##### A. 1.—SUMMARY DESCRIPTION OF THE DISEASE.

In all confirmed cases, the face is most affected; the eyebrows, nose, cheeks, lips, and chin, and the ears are more or less swollen and livid, the surface being firm, smooth, bronzed, and shining; it is not so common to find here distinct tubercles, the tumefaction being general over a certain space; or, as a variety, the appearance may be rather like, great thickening of the natural folds of skin, loose and pendulous, with less bronzing than usual and oiliness of surface. The nose frequently becomes depressed, and along the margin of the lips a 'corona' of small tubercles may be seen; from subsequent ulceration and union, the aperture of the mouth has been noticed nearly closed: the rim or lobule, alone, of the ear may be affected. The hairs of the face, ciliary and supra-ciliary, soon drop away:\* the opening of the eyelids becomes round, and the eyes, unshaded by their lashes, acquire a staring look; this, their sallow colour, and the overhanging brows, gives an expression not inaptly termed 'leonine,' or 'serpentine,' and even 'vulpine'—to adopt the conceits of old authors. Sensation may persist in some parts of the face, and high on the forehead, but it is generally wanting

\* Of all localities, the eyelids and eyebrows are soonest deprived of their hairs. I should suppose this falling off is necessarily dependent upon new growth within the skin of these parts; but the contemporary condition of the nerve-filaments concerned, which are here larger and more numerous than usual, has not, so far as I know, been precisely ascertained. The loss of hair is sometimes curiously one-sided, a tuft remaining on the outer end of the brows. Tubercles very early appear in the same localities, and may be felt in the skin, even when not visible to the eye. Boeck correctly remarks that the growth or development of hair, in

general, seems not to stand in any fixed relation to the external development of leprosy; abundant growth of hair may be found in lepers greatly diseased. He describes a few cases in which the hairs, or cilia, were wanting, when there were few other signs, or none, of leprosy, except on the mucous surface continuous with the skin of the face, but these instances were all of the early stage of disease, and their description bears out his statement that they rather resembled cases of 'smooth' leprosy. Nerve-disease was, however, not developed in a marked manner.

or lessened on the brows, nose, cheeks, and especially the lobules of the ears, and also elsewhere, when the cutaneous thickening is considerable. In the localities just named, the anæsthesia may be owing to disease of the subjacent nerve trunks, rather than of the small filaments in the skin itself; but it is always present, in some degree, wherever the local tumefaction is great.

The mucous membrane of the hard palate, in advanced cases, sooner or later, presents one or two broad pale lines, tubercular or flattened, down the middle; but the soft palate and fauces have been found free from thickening, in all the instances examined. The dorsum of the tongue may be studded with distinct, pale tubercles; and, as on the palate, superficial ulceration may co-exist: the sense of taste appears to be seldom impaired, but one patient complained of a feeling of heat in the mouth, while eating, and another declared he could not taste even pungent condiments. Ulceration of the skin, or tubercles, on the face, is seldom seen; it occurs however within the nose, which becomes clogged with discharge; and it may be present on the ears. Lepers are often 'blear-eyed,' but I have only once seen thickening of the conjunctiva and opacity, &c. of the cornea, with blindness; yet this complication is particularly noticed by some writers.\* The voice being not only weak, but changed in tone, it may be presumed that the mucous membrane of the larynx is more or less thickened, &c.; this alteration of the voice does not commonly occur in simple 'anæsthetic' leprosy.

On the trunk, small palish tubercles are seen in all advanced cases, widely disseminated in the skin, and often clustered into rounded groups or masses: their size when isolated is not larger than a pea or horse-bean. The intermediate skin is harsh, shrunken, and dry, and too often stained with dirt: traces of a pale eruption (baras) are occasionally present. The nipples are frequently affected in both sexes, in the advanced stage being converted into mere 'knobs,' sometimes of considerable size;† and in male subjects the testes may be very small, but the reverse is sometimes the case. The hair on the pubes, as elsewhere, is apt to fall off.

The skin of the upper extremities is similarly affected, especially on the outer and posterior surfaces; the tubercles being sparse or clustered, and several may be found on the dorsum of the hand and knuckles. In more than half the cases I have noted, sensation was diminished or absent in the skin, often from the shoulder downward; but the palm of the hand may remain partly sensitive. On the lower extremities, the same appearances are visible; the tubercles being here rather smaller and less numerous, than on the upper. Anæsthesia was never quite absent; the dorsum of the foot, at least, sometimes the whole limb, being benumbed. Tubercles (like the eruption of baras) never occur in the palm of the hand or sole of the foot; on the contrary, the skin of these parts has been found thinned, and in consequence rather tender, even when tumefied elsewhere.

I do not pretend, from experience, to treat of the various stages the 'tubercles' pass through. They may be preceded by a puffy, sensitive state of the skin,‡ but sometimes, at least, they

\* Leprous diseases of the eye will receive a special notice; see Appendix D. Boeck noted in 111 patients, 49 examples of eye-disease of some kind. In India the complication is probably much rarer.

† Bakewell, at Trinidad, West Indies, also remarks:—"One peculiarity I have noticed in a very large portion of males, and that is the nipples are early attacked by tubercles, and then become enlarged. So common is this, that in order to save time in noting, I gave this peculiar condition a name, and

"noted them as 'feminine nipples.' The prepuce is always attacked early also."

I do not recollect that the Norwegian observers, insisted upon this localisation of nodules; but during my visit to Bergen, I noticed its presence, and in Plate VIII. it is indicated. Boeck states that tubercles are almost never found on the chest in men; although they may occur in women.

‡ Boeck noticed hyperæsthesia only seven times in 112 cases, and commonly in the early stages of the disease.

appear, from the first, distinct and close-set; and they may certainly be wanting even in advanced cases, the integument of the face being, as already mentioned, generally tumefied, or thrown into large folds. On this smooth surface, the openings of the sebaceous ducts and emptied hair-follicles, are very distinct, and the oily aspect is here owing, partly at least, to increased effusion from the former: I have found the sebaceous glands enlarged after death, under these circumstances. There is often a special character about the tumefied skin, giving the impression of a 'gelatinous' deposit beneath, or in it; and the colour will vary with that of the deposit itself, reddish or pale, as I have precisely ascertained. It should be also observed, that a sensation like that of tubercles, may sometimes be felt in the skin, when to the eye none are clearly visible; but as this and the other varieties of appearance, depend on the mere consistence, or limit, of the endo-cutaneous deposit, much stress need not be laid on them. An ulcerative stage of the tubercles has been distinguished, but it is certainly not very common in India: small superficial ulcerations may be seen on the extremities and the ears; never on the face, where the tubercles are largest, so far as I have seen; and they here very rarely lead to those frightful sores, &c., some authors describe.

Of the destruction of the digits, by caries and necrosis of the joints, I shall immediately treat; but this process is not, necessarily, connected with the presence of tubercles in the skin.

Some sort of an eruption ('baras' in one of its forms), has, in the majority of cases, been present at the onset of the disease, according to the statements of the patients themselves, and traces occasionally remain even at the advanced stage: this fact confirms my opinion, that with leprosy, is essentially associated a definite skin-disease. I have already quoted cases which indicated this connection of tubercular leprosy and baras; another is given below (No. 1), where simple anæsthesia was also present. Enlargement of the lymphatic glands in the groins, arm-pits and neck, is common; in the former locality, the swelling thus caused, has been expressly specified by the term 'femoral tumour.'

In more than one-half of the cases, the fingers and toes were affected, being swollen especially at the joints; the terminal phalanges of one or more are destroyed, and the skin is thinned, smooth, often pale, sometimes bronzed. The distortion is not quite similar to that of anæsthetic leprosy, the swollen digits being spread out, and though stiff, not permanently flexed; the ends are clubbed, and the nails usually converted into horny masses, and scurf accumulates beneath them, or a thin discharge exudes. Fissures and ulcerations occur on the knuckles, at the heels, or on the soles; and loss of parts takes place by sloughing and necrosis, commencing at the joints, rather than by interstitial absorption; but both processes may go on simultaneously. Even when

It seldom remains long, and terminates in loss of sensibility. This symptom seems, hence, connected with subjacent nerve-disease of the ordinary kind.

In India, Brodrick (Bengal Lep. Reports, p. 215), remarks that he had seen "a few cases very early in their career, when the disease had only reached the condition of hyperæsthesia. In these there were portions of the integument raised above the level of the surrounding skin, about the height of one line; this tract was naturally vascular . . . in one case the spots were situated over the malar bones, and were subject to itching, pricking, and burning, especially after eating stimulating food. In another case, they occupied the same site, and also formed a heart-shaped patch on the forehead, whose base was at the root of the nose, and apex upwards." It does not seem certain that the form of disease was, in these instances, of the tubercular kind,

but the observations are clear and precise enough, to warrant their introduction here.

Lisboa (*loc. cit.*) observes:—"When fresh tubercles appear (under febrile excitement), the affected portion of skin becomes tumid, discoloured and shining, and sometimes very sensitive; but when the fever has subsided, which takes place one or two days after, the swelling, redness, and pain subside. . . ."

Day (*loc. cit.*) states that in the preceding stage of tubercles, there are "dark, raised, bronzed patches, very sensitive; sometimes oily. In three cases, febrile symptoms accompanied them. There is some local irritation as burning, tingling, &c. The face is most affected, and exposure to the sun or taking stimulating food increases the irritation. This stage varies in duration. . . ."

the distortion is considerable, some sensation may persist, especially on the palmar aspect of the hands, &c.; hence it might be supposed, that the former is not wholly referrible to loss of nervous influence, but also to a general impairment of the nutritive processes, such as undoubtedly attends this form of leprosy, in all its modifications; and, as compared with the anæsthetic, is one of its fundamental characteristics.\*

With regard to the *premonitory* symptoms, which some authors have described in detail, few opportunities of observation have occurred to me; but, as before intimated, I am somewhat sceptical concerning 'prodromata' which last for months or years, and I think leprosy should be compared with scrofula or syphilis, rather than with the ordinary exanthemata.† On

\* I may here, by anticipation, observe that the nerve-disease in any form or degree, is not necessarily measured by defective tactile sense only, for such sensation may be increased, or, as here, secretion and nutrition chiefly be implicated.

† The following are Boeck's remarks in Norway, which, like my own in India, were based upon examination of numerous lepers, at all stages of the disease. In both instances, be it remarked, the history of the cases was necessarily based upon testimony, and not upon observation. "The complaint often begins with prodromata; namely, oppression, drowsiness, languor, apathy, and disinclination for any exertion. Furthermore, a persistent feeling of cold. These prodromata commonly endure from a few months to one or two years; yet it is also noticed that they may last for only a few weeks, or even only a few days, whilst in individual cases I have noted them as continuing for as long as five years. Thereafter commence the special signs of the disease. . . ." Memoranda in foot-notes are these:—"Amongst 112 affected, in 28 cases the disease began with prodromata, and there are grounds for supposing that the same have taken place in other instances, but in some cases have not been minutely observed, and in others have not, on account of the long duration of the malady, been recollected by the patient. The debility, in one case, came on so suddenly, that the patient could hardly get home from the fields, where he happened at the moment to be, to his house." Boeck also remarks that he has seen a smart epistaxis and an impetiginous eruption immediately precede the disease, although he could not, with certainty, connect these symptoms directly with it.

In their combined work, Daniellssen and Boeck record similar statements. Thus, it is said that there are lassitude and stiffness of the limbs; a drowsiness so great that the patient often "sleeps in society, sleeps at work, sleeps while eating. His body is a heavy burden; he hates work; is low spirited and disgusted with the idea of pleasure: he has wandering chills of the body, and shifting pains in the limbs, and in some cases cardiac oppression and defective appetite; occasionally nausea and vomiting. . . ." Then there follows an eruption, which, to judge from the description, is erythematous or like urticaria, and on its advent, these dyspepsia-like symptoms subside.

Boeck states that, so far as he had observed, these prodromata only appeared in the chronic, or more common, form of tubercular leprosy. The 'acute' form, so

called, does not, it would therefore seem, present such premonitory symptoms, and the remark is in my opinion noteworthy.

The nearest approach to Norwegian experience is certainly to be found amongst other Europeans, also, who have contracted leprosy in the tropics, and probably returned to their homes. The natives of India do not, even rarely, speak of other than dyspeptic symptoms, of such ill-defined general feelings as may well follow malarious influence. A further appreciation of this subject will be attempted in the chapters on 'General Pathology.'

Respecting experience in the West Indies, I have met with the following statements:—Dr. Bakewell, formerly Medical Superintendent of the Leper Asylum in the Island of Trinidad, remarks (Correspondence, &c., p. 22):—"I have never had an opportunity of observing the earliest symptoms accompanying or immediately preceding the formation of tubercles, as described by Daniellssen and Boeck, Alibert, and others. The narratives of patients, particularly of the class to which most of my patients belonged, are quite untrustworthy." Dr. Bowerbank, of Kingston, in Jamaica, observes (Report on Leprosy and Yaws, &c. by Dr. Milroy, 1873, p. 37):—"The tubercular form is generally preceded for some time, as for several months, by a feeling of debility and weakness. In many, if not in the majority of cases, the sufferer will be found with his general health impaired, anæmic, pulse weak and small; it will be found, too, that he had previously suffered from some debilitating disease, from the effects of which he had never rallied, such as an attack of yellow fever, typhoid fever, small-pox, scarlet fever, measles, dysentery, &c.; he complains of a feeling of malaise, &c., an indefinite feeling of something wrong, chills, like ague, rheumatic pains about the extremities, creeping, pricking sensations of the limbs, a sensation (so-called) of pins and needles, stiffness and numbness of parts, a falling asleep of a limb, a hand, a foot, a finger or toe. . . . Yellow or copper-coloured spots then make their appearance in different parts of the body, and it is for this symptom in general that a medical man is consulted, the patient taking them for chloasma (*Pityriasis versicolor*), &c.; his surprise is generally very great, on a needle being thrust into these spots, to find he is insensible to pain.

"The same premonitory symptoms exist also in the anæsthetic form, and I think the first symptom here may be said to be shooting pains like electric shocks,

this point, however, my information is deficient, and I am as little acquainted with the general symptoms, if such there be, which attend the onset of the disease.

As to the *order* of appearance of the signs of disease, an eruption in the mixed form is the first, then the face becomes tumefied, afterwards the trunk and extremities; anaesthesia and distortion of the latter usually appear at a latter period.\* As the face, including the ears, is the earliest seat of tubercles, so it remains the most affected.

The *progress* of the disease is steady and uniform,† the local changes become more marked, and the powers of the system decline; after a varying interval of some years, complications, as diarrhoea, &c. supervene, and the whole *duration* of the disease is less prolonged than in anaesthetic leprosy, for in only one of my cases had it extended beyond 12 years.

As to the *cause of death*, this will be afterwards fully discussed; a chronic bowel affection is often the immediate one, and it may be associated with fatty degeneration of the kidneys.—M.L. TABLE (II.) Nos. 5 & 6. During life, the urine is by no means frequently albuminous, nor the pulse very quick or slow. I have not found that the mental faculties are more debilitated or blunted in any form of leprosy, than in other diseases, accompanied by a similar depressed and miserable state of the system.

In tubercular leprosy, the constitution is evidently deeply implicated, the disease is widely located, and exhaustion is accelerated by prolonged, though limited, ulcerations, &c. The state of the leper at the *advanced* stages, is even more pitiable than in the other form, his appearance more repulsive, his sufferings greater, though not extreme; but it will not be necessary to again catalogue his miseries. See the annexed fatal case T.L. TABLE (I.) Case No. 3, and M.L. TABLE (I.)

" &c. along the course of the nerves leading to the hand and foot. . . ."

In these interesting remarks of Dr. Bowerbank, one should distinguish between strictly premonitory symptoms and signs of incipient disease. Respecting the former, I note the absence of dyspeptic symptoms so strongly insisted upon by the Norwegian writers; and amongst the latter, I observe the marks of attendant nerve-disease.

\* Loss of feeling was noted by Boeck in 31 patients out of 112; in eight instances it was complete. It was commonest in the beginning of the disease, according to this observer; appeared in localities often affected by nerve-disease, and seemed to gradually subside, so that at late periods, sensation becomes again normal. This order of symptoms is not, however, such as is generally observed, even in Europe.

I am unable to tabulate my own experience in India, not having the notes at hand; but I have already referred to the instance of 'mixed' leprosy. Probably anaesthesia, in some part or degree, is never absent in confirmed 'nodular' leprosy, but it may have to be searched for, and that carefully.

Recorded experience in the West Indies equally demonstrates the common presence of nerve-disease, even at early stages.

Hansen has recently arrived at the conclusion that anaesthesia belongs rather to the more advanced stages of tubercular leprosy, and for his most interesting comments I would refer to Appendix A., page xiii. These observations will serve in great measure to reconcile statements seemingly at variance; but it should

be recollected that nerve-disease is also a primary, as well as a consecutive, phenomenon in leprosy.

† The statement in the text is not sufficiently comprehensive, for, according to competent observers, the progress of tubercular leprosy is commonly in Europe, and in India, at least, frequently, attended with febrile exacerbations, during which crops of fresh nodules appear, so that, in such cases, the disease appears to advance by a series of successive stops, rather than in a uniform or steady manner. Both orders of symptoms, indeed, occur, but under circumstances tending to aggravate or favour the complaint—amongst which I reckon a harsh climate, bad food, and hygiene, and, originally, a copious, leprosy deposit—these acute or febrile outbreaks seem to become the rule. As the whole subject will be again reviewed under the head 'General Pathology,' I will here only add one or two supplementary references from experience in India.

Lisboa (*loc. cit.*) remarks:—"Eruption of tubercles. " These come on the patches or on the sound skin. " The tubercles, like the blotches, generally appear in " successive crops, sometimes being preceded, like them, " by febrile symptoms, but during the intervals of the " eruption of these crops, the patients continue free " from fever."

Day (*loc. cit.*) states, that:—"The eruption of tubercles may be slow or rapid. In one case the face was " covered in the course of three months. . . . " In the later stages of the disease the eruption of " tubercles in natives is rarely preceded by fever, but " frequently by obstinate itching of the skin."

Taking mixed and tubercular leprosy together, I find that over one-third of the cases were females: in 7 out of 40 the symptoms appeared under the age of 10 (in 3 females at the period of infancy); under 20 years in 12 cases; under 30 years in 11; in 9 cases under 40 years, and once above that age. In more than one-third of the whole was an hereditary taint, direct or indirect, acknowledged; and it occurred rather most often on the female side.

The second and third of the following cases are appended for the sake of illustration; the first as of general interest. Following after, are some more detailed comments upon the whole malady.

CASE 1.—*Simultaneous occurrence of the three forms of leprosy—early stage.* A Mussulman, *ætat.* 35, tin-smith by trade, native of Rajcote, two years sick. The disease began in the hands with loss of sensation in one finger, which spread upwards: after some months the feet were similarly affected, and a year since the face become swollen, &c.: a burning sensation in the extremities was at first very troublesome, but has now subsided. No fever: never had syphilis: is in good health and intelligent. Head,—the skin of the forehead is tumefied, bronzed, and roughened from the enlarged orifices of the gland-ducts; in parts shining and smooth, as on the eyebrows; the nose is bronzed and its alæ tumefied: the skin of the ears red, tumid, harsh: on the temple, cheek, and chin, are some small slightly raised patches of a reddish-bronzed tint, smooth shining surface, and tolerably defined; on the chin a few small tubercles. The patches are placed chiefly over the situation of the larger branches of the fifth cranial nerve; all are benumbed, the sound parts being normally sensitive. The ciliary and supra-ciliary hairs are scanty, the eyes rounded and staring, which, with the bronze tint and swelling, impart a decided 'leonine' expression. Nothing visible in the throat. On the trunk are large discoloured patches of *baras*. The right nipple is evidently enlarged. On the upper extremities are some silvery patches, extensive anæsthesia, and commencing changes in the hands; the fingers are slightly clubbed, but there is thinning of the first row of the phalanges; muscular power is yet little impaired. The lower extremities are similarly affected; there is extensive anæsthesia; discoloured spots, fissures, or cracks at the heels, but no distortion of the toes or nails. The organs of generation appear unchanged, but there is anæsthesia here. He is married, no children; the venereal appetite is now diminished. No hereditary taint that he knows of; has been under active native treatment without benefit. (*Dispensary patient, No. 48.*)

CASE 2.—*Incipient Tubercular Leprosy.*—A Mussulman, *ætat.* over 30, a stoker, native of Mhar (where leprosy is frequent); affected about 12 months. The disease began on the face (eyebrows) and spread to the trunk; no premonitory symptoms. At present the skin is studded with small tubercles, most not larger than a pea, colour pale, especially on the trunk; on the face they are bronzed and the intervening skin is tumefied; they are present on the eyebrows, nose, cheeks, chin, the ears are much enlarged, their eminences and rim, including the anti-tragus. Also on the chest (most) and back; shoulders, outer side of arm and fore-arm as far as the wrist, and on the back of one hand; they are also present on the lower extremities, including the dorsum of the feet, but not to so great an extent. The face is much the most affected; the hairs on the eye-brows and the eyelashes are scanty, the beard and moustache little affected. There is doubtful thickening of the mucous membrane of the palate; voice is natural; *mammæ* not enlarged. Sensation is not perceptibly diminished in any part, except perhaps the lobules of the ears. He denies a syphilitic taint; formerly suffered from rheumatic pains, and has been actively treated without avail. The urine is healthy; *sp. gr.* 1009. (*Hospital patient, No. 71.*)

CASE 3.—*Confirmed Tubercular Leprosy.*—Dhundoo, *ætat.* 26, from near Rutnagherry (coast), 11 years sick. There were first light patches on the skin beginning at the nates, four years subsequently tubercles followed, first on the face, then the legs became benumbed. Was not subject to fever. There is well-marked tubercular thickening of the brows, nose (which is shrunken), cheeks, lips, and ears; the hairs on the face are wanting; all these parts are deeply bronzed. The tongue is covered to the tip with tubercles, and two large rows or masses may be seen on the hard palate. The voice is very hoarse. On the trunk no eruption is now to be seen, but the skin is studded with small tubercles, the size of a pea. The same are present on the upper extremities, on the

outer side of the arm and fore-arm, forming elevations of considerable extent: the hands and fingers are swollen, the latter expanded and marked with fissures; some of them are shortened. On the nates are light tubercles, a few on the back of the thigh and leg; the feet are swollen, and some of the toes destroyed, just as in the hands; a bronze tint is not marked, but the skin of the thighs and legs is darker, smooth, and shrunk or atrophied; this appearance indicates the extent of complete numbness, from the middle of the thighs downwards. There is no perceptible loss of sensation on the face, trunk, or upper extremities. The nipples are converted into small knobs. He never had syphilis. Both his father and mother were lepers; a sister younger than himself is healthy, no brother; it is also said that a (paternal) male cousin is a leper, being about his own age. Is married, but has no children. Is in poor condition, having just returned from Ahmednuggur, a long pedestrian excursion. Was formerly in the army. (Dhurumsala patient, No. 93.)

CASE 4.—'Mixed' Leprosy.—Male, aged 25 years; single; duration of disease, 8 months; from a leprous district. The man is strong and in good condition, but complains of debility, and of pains in the feet when he walks; this is the chief complaint. The body is covered with small spots, none being larger than one to two inches in diameter, often rounded or irregular in form; some are pale, others almost subsided, leaving a brownish mark or no mark at all; these spots look very like those of a syphilitic eruption. The new spots commence with decided inflammatory points, which enlarge and form elevations (tubercles) in the skin, but these tubercles are of temporary duration, and, on fading, leave the marks just mentioned, afterwards to disappear altogether. There is bronzing of the face and hands, but no loss of sensation; there is some atrophy of the hands and muscular weakness, but no loss of feeling. The temperature has not been observed in this man. He never had syphilis.

The spots above-named are not prominently raised above the surface of the skin; they do not acquire a serpiginous character, and they leave mere stains which fade away; over them the cuticle desquamates. The fresh crops last a few weeks or months. There is no tendency to suppuration. Besides the above there are some deeper-seated spots or small tubercles (?), over which the skin is free, and not altered in appearance. The glands in the groin are swollen and firm, as well as those in the neck, axilla, &c. The hairs on the eye-brow have partly fallen off.

I am told that the malady began in August last (11 months since), with tumefaction of the inguinal glands, and eight days afterwards, he observed reddish nodules around the joints of the hands, and, soon after, all over the body. These spots left and recurred at nearly regular intervals. He says that he often has suffered much exposure while fishing at sea in the winter season, and as well in summer while tending cattle on the mountains. His food has been bad and insufficient. He does not know of any leprosy in his family. He says that many cases of this complaint are to be found in his parish. The treatment is, as in the other cases, namely, internally, carbolic acid; and besides, the use of baths. (Rigshospital, Christiania.)

CASE 5.—*Tubercular Leprosy*.—Female, aged 30 years; single. Resides in an inland district, not far from Christiania. The disease began eight years ago, on the eyebrow; afterwards spots came on the trunk; there were premonitory symptoms of debility. The tubercular swellings are limited to the face, and the hands and feet; they are characteristic; there are also spots on the back of the shoulder, outside of the arms, &c., which are of irregular form, and though attended by thickening of the skin, are yet not entirely composed of 'tubercles;' these spots are of a dark brown tint, and are apparently one of the forms of *Morphaea*, co-existing with tubercles. There is diminution of sensation in the spots on the back and arms, and also on the back of the hand; but the fingers, which are swollen, are red and tender, the skin over them being very much thinned. There are on the right fore-arm large, irregular, white spots, looking like thin cicatrices, or rather as if the cuticle had been removed and the pale subjacent corium exposed; their diameter varied from one to two inches, and their form was irregular; that they were depressed below the general surface, seemed to be doubtful. These spots follow after crops of *pemphigus*, and are permanent. The temperature of the body has been taken for several months, it ranges between 35° and 40° Cent., rising to the latter point at irregular times, and then it is sometimes attended with general fever, swelling of the face, and increase of the tubercles. The treatment has consisted of the internal administration of carbolic acid

(gtt. iij. in water, thrice daily); the vapour bath frequently, and cupping to the loins occasionally. This patient has not been in the habit of eating fish.

The following table shows the temperatures (Cent.) taken morning and evening at 7° in the axilla, during a period of eruption of fresh tubercles, commencing December 25, 1872, when the temperature of the body was natural:—

| Date. | M.       | E.       |
|-------|----------|----------|-------|----------|----------|-------|----------|----------|-------|----------|----------|
|       | Degrees. | Degrees. |
| 25    | 37       | 36       | 30    | 36·4     | *40·2    | 4     | 38·6     | 39·6     | 9     | 37       | 39       |
| 26    | 36·5     | 38       | 31    | 37·4     | 39·4     | 5     | 37·8     | 40·4     | 10    | 37·8     | 38·4     |
| 27    | 36·2     | 38·2     | 1     | 38       | 38       | 6     | 38       | 40·2     | 11    | 36·8     | 38       |
| 28    | 36·4     | 38       | 2     | 39·8     | 39·8     | 7     | 38       | 40       | 12    | 36·6     | 38       |
| 29    | 36·6     | 38·6     | 3     | 40       | †40·4    | 8     | 38       | 38       | 13    | 36·4     | 38·2     |

\* Date, 26th December, it is noted that, in the evening, she had strong eruptive fever; pulse, 124.

† Date, 3rd January, still fever; pulse, 136. Other details not supplied.

## 2.—APPEARANCES, SEAT, AND DISTRIBUTION OF THE DEPOSIT.

Observers in all ages and countries, concur in naming 'the face' as the most frequent seat of 'nodules' or 'tubercles'; and here, and on the margins of the ears, is also their earliest position. This preferential locality in tubercular leprosy, reminds one of the digits as specially affected by numbness in the 'anaesthetic' form; and of the arms and legs as common seat of eruption ('lepra leprosa'). But it is more worthy of remark, that the same localities, as the face, back, outer side of the limbs, and back of the hands and feet are, upon the whole, selected spots common to the entire leprosy disease, in some or other of its three chief manifestations.

I have already pointed out that the new growth assumes the character of either 'nodule' or 'infiltration;' and may add that the latter passes by transition to a simple eruptive form. All forms of leprosy deposit may co-exist. Infiltration of the skin is most common on the face where the sub-cutaneous tissue is slight in amount; and it may also be seen on the back, the shoulders or buttocks, &c., where, too, the integument is very compact. Its presence is, thus, an indication of certain physical conditions, as well as of the mode and degree of morbid effusion. It may assume a circular form and attain a diameter of three or four inches, spreading at the edges and subsiding in the centre; it is seldom greatly elevated, and never, except as an accident, gives rise to ulceration. Its hue and consistence vary, as do those of the 'tubercles' themselves. It may be regarded as intermediate in character, between the leper-nodule, and the leper-spot.

On the eyebrows, nostrils, cheeks, chin, and ears—all places where emerge cutaneous branches of the trigeminal nerve—the nodules, or tubercles, first appear; and here they may become very prominent and well defined, or coalescent and less prominent. Here, as elsewhere, their size varies, *e.g.*, from a pea to a nut, and it may even exceed this last in the thin loose skin of the back of the hand or fore-arm (or membrum virile); the nodules are also scattered or confluent; either prominent, or, as on the trunk and limbs generally, rather flattened. Thence a transition to the broader infiltrated form may be traced.

On the pale skin the tubercles are always darker than natural, and even in the dark skin of the Hindoo, the pre-existing dusky tint becomes deepened by them. At first they seem to be pinkish (vascular) and soft; then paler (less vascular) and firm, being comparable to nodules of fibrous tissue, or 'molluscum'; afterwards they are of dark, muddy, or livid tint, and doughy to the feel (softening of the tubercles). Inflammation, disorganisation, and extension of their contents is not an uncommon sequel. When first formed, they are seated in either the substance

of the skin, or in sub-cutaneous tissue; and can then, or in the last case, be detected at first only by the sense of touch. While in some regions, tubercles are subsiding, in others, fresh ones may be forming.

The present remarks refer only to the chronic tubercular changes, and from them it will be evident that the size and condition of the leprous nodules, may vary in a wide range without losing any of their essential character. What are the circumstances under which such variation occurs, I have endeavoured to show in brief, but many particulars not mentioned here will have to be gathered from other pages, so numerous are individual outward differences.

Tubercles are not found on the hairy scalp, nor have I seen them in the palm or sole, where, however, some infiltration may be present.\*

### 3.—CHRONOLOGY.

Most commonly, the leprous nodules make their approach in a slow and gradual manner, upon a part not previously changed in appearance, and unattended by constitutional disturbance. At other times they are preceded by a local, but diffused tumefaction of the skin, whose duration is limited, and which at intervals reappears, finally becoming permanent, in the form of a defined thickening of the integument. Such spots have, at first, a decided erythematous aspect; they desquamate, but their colour, as well as consistence, subsequently becomes intensified. Their advent is attended with febrile disturbance, which subsides when the spots come out, and these exanthematous flushings, with pyrexia, are not uncommon at nearly all stages of this form of leprosy. There is here so manifest a transition from the acute outbreak to the more chronic advance of the malady, that it may be supposed there exists an underlying connexion, and for an attempt to substantiate this view, I would refer to the chapters on General Pathology.

The material for these remarks are derived chiefly from European sources of information and in a case of leprosy, which I saw at Christiania (*vide* Case 4, *supra*), were illustrated some of the appearances above-mentioned. The advent of fresh tubercles was said to be heralded by febrile paroxysms, and the appearance of erythematous patches; some of the latter were still visible, and their resemblance to spots of *erythema nodosum* are very evident. On pressure and under climatic influences repressing the circulation in the skin, these swellings briefly subside, but there is soon or always formed a solid residuum, which increases in amount after each attack. Absorption of leprous matter in some places, and its re-deposition in fresh spots, seem to be the preliminary and terminal attendants of these paroxysms, and commonly the process is attended with evident implication of the absorbent system, or, it may be, even of the blood itself.

### 4.—COURSE OF THE DISEASE.

Very early in the parts affected with leprous thickening, the local functions are disturbed. No invariable rule in any respect, obtains, but usually the cutaneous secretion is at first

\* The following memoranda respecting the seat of tubercles, are interesting. Boeck (*loc. cit.*) found amongst upwards of 100 cases, tubercles on both face and extremities in 55; on the face only in 32; on the extremities only 5; on the mucous membranes only 9; only very seldom all over the body; in men, the chest

is hardly over their seat. In only 25 instances were the mucous membranes altogether unaffected. Day, too, found by far oftenest tubercles on both face and limbs; and such, among indiscriminated examples, is ordinary experience.

increased: thus, the tumefied part may have an oily or shining appearance, is dotted with the openings of the sebaceous glands, and, in general, has frequently an aspect not inaptly compared with that of the rind of an orange; afterwards secretion is diminished or suspended. The hairs early fall out, being extruded from their sacs by pressure; they may be thickened, wasted, or otherwise changed; and their absence imparts a peculiar, and popularly well-known aspect to the features. If leprosy came on before puberty, the hairs are never, or only scantily formed. I have already said that the nails of the digits become stunted and deformed; but there is much variety as to the extent of these changes.

Sensation in the skin, the seat of tubercles, is sooner or later rendered defective. What are the precise changes that have occurred, is not yet known. A preliminary hyperæsthesia is rare in the tubercles, except under the condition of a febrile accession, it may be present in the patches of infiltration, under similar circumstances.

The temperature of the affected surfaces is said to be below that of other parts. The whole body, too, seems to be kept at a warmth lower than normal.\*

The nodules continue to grow, or remain stationary, or else subside. The first-named process may be slow or quick, and in successive steps; the last-mentioned may be consequent upon softening and interstitial absorption of their contents, at a rate tardy or rapid; or upon ulceration and direct elimination of the leprosy material. So great is the tendency to disintegration, that a perfectly stationary condition of the tubercles, is seldom of long standing.

The infiltrated surfaces, also, have a tendency to subside; it is seldom that acute softening, or ulceration, occurs in them, except in conjunction with other incidents.

Inflammation and suppuration, strictly so-called, of the tubercular deposit is very rare, and then, probably, always incidental.

##### 5.—ATTENDANTS AND COMPLICATIONS.

I have briefly mentioned the local changes, which occur in the skin; and also those paroxysmal outbreaks of cutaneous tubercles, which are not uncommon. This last subject will be again referred under the head of General Pathology.

*Lymphatic glands.*—Earlier or later after the advent of tubercles, the superficially placed glands which correspond to their seat, become enlarged, *e.g.*, the cervical, &c. for the face; the axillary, &c. for the upper extremity; the inguinal, &c. for the lower extremity.†

This complication becomes especially noticeable, when the nodules in the skin undergo rapid or acute disintegration and absorption; and at such times, the course of inflamed lymphatic vessels, passing from them to the first series of sub-cutaneous glands, may sometimes be perceived by sight or touch, but, so far as I know, there are no external appearances in vessels or glands, other than those following any kind of irritation of the skin.

Commonly, more than one gland (as in constitutional syphilis), is affected; and suppuration of the buboes is very rare indeed.

\* An abnormally low temperature of the body has been noticed as common in lepers. Many years ago Boeck made some observations on this point, finding the temperature in the hand to be sometimes as low as 77° F., oftener over 90°, or as much as 97°. Liveing has lately given continuous measurements of the bodily heat in a European leper under his care, which were carefully taken on the axilla; and it was found that in

the intervals between febrile paroxysms, the mean degree of heat was 97° in the morning, and about 98° in the evening.

Similar data for lepers in other countries, I have not seen.

† For many details, especially of an anatomical nature, see Hansen's observations in Appendix A., page ix.

Glandular implication, as a result of simple cutaneous hyperæmia, &c., may undoubtedly occur; but, as a rule, in leprosy this complication is of the more chronic form, and not in appearance so closely allied to skin-changes, as commonly is seen.

*Eruption.*—It has been already stated, that some of the less pronounced forms of 'lepra leprosa' attend this tubercular phase. Commonly, these are the pale and little raised patches, which seem to be due to combined local deposit and nerve-disease; and there are forms transitional to more simple thickening of the skin.\* Again, the characteristic marks of pemphigus, and of skin-atrophy, owing to attendant nerve implication, may be present. Lastly, there are signs peculiar to this nodular phase of the disease, in the presence (a) of small scars following ulcerations; and (b) of other defined cicatrices, seated in the skin itself, which are consequent upon molecular absorption of the nodular mass, whereby a collapsing of the superficies occurs, ending in an aspect not unlike to vaccination or small-pox marks.

Of attendant skin-diseases, those named in the note below, may be briefly indicated.†

*Anæsthesia.*—Under this head, I refer to the conjunction of nerve-disease with the nodular deposit. It is, as has sufficiently appeared, a common one; but not at first. In most or all advanced cases, however, this complication appears; and it sometimes becomes very much marked, being, in its own character, more persistent than mere deposit in the skin, and thereby surviving every other trace of leprosy in very old subjects. Such, at least, is the latest Norwegian experience.

I have already alluded to caries and necrosis of the small long bones of the hands and feet. Distortion of these parts, however, is not so common as in uncomplicated, or severer nerve-disease. There is often conjoined, tumidity and thickening of the soft parts of these members, which are different to the smooth atrophy, common in anæsthetic leprosy, and which are not necessarily accompanied by loss of sensation. Probably, liability to exposure to hurtful influences, chiefly determines these local inflammations, which in cachectic states of the system

\* In their account of tubercular elephantiasis, Danielsen and Boeck describe patches of eruption, some of which were afterwards correctly referred to the anæsthetic form, and are here included in the macular phase of the disease. They have distinguished and figured one variety—*morphœa nigra*—which looks to me nothing more than either an incidental complication of skin-changes, or the remains of true leprosy eruption happening in a cachectic subject. There appears nothing characteristic about these spots; and those which I have mentioned in Case 5, as being possibly a form of *morphœa*, were of a different character, being livid and congested relicts of erythematous effusion. The '*morphœa alba*' of Danielsen and Boeck pertains, as I think, to macular leprosy; and seems to correspond to the first or second of the form of *lepra leprosa*, described in this memoir.

I have endeavoured, in the text, to briefly indicate the several different appearances which the skin presents, under the head of the causes to which they are due; and are appreciative estimate of the latter, will render further details unnecessary.

Of all analogous skin-affections, undoubtedly the syphilitic offer the closest similarity to leprosy, which could be named; and it may probably be said, that their anatomical explanations are somewhat alike, both being due to the changes undergone by a new growth, which

has of itself various peculiar tints and other physical characters.

† Of skin-diseases, frequently accompanying nodular leprosy, the following:—Eczema, Herpes, Prurigo, and Ecthyma, Lichen, Ichthyosis, are mentioned in Europe; and I think, in India the same would be found. Boeck refers to a peculiar blotched or chequered appearance of the soles of the feet as due to the presence of eczema; and remarks that Dr. Röser, of Athens, considered this sign to be one of the earliest developed symptoms of the disease. All such marks should, if possible, be associated with the definite and known pathological changes, for their better apprehension.

In the West Indies, Bakewell thus comments (Correspondence, &c., p. 23):—In both forms of the disease, psoriasis, eczema, and other forms of skin-disease are common, but not, I think, essential symptoms. Although nearly every patient in the Trinidad Leper Asylum had some eruptions of the skin, I am inclined to think they were formed by filth more than anything else. At any rate, cases may reach a very advanced stage, without anything of the kind occurring. A squamous and sometimes ichthyotic condition is, however, exceeding common in tubercular cases. Having before attempted to discriminate the incidental and the essential, amongst the skin changes and attendants of leprosy, these remarks must now pass as they stand.

become more destructive than they would otherwise be. I have, however, found nerve-disease in all such cases examined, in Bombay.

*Eye.*—Tubercle in the cornea is not uncommon in Norway, and is well-known in India. I have not had occasion to study this complication; and, therefore, must look to other writers for information. As in the nerve-leprosy, a form of iritis, is also frequent here, in addition to the characteristic corneal tubercle. For details, see Appendix D.

*Mucous membranes.*—I have said that the mucous investment of the nose, mouth (including the tongue), the throat, and the larynx, may be the seat of leprosy tubercles. These in the nasal fossæ, where the mucous membrane is closely adherent to the periosteum, I have not seen; nor have I found them below the larynx, or pharynx.\*

As indicated in my notes and cases above detailed, the leprosy deposit of mucous membranes may assume the form of nodule, or of infiltration; the appearances of each vary, as in the skin; here, too, ulceration is not common, but cracks and fissures may be present. When the larynx is affected, the voice comes to resemble that common in secondary syphilis, and the immediate cause of the change may be the same; but leprosy ulceration does not usually extend to cartilage or bone. All these parts are affected subsequently to the skin.

#### ADDENDUM.

*The acute onset of tubercular leprosy.*—Respecting this phenomenon, which I had not seen in India, but which was long ago described by T. Heberden (Madeira) and the Norwegian physicians, and has been always referred to writers on leprosy, it should be remarked that Danielssen and Boeck expressly state "they had seen only four instances of the kind, out of the large number of lepers who had passed before their notice." No detailed cases of this acute form are given in the large work on "Spedalskhed," and, for fuller information, I therefore turned to Boeck's earlier treatise. Probably Boeck was the first to distinguish this variety of Norwegian leprosy, and he refers to the history of four lepers whom he had examined, two, namely, in Norway, and two in Italy. The first instance named (which may be taken as a fair sample of the rest), is the following:—"A young woman, ætat. 18, stated that three months ago, she was attacked with smart febrile symptoms, attended with much swelling and redness of the face, and with head-ache. In consequence, she was obliged to keep her bed for more than a week. Afterwards, she became perfectly well, and remained so for three or four weeks, when another attack, precisely like the first, came on, and now, quite recently, she has had a third attack. The face, especially its upper half, is puffed up, and it has a peculiar livid tint. Menstruation, which appeared only twice before she became ill, is checked, otherwise her health is good." As Dr. Boeck's remarks are of much interest, I will quote some others, in continuation of the above. He says:—"The redness and swelling of the skin, already referred to as the local marks of the malady, may suddenly set in, with but slight febrile disturbance. The swelling may be limited to the face, or it may include the limbs, or even the whole body. The redness of the tumefied skin, is quite a peculiar tint, and for those who are accustomed to see patients, it is an infallible sign of the presence of leprosy."

\* Perhaps the mucous membrane continuous with apertures on the face (or, as I should rather say, supplied by the fifth pair, and perhaps other cranial sensory nerves), is more frequently implicated in Europe than in India. In three-fourths of all his cases, Boeck found it to be affected. Tubercles (flattened) and ulceration, or the latter alone, were found in the uvula, tongue, palate, pharynx, &c.; in these parts the tendency of tubercles to ulcerate is common. The septum nasi is said to be a usual seat of nodules, as it is of ulceration.

Respecting the larynx, I am not able to write from knowledge; and I think it remains to discriminate between leprosy and other disease in this part. Boeck correctly remarks that "affections of the mucous membrane stand in no fixed relation to the outward manifestation of leprosy; for one finds instances of much developed disease without the smallest affection of the mucous membranes."

I may add that a gleet discharge from the urethra, in males, is said to be rather frequent amongst lepers.

" Not rarely, there is conjoined an increased sensitiveness of the skin in the parts attacked, and this may be so great, that the patient cannot bear them to be touched. This state may last for one or two weeks, whereupon the fever subsides, and also the swelling and redness, but these not completely. Some puffiness remains around the eyes and in the upper part of the face; and whilst the more intense reddish-brown tint subsides, there still remains the peculiar brownish shade, which does not any more fade.

" After this first attack, the patient may again become well; he has seldom any suspicion that he already is affected by the disease, but after a longer or shorter time—weeks, or months—there happens a fresh attack, and the symptoms above described again repeat themselves. The tumefaction, and bronze tint, however, increase. After the second or third attack, and sometimes immediately after the first, there appear other symptoms; thus, the hairs, especially of the eyebrows, fall out, and 'tubercles' are developed under the skin, which at first can be detected only by feeling for them, but which, most often, rapidly grow. Should they subside after their first formation (which may also happen), this event always brings on a fresh, febrile attack." . . . . I may here add, that in their great work, Danielsen and Boeck remark . . . . "When the tubercles first formed, become softened, the affection assumes its chronic course, but when such is not the case, there supervenes a pneumonia, a pleuritis, or a meningitis, which kills the patient in a few days." This last statement refers to a complication which will be more fully described under the head of 'General Pathology.'

The writers last-named describe the acute or febrile advent of tubercular leprosy in the following terms:—"There comes on, without appreciable cause, a series of violent febrile paroxysms, with marked nocturnal exacerbations, and accompanied by an unbearable sensation of weight and lassitude in all the body, alternating with violent headache, with delirium, sometimes raging, a burning thirst, a skin dry, red, and, as it were, turgescens; no sleep, full pulse at 120-130 beats the minute, urine scanty and tolerably pale, tongue dry and red, constipation. After these symptoms have lasted without any mitigation, for from 12 to 15 days, an eruption of bright, livid (blenâtres) spots makes its appearance; these spots commonly spread over the body, quickly rise above the level of the skin, increase in volume and consistence, are often confluent, and give rise to tubercular infiltrations of considerable extent. The disease may thus in a few weeks as seriously affect the frame, as, in its chronic course, would occur only in the course of years. On the eruption coming out, these general symptoms subside and gradually vanish, whilst the tubercles continue to be developed." . . . .

I next append an extract from the lately published "Correspondence relating to the alleged cure of leprosy" by Beauperthuy's method, in the West Indies, p. 34, as affording perhaps the nearest approach to the Norwegian data, which I have lately met with. The writer is Dr. Bakewell, whose entire description is here reproduced:—

" The following case is one of so much interest, and has such an important bearing on questions both of pathology and treatment that I venture to introduce it here, although it was not treated by Dr. Beauperthuy's method. W. T., white creole, father an Englishman, mother a white creole. *History*—Is the son of poor parents, and lives in a very unhealthy part of Port of Spain. Up to a few weeks ago was always in good health, and a very hearty eater. Diet chiefly fish, salt and fresh, does not like meat (father a fisherman); very fond of fruit, sugarcane, and plantains. He went down to the Islands, in the Gulf of Paria, about four months ago, to visit an uncle. While there his diet was very bad; he bathed when very hot. Remained a fortnight, and when he returned had slight fever, and was sickly. He continued feverish and sickly, but without loss of appetite, until about three or four weeks ago. The fever then became much more severe and continuous, that is, without intermissions, but was worse at night. At the same time the father observed a breaking-out of pinkish patches on the cheeks. The appetite, from being large, became voracious, so that he would eat until vomiting came on. He complained of headache, rambled in his sleep, and was sometimes delirious.

" *Present state*, Nov. 22, 1870, 1.30 P.M.—Skin hot to the touch; temp. 104.2° F.; pulse, 126; respiration, 36. No tenderness or pain in iliac fosse, no diarrhoea. Very thin, but not exactly emaciated. Complexion fair, with flaxen hair. On the cheeks are large flat shiny patches, closely resembling those of *erythema nodosum*, much redder than the surrounding skin, redness disappears momentarily under pressure. The same kind of patches were found thickly scattered

about the whole of the trunk and limbs. On the trunk they were not quite so deep-coloured, or so much raised from the surrounding skin. The ears were natural. There was no anaesthesia, or numbness but there was some hyperaesthesia, as he complained of the skin being sore, and if any one touches him he cries out. Is weak, but can sit up. Hands and feet swollen, but not oedematous; no albumen in urine.

"Nov. 25th—Just in the same state, temp. 104.8° F. Ordered quinine 3 grs. three times a day.

"Nov. 28th—Has taken only about one dose of quinine a day, but to-day (11 A.M.) is much less feverish (temp. 100° F.) and the skin is not so red, nor the spots so prominent. Eats well; bowels regular. 30th—Much less fever yesterday and to-day. Has continued the quinine regularly. The redness of the patches has entirely disappeared; they are no longer raised, but have become level with the surrounding skin, purplish, rough, and slightly squamous. The patches on the cheeks are very conspicuous. On the thighs and gluteal regions the patches have invaded nearly the whole of the skin. There is no anaesthesia; the swelling of the hands and feet persists; no albumen in urine. Appetite not so good as before; tongue clean; bowels loose yesterday. Temp. 98.6. Nov. 31st—Slept half the night. Tongue clean; pulse, 84; temp. 99.4. Skin dry. Spots, &c., as before.

"February 2nd—The boy has remained much in the same state as when the last note was taken. There has been no return of the fever. The patches are somewhat paler, but still persist and are scaly. To take cod-liver oil.

"This case very strikingly illustrates the earliest stage of the tubercular form of leprosy. Had I seen it at the commencement of the attack, I should have been inclined to treat it with large doses of alkalies, and with the wet packing, so as to produce a copious sweating."

I have not found amongst the writings of independent observers in India, any additional illustrations of this subject. Day, indeed, (*loc. cit.*) observes:—"Acute tubercular leprosy is apparently quite unknown amongst the natives of Malabar, some few instances amongst the East Indians (Indo-Europeans) might be termed 'sub-acute' in contra-distinction to the chronic character of the anæsthetic spots."

In anticipation of what will afterwards be advanced, I may here say that, in my opinion, there prevails in this subject, some confusion of observation. A series of phenomena precisely like in character to those above described, is by no means uncommon in the after-course of leprosy whether European or even tropical; hence, while for practical purposes one may admit the existence of a seemingly sudden onset of the disease, still, from the scientific point of view it has yet (as I think) to be demonstrated that in every such event, there was not some previously existing deposit, however small, in the skin or glands, from which infection of the system might have proceeded.

## B.—GENERAL SYMPTOMS; DIAGNOSIS; PROGNOSIS.

Owing to the same causes as those producing the local disturbances, and partly due also to consequences of the latter, there ensues a series of general symptoms, which may here be briefly noted. For a time, at least, the bodily health of the leper does not suffer; and should his disease remain moderate and quiescent, there is no great departure from the normal state.\* The

\* In his series of cases, examined in circumstances so much on a parallel with those attending ordinary observation in India and elsewhere, Boeck found "that under an equable development of the disease and prior to its reaching its higher grade, the general health of the leper may be quite tolerable, yet one sees that some functions proceed less regularly on account of it. Digestion, indeed, suffers only so far as the appetite is diminished, the evacuations are almost always good. On the other hand, in women menstruation may be either diminished or

"arrested, after a time becoming scanty, or ceasing immediately on the advent of the malady. In many cases, however, it is clear that the same cause, which brought about the outbreak of the disease, also produced cessation of the menstrual flux."

So remarkable and characteristic a condition of the leper, as this ordinarily painless, and except from mutilations, hardly more than inconvenient state—however repulsive his appearance may be—is surely one which cannot but arouse deep contemplation in the physician: one can hardly help surmising that here is a local blight,

conditions, in short, seem to be even more subdued than those attending the course of tuberculosis, or canceroid, or, though less aptly quoted, of syphilis itself.

That mental depression, however, in all its phases, should often supervene, is likely enough, from the wretched social, domestic and hygienic state of most lepers. Yet many sufferers retain a certain amount of cheerfulness.

That physical debility is inevitable, must be admitted in consideration of the pain, exhausting deposits and discharges, the necrosis of the digits, the enforced quietude, and too often neglect and exposure to inclement seasons, which are part of the leper's common lot.

But, in addition, and as other direct consequences of the malady, there occur frequent and enervating febrile paroxysms, which appear to be due to infection of the blood, from absorption through the lymphatics of disintegrated leprous matter, and this event is of itself a source of deterioration and great wasting of the frame. Probably, too, every such febrile attack leaves the body more deeply infected, and less fit to sustain the burden of disease than before; and with each there seems to be a risk of some acute organic disorder, of itself sufficient to kill the patient.\*

More remote consequences of leprosis and due rather to its attendants, such as the prolonged caries and puriform discharges, with contamination and lesion of the lymphatic system, are organic changes which under the heads of albuminuria dropsy, diarrhoea, dysentery, are well known in India, and which have in Norway been also referred to wide-spread amyloid degeneration of tissue.

It is possible that even phthisis, and other forms of tuberculosis, may be a direct consequence of leprous disease.

An enumeration of the intercurrent affection of leprosy, in general, will be found further on.

### C.—DIAGNOSIS (a.) AND PROGNOSIS (b.).

(a.) *Diagnosis.*—The detection of nodular leprosy is, as a rule, difficult only at the commencement of the disease. From the so-called premonitory symptoms, happening anywhere outside a focus of the malady, could not be inferred any likelihood of its approach; and even in Norway, India, or other leper-infested countries, such symptoms are no certain guide.

perhaps a parasitic infliction, and certainly one may hesitate to call in the aid of dyscrasia, or diathesis, to elucidate this physical condition of the leper, which may be termed the normal one. Far different, indeed, is his state when privation and hardship are superadded; but then for scientific analysis of disease, which must precede therapeutic efforts, the incidental effects wrought by such influences, must be rigorously disassociated from those belonging solely to the malady itself. These remarks are anticipatory, but they are hardly here out of place.

\* Intercurrent pyrexia, following on or attended with absorption of leprous matter from the skin has yet to be studied in India. For guidance of inquiry I shall afterwards illustrate the subject from Norwegian experiences, and may here remark that the event is still known in India. Thus, Lisboa describes the febrile eruptions of nodules almost after the fashion of Dan-

ielssen and Boeck, and he adds, "in some cases on the subsistence of febrile heat, the eruption also disappears altogether, to re-appear after some time with or without the same train of symptoms." Day, too, mentions that along with ulceration of the tubercles, fever may be present, whilst headaches are common. He also comments, at some length, upon the character of the fever which is apt to attend leprosis, comparing it with the so-called 'elephantoid fever.' These remarks are of much interest, and will be afterwards more fully referred to.

It is well known that in Norway suppression of secretion from old leprous ulcers was supposed to give rise to severe constitutional disturbance.

For an illustration of a form of skin-eruption, which attends the febrile paroxysms in Norway, see Plate VIII.

The signs of developed leprosy, as above described, are characteristic. Simple or uncomplicated tubercular leprosy (which is comparatively a rare form) might, at an early stage, resemble some varieties of lupus of the face.\* Isolated tubercles, rapidly growing might be not unlike to acne, and less active nodules, greatly similar to molluscum. Thickenings of the skin, in an atrophic state, would, to some extent, approach to scleroderma; and tumefaction of the foot and leg might at first sight, resemble elephantiasis (Arabum). If, however, tubercular leprosy be present, its indications will be apparent; and then, too, most marked upon the face. The universal rule here obtains, namely, that a knowledge of the disease is the best guide to its detection. The following details will, however, be useful.

Boeck declares the peculiar reddish, or bronze, tint of the incipient tumefaction on the face, to be of itself characteristic; but he wrote as an expert, and as an inhabitant of a leper-infected country. In India, good observers have not found the colour of the syphilitic spot to be so distinctive, as they are regarded (with their coppery tint) in Europe. A single leprous nodule, at an early stage, could not be distinguished from one of syphilis; nor could a small leprous patch in the dark skin of a Hindoo. Broad patches and wide infiltrations of the skin are peculiar to leprosy, as contrasted with syphilis. The manner in which the face becomes affected in leprosy, is peculiar: the eyebrow (inner side), ala of nose, forehead or cheek, and rim of ear, being first affected; the loss of cilia on brow and lid; give to the eye a distinctive aspect, the smooth and oily character of leprous thickening of the skin, are, with its reddish tint, almost alone characteristic.

There is some difficulty in distinguishing between tubercular venereal eruptions and the leprous, but in the former the hair does not fall off or loss of sensation occur. Although in both exalted sensibility may, at first, be present; yet in leprosy, loss of feeling follows, and there is thickening of the nose, ears, and face. When the bones and soft structures of the nose have become destroyed in tubercular leprosy, at first sight the deformity appears due to secondary syphilis; but a minute examination, and the history of the case are always sufficient to guide.

A distinction between syphilitic and leprous blotches, is that in the former there are scales; they are not raised, and have a somewhat different colour.

A careful observation of the lepra tubercles will show that the regular series of phenomena, which always characterises the involution of syphilitic tubercles, is wanting; such are the central depression of the individual tubercles of larger size, scales and crusts, and ulcers of the peculiar syphilitic form. The tubercles of lepra are distinguished from those of syphilis, by their whole course. The former exist for a very long time, and seldom become openly disorganised, and if softening does occur, it is of all the tubercles at the same time (Kaposi, in Hebra).

Finally, I would point out, that in all cases where the diagnostic marks are obscure, a reserved opinion is best; and that when a combination of signs appears, a precise analysis of their import should be attempted. I know of no constitutional complaint, along with which leprosy may not co-exist, hence, discrimination of tokens may be needed.†

\* Kaposi has described an instance of lepra, resembling lupus, in which small superficial tubercles of the size of lentils were formed, being at the same time arranged in groups and even in circles as large as a sixpence or half-crown, around a cicatricial or superficially infiltrated portion of skin. The thickened and infiltrated lobes of the ears were also very similar to those of lupus. In such cases, however, the skin itself is diffusely thickened, oily-looking, uneven, but at the same time smooth, whilst in lupus there are small tubercles imbedded in the corium. He adds, that there is form of 'Sarcoma pigmentodes,' not uncommonly seen and of typical aspect, which bears a still greater resemblance to lepra tuberculosa, than even lupus or syphilis does. In this instance, however, while,

curiously enough, the feet or hands are the seat of the new nodules, yet the face, which is primarily and chiefly affected in nodular leprosy, does not seem to be specially implicated.

† An instance has come within my knowledge of combined leprosy and syphilis, which would have been puzzling if the facial signs alone had been regarded. For although there was some tumefaction of the cheek, and the cilia had fallen off, thus imparting a peculiar aspect; yet the patient has had syphilis, and a largish tubercle on the forehead presented a rounded form, with depressed centre, which was not leprous and might be syphilitic. Here, however, the ulnar nerve in one arm had become affected shortly after the eruption appeared, and already, at the end of six months, the two

(b.) *Prognosis.*—As the result of information and experience, I would observe that leprosis—best represented in this nodular form—when compared with tuberculosis, seems to attach itself quite as closely to the body, but has not so active and steady a course within it. On the adoption of the more recent views, it may be said that leprosy can cause death under acute or febrile symptoms, at any time after the first deposition of leprosy matter in the skin and lymphatic glands; and that its worst form is that in which such deposition is abundant, *i.e.*, the so-called ‘tubercular’ leprosy.\* Risk to the patient seems to prevail in proportion to the amount of this material, because its inevitable disintegration, with subsequent absorption, is a process which, when actively proceeding, is not seldom hurtful to the system. To some extent, therefore, leprosis and tuberculosis may be said to resemble each other; but, as I have above suggested, the former is the more chronic malady of the two. The average duration of its nodular form is, in Norway, between eight and nine years, and, in India, I had observed but one case, the duration of which exceeded 12 years. As before said, the anæsthetic form of leprosy is of much more prolonged duration (15 to 20 years).

The data for certain prognosis are not yet, anywhere, fully ascertained; but while the voice of universal experience proclaims the serious nature of leprosy as regards the life of its victim, it may yet be said that firmly implanted in the body as the taint may be, yet its development there is an event liable to many contingencies, which may hasten or delay—favour or oppose. In Norway, it is known that a patient may remain, to all appearance, perfectly well for a period of five or even six years; and then suffer from an outbreak of tubercles, which are often the harbingers of more suffering and early death. Unquestionably, the same phenomena happen in other countries; † and such being the wide, natural variation, so to speak, of the disease, it is evident that only under certain limited conditions, can a confident prognosis be given. These data, I may here remark, have a direct bearing upon the alleged results of the treatment of leprosy, according to plans of treatment, which may be too confidently estimated by their originators.

minor fingers were assuming their characteristic position. The patient had been resident in India, but had left the country six years before these symptoms came on: he was an Englishman.

\* The views upon which the above remarks are founded, are those first insisted upon, so far as I know, by Dr. Hansen of Bergen, and they have in substance been adopted by Danielssen himself. (See below and Appendix A.) What is stated in the text is, however, almost a repetition, as to fact, of earlier experience. Thus, Danielssen and Boeck remark:—“Plus la maladie se développe, plus est défavorable le pronostic,” and it needs but a glance at the history of leprosy to learn how much importance, in this respect, was paid to the stage which the complaint had attained to. The hereditary form of the malady has been said to be the most obstinate, which is likely enough in conception, but, as a precise statement, requires to be demonstrated.

The Norwegian authors quote (Fr. transl., p. 107), a remarkable statement, in the following words:—“Lorsque la spédalskhed (leprosy, H.V.C.) commence avec freivre, dit Théodorik, et que le sujet remarque de suite les accidens, alors la maladie se guérit avec plus de facilité que si sa marche est chronique.” I

notice this opinion, which seems to be contrary to modern experience, for the purpose of drawing attention to a very rare result of acute leprosis, and would invite for further details, perusal of the chapters on ‘General Pathology.’

† I am unable (from absence of my memoranda) to offer a similar statement to the above for India; but may quote the following remarks of Bakewell, of Trinidad, West Indies (Correspondence, &c., p. 24):—“I have notes of 15 cases, in which the disease remained stationary for a period exceeding three years. Of these, eight were anæsthetic, and the remainder tubercular. Dr. Brassac (a French physician), found precisely the same number at La Deserade, and some of his cases had been stationary for more than 20 years.” Almost similar observations may be found in most treatises on leprosy, and it is this very liability of the disease to spontaneously subside for a prolonged interval of time, which renders a correct discrimination of the value of therapeutic agencies, so difficult to elicit.

A cognate topic, to which I shall afterwards refer, is the equally prolonged period to which latency or incubation of the malady may also extend.

It would then appear, that the most favourable state of the body, is that in which all signs of leprous deposit have subsided; but this event, which is not proof positive of the non-existence of deposit in the deeper-seated viscera and lymphatic glands, is exceedingly rare, being chiefly seen in old tubercular lepers, who have, as it were, survived their disease. In such instances there may be well marked nerve-disease, or even much mutilation of the hands and feet; but this is a mere result of irremediable, perhaps pre-existing, injury, and does not greatly add to the future risk of the patient.

Finally, considerations of the kind now submitted, will be found to be elucidated in the history of cases related in this memoir; and their important bearing upon the treatment of leprosy, will be shown in a subsequent chapter. I will afterwards, too—as belonging to the natural, rather than clinical, history of leprosy—discuss the questions of spontaneous cure, the influence of heredity upon the course of the malady, and the varying periods of seeming incubation of the complaint.

#### D.—NATURE AND ANALOGUES OF TUBERCULAR LEPROSY.

This form of leprosis is so characteristic in its outward manifestations, that I do not find in nosological lists any malady which approaches very closely to it, or, at least, which is so strictly analogous to it, as certain skin-diseases may be said to be to '*Lepra leprosa*,' and especially as mechanical injury of nerves is, in its results, to '*Lepra nervorum*.'

'*Lepra tuberculosa*' is the most fully developed, and the most serious form of the great leprous complaint; and it is commonly associated with both the other forms already described above. A discussion, therefore, of its nature and analogies would be, in reality, a discussion of the nature of the comprehensive malady; but this last can best, and most conveniently, be undertaken, after that all the general and anatomical characters of leprosy have passed under notice; hence, I must refer to the chapter on '*General Pathology*,' for my views upon the subjects in question.

These topics should not, however, go entirely unnoticed in this place; and I will, therefore, briefly state that, at present, there are at least two classes of opinions, which are yet connected by an intermediate hypothesis, perhaps more accurately founded than either of the two.

On the one hand, the local deposition of leprous matter in the shape of nodules or tubercles, &c. is regarded as a direct consequence of a '*dyscrasia*' of the blood; it has even been said that not only the precursory symptoms, but also the different physical qualities, at different stages of leprosy, of the morbid deposit, are wholly due to a primary and other subsequent alterations in the composition of the blood, these having reference to quantities of albumen and fibrine which the blood contains. Data were given by Daniëlsen and Boeck, in their great work, in support of this view; and the same have been, even lately, reproduced in standard English works. But some authorities (whom I should follow\*) do not admit the validity of these observations; and all writers would allow, that in questions concerning so recondite a subject as the comparative composition of the blood, there is need of most precise manipulation and cautious inference.

Yet almost every observer of leprosy, has, it must be said, conformed in principle to the views so definitely put forth in Norway in 1848; and it is true that writers of antiquity, as well as those of comparatively modern date, have almost universally concluded, in more general terms,

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\* I must refer to Virchow (*Pathology of Tumours*, translated by Jourdain, 1869, vol. ii., page 486) for a summary statement of the objections in question.

that leprosy—meaning its tubercular form—is a constitutional complaint dependant upon a morbid state of the blood.

My own idea, also based upon observation, was, that the constitutional nature of leprosy is not demonstrated. But, during my late visit to Norway, I became for the first time, acquainted with views which were put forth originally by Hansen of Bergen, and are now countenanced by Danielssen himself; and which serve, in great measure, to reconcile the pre-existing and non-concordant opinions. According to these views, the implication of the system in leprosy, may be said to be a secondary consequence of the primary local implantation of the malady. More will presently be said upon this subject; but I will here remark that the visceral lesions, in even the most confirmed or advanced stages of leprosy, are, admittedly, of a very minute kind, and little marked degree.

Lastly, passing over the earlier and more crude hypotheses of the extraneous origin of leprosy, I note that the superadded or parasitic nature of the malady is a subject calling for renewed investigation, to be pursued in accordance with modern means and attainments.\*

Respecting the analogues of tubercular leprosy, it may be briefly stated that with tuberculosis, syphilis, and even cancer in some of its forms, there are points of greatest contact; but, as above intimated, a consideration of this topic will be undertaken in the chapter on 'General Pathology.'

\* As regards this desirability of further investigation, I refer more especially to India and the East, but may here advert to leprosy in the west or American tropics, as studied by the late Dr Beuperthuy, of Camana (Venezuela). This physician, who is highly spoken of by those who had opportunities of judging, introduced a special plan of treatment in leprosy, which consisted, partly, in the external use of cashew-nut oil, and partly in the employment of internal remedies. His views are thus referred to (Correspondence, &c., p. 17):—"The weak point of Dr. Beuperthuy's system is his erroneous theory that the disease is essentially local and parasitic. This leads him to rely too exclusively on his external medication. His internal treatment is merely directed to removing certain diatheses, particularly the herpetic and the syphilitic, which he thinks favour the growth and reproduction of the parasites. He accounts for the relapse of the first series of cases by saying that some of the 'germs' of the disease remained undestroyed, and they rapidly reproduced the tubercles. . . . It was quite in vain for me (Dr. Bakewell) to tell him that I had made scores of microscopical examinations of tubercles, taken from different parts of the bodies of seven leprosy subjects, and never found a single specimen of the parasites he believes in, or of any other. He was quite confident that they exist, and that if I had not seen them it

"was my fault." Again at p. 16:—"Dr. Beuperthuy now considers it necessary to touch not only the parts evidently diseased, but the whole of the skin. He believes that germs of the disease may exist in parts apparently quite healthy." . . . In Dr. Milroy's Report on Leprosy and Yaws, &c., p. 40, the express statement of Beuperthuy runs as follows:—"There exists in this disease a *living organism* which may be an agent in the propagation of the evil, and which, in such case, would constitute a danger of contagion, which was not imaginary. It exists in the stage of ulceration, during the most advanced development of the disease." This instance is mentioned as a late illustration, and perhaps not a favourable one, of the parasitic theory of leprosy, and I shall afterwards refer to a similar view, which appears to be based upon precise observations respecting the extraneous or implanted character of that disease. It is true that, at the present time, there prevails a disposition to resort to such explanations in other cases than this; and the reason may be, the exceeding vagueness of the common expressions—cachexia, dyscrasia, and the like. If only these hypotheses of local infection and subsequent implication of the system lead to close and accurate investigation of the seat and character of the maladies referred to, there will have been effected one object of their production.

## SECTION I.

## CHAPTER IV.—THE MORBID ANATOMY OF LEPROSY.

THE following remarks are, like the preceding, entirely based on personal observation; and they will convey, I think, a satisfactory explanation of the symptoms noticed during life. The most striking results of my inquiries concern the peripheral nervous system—or the nerves,—in which morbid changes are found, which are probably peculiar to leprosy.

With the aid of the accompanying Tables and Plates, and notes of microscopic examinations, I propose to consider in order the state of the viscera, nerves, bones, skin, &c., in the two chief forms of this disease. The whole number of autopsies being small, I should have hesitated to lay much stress upon their revelations, were I not convinced, from the uniformity of results, and from the precise correspondence to symptoms observed during life, of the morbid alterations found after death, that the true anatomical characters of leprosy, as seen in India, have been fairly made out, or at least sufficiently to indicate the direction of future research.\*

## GENERAL EXAMINATION OF THE ORGANS.

According to the circumstances preceding or causing death, the *General Condition* of the body varies; the frame being adequately nourished when decease has been rapid, or the disease not very prolonged; emaciated, under opposite circumstances. But to what extent, in the latter case, the impairment of nutrition is referrible to the leprosy and its direct results, alone,—*i.e.*, independent of concomitant diseases—is not yet precisely ascertained.

*Nervous System.*

1. The *Brain* and its *Membranes*.—A.L. (Anæsthetic Leprosy), eight cases. In all the membranes were healthy; the Pacchionian bodies presented only normal variations. Brain substance—generally rather soft, especially about the central parts, but not differently in manner or degree to what might be anticipated, considering the influence of climate, and the length of time between death and autopsy: the pallor and wetted condition, sometimes met with, may be readily explained by the fact of the bodies, having been injected with a solution of arsenic, soon after death; this operation would not interfere, however, with the detection of any organic changes, if such had been present. The vascular punctæ and minute extravasations noticed in Case 1, did not strike me as very peculiar.—M.L. (Mixed Leprosy), seven cases. The membrane

\* Text as in original memoir, with very few alterations. Commonly, no distinction is made of the two chief forms of the disease, or of the frequent 'mixed' form; but, on reference to the tables at the end of this chapter, the details necessary for this discrimination may generally be found. The foot-notes are chiefly

limited to records of observations in Norway, because they were most accessible and best known to me, and because the time at my disposal did not allow of other references to original sources, none of which, however, are, it is believed, more valuable than those just named.

healthy. Pacchionian bodies once large and scattered; one at the base of the skull appeared to press upon the third division of the fifth cranial nerve, but as the nerve was unchanged in appearance, it is probable no injurious consequences followed. Brain substance—either quite healthy or slightly altered as above, and the same remarks apply, for when examined early after death, the consistence was unaltered.—T.L. (Tubercular Leprosy). The single case which was examined, presented, as a peculiarity, only a slightly irregular distribution of pigment in the pia-mater.

*Conclusion.*—That in all the ordinary forms of leprosy, the brain and its membranes are not diseased. And I would here remark, that, during life, there is an absence of symptoms indicating any affection of the brain.\*

\* In the text 'Brain,' stands for 'Encephalon;' and includes, therefore, the cerebrum, cerebellum, pons, and medulla.

As an aid to comparative illustration, I append the following quotations. The early Norwegian observers in describing the condition of the viscera in cases of 'tubercular' leprosy, observe (Treatise on Spédalskhed, French transl., p. 228), there was also found in the cranial cavity, and especially in the sub-serous cellular tissue of the arachnoid, gelatinous exudation; and in the ventricles, more or less serous effusion; there was also venous congestion—things belonging to many other maladies, and which are accidental as regards this form of leprosy. And referring to the post-mortem appearances observed in anæsthetic leprosy, they relate:—We have always found in the cerebral cavity in the sub-serous tissue of the arachnoid, a sero-albuminous and more or less copious exudation, which was often so thick, that it had filled the spaces between the convolutions of the brain, and rendered the arachnoid quite opaque. The pia-mater was, in consequence of this exudation, so strongly adherent to the arachnoid, that with the greatest facility the cerebral substance could be separated from these membranes, whose thickness here, as well as in the spinal cavity, attained to several lines. This exudation was not limited only to the arachnoid covering the upper part of the brain, or to its prolongations; but it also extended to the base of the brain, where especially around the origin of certain nerves (fifth, sixth, seventh, eighth pairs) it was tolerably abundant. Most often, there was also vascular injection, more or less marked. The cerebral substance was commonly of firmer consistence than normal; partly more tough, partly somewhat injected with blood. There was, not unusually, a more or less abundant, aqueous effusion into the ventricles; but never to a remarkable amount. . . . The authors then refer to changes in the Gasserian ganglion (of which more below) . . . they remark that the exudation above-described when surrounding the seventh pair (nervus communicans faciei), does not entail any particular changes in its branches. "The cerebellum is generally found in its normal state; twice its substance was softened, but then only to a slight degree. The pons Varolii, and the medulla oblongata, were normal. Yet, as we have before said, there were present in the arachnoid structure covering them, small and circumscribed albuminoid exudations . . ." (Traité de la Spédalskhed a 1848, p. 286; see also the special

memoir on Anæsthetic Leprosy, 1862, p. 9, where the above statement is reproduced.)

Hansen remarks that in advanced stages of anæsthetic leprosy, he, in neither brain nor spinal marrow, has come upon anything abnormal. And, subsequently, he observes:—In the central organs of the nervous system, I found nothing abnormal, on examination of two instances of (supposed) hydrocephalus occurring in tubercular leprosy (Appendix A., p. viii). Another example of this sort, had the opportunity of seeing at Bergen; and the case is detailed at page . . .

In further confirmation of the negative results stated in the text, and again just alluded to, I may here introduce an instance (the only one recorded in full), which is contained in Mr. Lisboa's paper in the Bombay Transactions, New Series, vol. ii., 1853-54. The patient was affected with anæsthetic leprosy.

An East Indian, aged 44, had chronic ulcers in the sole of the foot, and others on the legs; necrosis and absorption of the fingers, and loss of feeling in the extremities. No constitutional disturbance; nothing abnormal detected in the chest or abdomen. The disease commenced by bullæ, resembling very much those caused by the guinea-worm; they occurred for several months upon the arms and legs, and first of all about the knees and elbows. No hereditary taint. The eye became affected; the glands in the groin were swollen and painful. He died from pneumonia of the left lung in Nov. 1851.

Post-mortem appearances. Cranial cavity: all the contents healthy. Spinal cord: healthy with regard to its consistence, and the colour of the grey matter was pale in the back and neck. Chest: adhesions on both sides; cutaneous nodules in the right lung; pneumonia in the left lung and gangrene. Abdomen: liver enlarged and very flabby; there was an abscess (?) or fibrinous deposit in the right lobe, which all had passed into a gangrenous state. Kidnies: healthy, but soft and pale; a similar fibrinous deposit was seen in one, and small cysts in the other. Spleen: small, soft; but healthy. Intestines: not examined.

It will be right to mention that Mr. N. C. Macnamara, in Bengal, wrote in 1863 (Medical Reports, &c., 1865, p. 147):—"I have made five *post-mortems* upon the bodies of leprosy patients, my attention being more particularly directed to the nervous system; and neither in the nerves themselves, nor in the brain and spinal cords have I been able to detect any lesion, either with the naked eye, or by the aid of the microscope." No details are given.

2. The *Spinal Cord* and its *Membranes*.—A.L. 8 cases. The membranes generally quite unchanged; once (No. 1) several small, opaque-white, osseous particles were seen in the arachnoid, chiefly on the posterior surface, and in the dorsal and lumbar regions, some being close to the posterior roots of the spinal nerves, but not in a position to press upon the nerve-bundles; their size one-tenth in. and smaller; form flattened, round, or stellate (very curiously so); they consisted of ossified connective tissue, the bone-cells being normal, and were hollow, containing fat-cells in their interior. See Plate X., fig. 19. These little deposits were clearly only incidental. Substance of cord—healthy, or a little softened from natural causes; in two cases, the softened parts in the dorsal and lumbar regions, appearing somewhat reddish in colour, were examined microscopically, and no disease was detected.—M.L. 7 cases. *Membranes* healthy; once stained with bile (case of jaundice, No. 3). *Substance* of cord: healthy, or a little softened from natural causes; once rather firm in the lumbar region, but no other change apparent.—T.L. 1 case. *Membranes* healthy. *Substance* rather firm in the lumbar region, but not diseased.

*Conclusion*.—That in all the varieties of leprosy, the spinal cord, and its membranes, have been found unaffected. During life, no symptoms are observed but such as are satisfactorily explained, by the condition of the nerves themselves; and none indicating a lively implication of the spinal cord.\*

\* Referring now to the observations of Danielssen, which were published in Europe about the same time as my inquiries were pursued in India (1862), I find the following passages, and the same are recorded in the Norwegian work of earlier date:—"When these alterations of the peripheral system of nerves are in their full development, the central organs begin to be affected in a manner which leads one to suppose that the pathological process visible in the great nerve-trunks is continued along them to the nerve centres; for when the spinal cord is attacked, those parts which give off the roots of the nerves are generally the first thickened, to a greater or less extent. It is true that at the earlier stages of the disease, the membranes of the cord and brain are occasionally found to be congested; but this appearance is too rare to be directly connected with the morbid alterations, which come on only at a later period. When that arrives, the blood-vessels, and chiefly the veins, situated on the posterior surface of the spinal cord, are considerably surcharged with blood, and in the serous tissue of the arachnoid, there will be found an albuminous exudation of varying extent. This exudation, which is located beneath the arachnoid covering the posterior surface of the spinal cord is tolerably well-defined, and has its seat in either the cervical, dorsal, or lumbar region. Commonly it passes a little beyond the posterior roots of the nerves; more rarely does it implicate the anterior surface of the cord, or if there met with, it will also be formed at the back. When this exudation is firmly blended with the pia-mater, the arachnoid may be easily detached from the medullary substance. This latter has acquired a much firmer consistence at those spots which correspond to the exudations, and that without any notable vascular injection. The grey substance has sometimes rather changed in colour; it has become paler and firmer, and so to speak, is more  
(9936.)

"compact and more surcharged with blood. When the anesthesia has been complete, and the disease has attained its culminating point, there will, in most cases be found a considerable collection of sero albuminous material between the dura-mater and arachnoid. In the sub-arachnoid tissue there is everywhere to be found a thick, pale yellowish, albuminoid exudation, which is most consistent and opaque at the posterior part. The arachnoid and the pia-mater are united and so changed, that the two thus joined, resembled in their thickness and opacity the dura-mater itself. Frequently, the albuminous exudation between these membranes attain a depth of two or three lines, and completely surrounds the cord." (Danielssen here refers to the larger works for illustration of these remarks.) "The whole medullary substance is somewhat surcharged with blood, and it has acquired a firmness and toughness, rendering it almost comparable to a cartilaginous material. On making an incision in it, a creaking sound is produced, and when a trial is made to squeeze it, this cannot be done without at the same time destroying its rounded form; the substance does not admit of compression. Generally, the end has lost something of its volume, it is thinned, and it may be atrophied even to such an extent as to be not much thicker than a quill, while the consistence remains as above described. The grey substance has completely changed its appearance, it has assumed a yellowish tint, which is much like that belonging to the medullary substance. The albuminous exudation, while it extends throughout the entire vertebral canal, also reaches to the roots of the nerves, but beyond that it ceases: the brachial and sacral plexus, on the other hand, and the large trunks issuing from them, have sometimes been atrophied." (Jagttagelser, &c., No. iii, p. 9.)

In the earlier work, it was observed that microscopic examination of the albuminous exudation, shewed only

The *Roots* of origin of both cranial and spinal nerves, in no instance, appeared abnormally changed, so as to call for special examination.

3. *Sympathetic Nervous System.*—In all cases, the larger ganglia of the abdomen, sometimes of the neck, thorax, and pelvis, were examined; but in none was any evidence of disease detected. I noticed that the great splanchnic nerves, once seemed large and opaque, and twice swollen at a point (symmetrically); also that the communicating branches of the superior cervical ganglion, once seemed rather firmer and rounder than natural, but, on closer examination, did not find clear traces of deposit or degeneration. See Plate XII., fig. 10.

The *Ganglia* on the posterior roots of the spinal nerves, were a few times examined microscopically, but no clear evidence of disease was in any instance detected. And the same may be said of the Gasserian ganglion of the fifth cranial nerve, which once or twice was, apparently, rather small and softened; yet no morbid changes were visible under the microscope.\*

numerous fine granules and a few very delicate fibres. The substance of the spinal cord, at the place where it was 'sclerosed,' did not present any material foreign to the part. On the contrary, the ganglion cells of the grey substance were much fewer than in the normal state: the nerve-fibres were in a high degree varicose, at these sclerosed spots . . . and this especially in the grey substance of the cord, where, in marked cases, every nerve-fibre assumed this appearance. The authors thought this highly varicose state was peculiar to leprosy disease, partly because it was so marked and unvariable, and, as well, the fibres are opaque and not clear, their contents do not exude on pressure, and they remain unchanged after maceration in water. As these observations have not been reproduced in the later brochure, it is probable their value was not then so much regarded as at first; and, in fact, the data are inadequate for the maintenance of strong conviction. I am not aware that the sclerosed state of the spinal cord now referred to, has since been met with by an observer able to determine the real character of the change, which must of necessity occur in such cases.

For further information on this and other cognate points of interest, see the tables in Appendix B, which should always be consulted in connexion with these summaries of Norwegian research.

In their large work, Drs. Danielssen and Boeck had remarked:—"These alterations have always been most marked in the cervical and lumbar regions of the cord; and, then, the sclerosis, as well as the atrophy and exudations, have reached their apogee, whilst the dorsal region has always been less affected. Once, a small portion of the cord was found to be completely softened, and another time there were seen several points of ossification in the arachnoid, but this circumstance we regard as accidental, and quite foreign to the leprosy disease." (*Loc. cit.*, p. 286), I have myself once observed the same kind of ossification; and have figured a fragment in Plate X., fig. 19.

In the same treatise the authors had remarked, with reference to tubercular leprosy (*loc. cit.*, p. 228), "As to the vertebral cavity, all here was normal, with the

"exception of engorgement of the great veins belonging to the vertebral column." For a tabular statement of examples of these investigations, see Appendix B.

In confirmation of the statements made in the text as regards both symptoms during life and the post-mortem appearances, I may quote from Hansen (*vide* Appendix A, pp. iv and vi), "In neither brain nor spinal marrow have I come upon anything abnormal" . . . "nor is there anything in the clinical phenomena of the disease which is suggestive of any affection of the spinal marrow; there is found no ataxy, but on the contrary it is quite marvellous to see how deliberately, for instance, patients will walk who have lost all superficial sensations in the soles of the feet." . . .

See also Lisboa's case, *supra*, p. 74, foot-note.

As to hypothetical considerations and their further testing, allusion may be here made to the views of the earlier Norwegian writers, and also to those of some observers in India, e.g. of J. N., which still require the autopsic evidence apparently confirming the first-named. An appreciation of these views will be found further on.

\* "What has particularly attracted our attention is the fact that morbid changes are always met with in the Gasserian ganglion, when disease had lasted some time, that is to say, when anaesthesia was present to a greater or less extent in the face. There are commonly a sero-albuminous exudation, which occasionally was so considerable that the dura-mater was stretched and raised by it at this spot. The exudation was thick and rather opaque; the nervous filaments of the ganglion were matted together, as it were, by it, but, so far as we saw, the exudation was not prolonged to the branches of the nerve, which, taking the ophthalmic and superior maxillary for example, did not present anything particular for notice." (Description of anaesthetic leprosy, D. & B., *loc. cit.*, p. 286.)

Respecting the condition of certain sympathetic ganglia in tubercular leprosy, the same authors observe:—"We have seen in one patient the celiac ganglion and the coeliac vessels entirely converted into a homogeneous mass; the vessels had partly retained their calibre, but it was quite impossible to discover

*Thoracic Organs.*

4. *The Heart.*—Was generally healthy; once (A.L. No. 6) soft reddish fibrine was seen on the mitral valve, and this case is otherwise interesting, as fibrinous deposits were also found in the left lung, spleen, and one kidney, being probably the result of embolism; the patient died of chronic dysentery. Once, the aortic valves, and lining membrane of the left auricle, were slightly opaque (M.L. No. 5). The *Aorta* was always free from atheroma; and, I may add, the *arterial system* generally, as far as examined. The Pericardium, usually clear, was twice spotted with opacities; and in one of these cases, the kidneys were diseased.\*

5. *The Lungs.*—Were not affected in any special way: in one half the cases, the organs were healthy. Adhesions were not uncommon: twice, congestion was marked: three times, inflammatory condensation of the upper lobes was found (once with albuminuria, twice with chronic dysentery; and in one of these cases, a few, firm, strumous tubercles were present—the only occasion on which they were detected): once, lobular condensation of one lung, especially towards the anterior margin, the intervening tissue being emphysematous—this was the case of fibrinous deposits in the spleen, kidney, &c. above referred to. On one occasion, the right lung was found wasted, and the cavity of the pleura filled with bloody serum; and on another, some emphysema at the margins and apex, with no further change. The Pleura was never alone diseased.†

*Abdominal Organs.*

6. *Intestinal Canal.*—Presented no uniform, or marked disease. Three times, ulcers were found in the rectum (dysenteric), and in a case of cholera, small ulcers in both intestines, with ecchymoses (M.L. No. 6). The Peritoneum had only once, a slightly soddened appearance.‡

"traces of the ganglion or of its structure, although we traced the splanchnic nerves right down to the mass, in which they were lost."

In his subsequent memoir, Daniellssen notes that, as a rare event, some of the ramifications of the Gasserian ganglion were thickened and brown tinted, and completely in the same state as is frequently met with in the nerves of the skin.

\* Plastic exudations are met with in the pericardium, which is sometimes considerably thickened by them. Large coagula may, in the early stages of the disease, be frequently met with in the ventricles and main vessels issuing from them.

In anæsthetic leprosy the pathological changes which were observed were very little different from the above. (D. and B. *loc. cit.*)

† Whilst the larynx and bronchial tubes are seen to be frequently affected, the lungs are spared and they seem to belong to the organs which are seldom, or, perhaps, never attacked. We are inclined to think that when leprosy has once shown itself, it has annihilated any dyscratic state which may have been present. Sometimes we have found pulmonary tubercles little developed or cretified . . . or cicatrices . . . and only twice, when leprosy was commencing, have we found softening tubercles and small cavernous excavations. . . . Pneumonia when occurring in lepers does not leave any peculiar traces or entail any changes in the lungs, special to leprosy. (Tubercular leprosy,

D. and B., *loc. cit.*, p. 222.) Similar remarks are applied to the state of the lungs in anæsthetic leprosy (p. 288).

The pleura, on the other hand, is very often attacked in tubercular leprosy; that is to say, there may be found everywhere imbedded in its sub-serous cellular tissue an infinite number of small tubercles, and these may be seen in different stages of development. Pleuritic adhesions are often met with. In anæsthetic leprosy it is remarked that large albuminous exudations may here be met with, and, as well, from adhesions.

The frequent supervention of tuberculosis of the lungs, &c. in all forms of leprosy is a subject which will be afterwards illustrated, see also the tables in Appendix B.

‡ It does not appear that there is anywhere known any special affection of the intestinal canal as an attendant upon leprosy. Such complaints as diarrhoea and dysentery are incidental complications, to which leprosy is not, perhaps, particularly liable. But this important subject is one of those needing much further investigation. See Hansen in Appendix A., p. iii and p. xii, for remarks on the condition of the villi and follicles of the intestines; and also notes given below for memoranda on the mucous membranes. When strumous deposit and ulcers have been present in the glandular structures of the intestines, the corresponding mesenteric glands may be implicated, but in them, too, the neoplasm is tubercular, and not leprous. Recently, however, Daniellssen has found these glands to contain

7. *The Liver*.—Was almost invariably healthy; some adhesions on the upper surface were once noticed, and once (M.L. No. 5) two small abscesses were found; this case was complicated with kidney-disease, and pale ulcers in the rectum. In the instance of rapid and fatal jaundice (M.L. No. 3), this organ was of full size, and dark coloured, surface smooth, outer coat clear, edges sharp: the substance had a mottled appearance, owing to the presence of small light-yellow patches, chiefly surrounding the portal canals. In these spots, the tissue seemed slightly shrunk, the lobules were distinct: the hepatic cells were loaded with fat, and rather smaller in size than in other parts, their nuclei were often indistinct and pale: in the redder parts, the cells also contained some fatty particles, and their size rather larger than in the light spots, but the biliary matter was more abundant. In the fatal case of albuminuria and fever (A.L. No. 2), the liver was also diseased, being much enlarged, mottled, and puckered on the surface: on section the puckered appearance was seen to extend for half an inch into the interior, but there was no distinct deposit around; the substance of the organ was congested and looked coarse: peritoneal coat clear. Both these patients were Portuguese, and probably of intemperate habits: since the appearances of the liver just described, are to be seen in individuals accustomed to drinking, and are not peculiar to leprosy.\*

8. *Pancreas*.—Always seemed healthy.†

9. *Spleen*.—Occasionally soft, enlarged, and the capsule thickened; once fibrinous deposit.‡

10. *The Kidneys*.—In 15 cases, were, one or both, six times noticed as large, as often small; thrice, as natural in size. Seven times, they were mottled, and in three cases, with more distinct deposit; once, also cysts. I will give the results of minute examination in seven instances, notes of which were kept.

leprous deposit, as well as strumous matter, in a case of acute tuberculosis.

It will be convenient here to introduce the scanty information collected, regarding the serous membranes. Under this head should be included the wide-spread tubercular infiltrations, which the Norwegian authors describe at length, in the peritoneal folds and investments, and this more especially under the section treating of tubercular leprosy. Judging, however, from the description, and from the coloured illustrations of their work, these deposits must be referred to ordinary strumous disease or scrofulous affections which are common in Norway, and amongst lepers, as amongst other people. From my own experience, and a perusal of the autopsies recorded by Danielsen and Boeck, it seems to me not unlikely that the not uncommon implication of the serous membranes in leprosy is explainable by the equally frequent complication of Bright's disease of the kidney in some of its forms.

\* The tabular statement below and that in Appendix B. should be consulted. As in India, so it does not appear that in Norway the liver was found to be specially affected in leprosy, but it is said, "tubercles were sometimes seen in the liver, of different sizes, but never larger than a nut; they have a yellow colour, and are either superficial or deep-seated; commonly they are in a softened state, and an incision gives exit to thick yellow matter, leaving a cavity behind, the walls of which are formed of the liver-substance, almost natural in appearance." (Tub. Lep.)

And again (Anesth. Lep.) we have often found the

liver hypertrophied, sometimes fatty, and with albuminous exudations on its surface. The gall-bladder was sometimes filled with thick black bile.

More lately, however, Hansen has detected a true leprous lesion, which, probably, commences here, as elsewhere, in a migration of white corpuscles from the blood-vessels (portal system), and results in the production of the characteristic leprous elements. To the unaided eye, the changes now referred to are minute, and hardly to be detected without previous intimation from experienced observers. Details are supplied in Appendix A., pp. ii and xi. For an early observation of my own, see the following TABLES, *Mixed Leprosy*, viscera, case No. 3; and other remarks on the pathology of leprosy.

† The pancreas was always normal; such is the result of ordinary post-mortem examination in Norway.

‡ Hansen has here, too, observed a characteristic lesion, indicated by a peculiar appearance, and situated in both follicles and arterial sheaths, &c.; see Appendix A., pp. ii and xi. Previously to his discoveries, the results of inquiry in Norway, were similar in tendency to my own; thus, it was said:—"We have found in the spleen an immense number of tubercles of a yellowish brown, and the shape of a pea; they occupied almost the entire substance of the viscus. At other times the spleen was hypertrophied, and double its normal size; it was, too, so much softened that on incision, its substance was diffuent." (Tub. Lep., D. and B.)

The spleen, too, in some cases, was hypertrophied, and its substance soft. (Anesth. Lep.)

1. (A.L. No. 2.) Organs large, pale, mottled, slightly granular, and cortical substance increased: the uriniferous tubes were sometimes much enlarged, and filled with opaque granular matter; the secreting cells also distended with granules (fat), though their nuclei could be seen. There was distinct fatty degeneration. For the state of the urine, see A.L. TABLE (1.)

2. (A.L. No. 3.) Kidnies large, pale, flabby, and smooth. Uriniferous tubes greatly distended with fat granules, or oil drops, sometimes free, sometimes within the secreting cells; in these the nuclei were still persistent and contained oil globules. The walls of the Malpighian tufts had also undergone fatty degeneration. Urine not examined.

3. (A.L. No. 6.) There was considerable deposit of yellowish fibrine in one of the kidneys: no alteration in size of either: not examined microscopically. Similar fibrinous deposits were found in the spleen, &c.

4. (M.L. No. 2.) Patient died of cholera; urine not examined. The kidneys were not obtained till 36 hours after death, but then found so much softened, that it may be questioned if some change had not occurred during life. The uriniferous tubes were hardly to be seen, but no fat globules were present; the apices of the pyramids had an opaque white tint, and the tubes were then filled with a homogeneous and refractile material; the secreting cells were barely visible, but it seemed as if this substance had been deposited primarily within them. These changes, if the result of disease, may possibly have been attendant on the cholera, rather than on leprosy.

5. (M.L. No. 3.) The kidneys, like the liver, were found to have undergone some fatty degeneration one being particularly affected. The urine was not healthy, see M.L. TABLE (II.).

6. (M.L. No. 4.) The patient died of cholera. Some of the secreting cells seemed more granular than usual, especially towards their attached surface; but it was doubtful how far this change indicated disease.

7. (M.L. No. 5.) Decomposition of the body had proceeded rapidly. The kidneys were large, firm, mottled, and granular; some of the uriniferous tubes were filled with a granular material, their epithelium being also affected; there were no distinct oil globules. Malpighian tufts healthy. The urine was albuminous.

In these seven cases fatty degeneration was found four times, and in one other case at least the kidneys were decidedly diseased (A.L. No. 1); if we add to them the fatal case (not examined), of the Portuguese woman who was affected with anasarca, &c., the proportion becomes 6 in 16, which is large enough to warrant the assertion I made, that leprosy, in India, is not unfrequently accompanied by disease of the kidneys, such as may, at least, hasten its fatal termination. There is no apparent relation between this, and either the duration, or variety, of the leprosy; but the instances now quoted, are too few, to permit wide inference. In five cases, where death was attributable to chronic dysentery, kidney-disease was certainly present in two, and in a third, fibrinous deposit was found; in one of the two just referred to, abscess of the liver was present, and opacity of the aortic valves, lining membrane of left auricle, and peritoneum; these and other facts are of interest, but belonging as they do to the general pathology of Bright's disease, need not be enlarged on here. I have, I believe, rather underestimated the frequency of this complication; but the connection that exists between general cachexia of the system, so common in the class to which lepers belong, and degeneration of the renal organs, has yet to be definitely ascertained.\*

*The Supra-renal Capsules.*—Healthy in all cases, when examined.

\* The kidneys are almost always attacked, if the disease is of long-standing; and that even if other internal organs are altogether intact. Their capsule is often covered with small tubercles; and the venal substance is also more or less affected. The morbid changes consist either of congestion and enlargement, or of a whitish, or yellow deposit in the tubular por-

tion. When this deposit extends through the cortical portion, the capsule becomes adherent . . . Lastly, we have found the whole kidney converted into a lardaceous, yellowish-white mass, in which destruction of cortex and medulla were hardly possible . . . the ruptured surface appeared as if granular . . . commonly, such a kidney was enlarged; sometimes, it was

*Other Organs, &c.*

The *Testes*.—Have not been minutely examined: sometimes there were enlarged (from syphilis), and occasionally the reverse; in one youth affected with mixed leprosy they were much atrophied, being hardly larger than those of an infant: the seminal vesicles were very small indeed, and the *vas deferens* very narrow. The *thyroid body* was rather larger than usual. The autopsies having been all of males, the condition of the *Ovaries, &c.*, has not been ascertained.\*

The *Blood* was in no uniform condition; no did it ever strike me as being peculiar in appearance.†

The *Lymphatic vessels and glands* were not affected in any special way, as far as examined; the latter were noticed as enlarged in about half the cases, either in the loins where a deep red colour was also common, or mesentery where once they were very numerous, or in the groins, &c.

atrophied, and its surface irregular . . . . . We do not doubt that these changes will be, by all, regarded as belonging to albuminous nephritis . . . . . and will only add, that when they were present, there had always previously been noticed the presence of albumen in the urine and diminution of area. (*Tub. Lep., loc. cit., p. 226.*)

Again (*Anmeth. Lep., p. 289*), the kidneys are the organs most frequently attacked in this form of leprosy; the changes in them supervene only, after a long duration of the disease, for they were absent in cases when autopsy was possible at an early stage. They are the same as were noticed under the head of tubercular leprosy; only we have here noticed, on two occasions, a number of small cysts in the renal substance . . . . . When Bright's disease was present in a marked degree, serous effusions were found in both the great cavities, and the sub-cutaneous areolar tissue.

From these quotations it is evident that there is here, too, a concordance between observations made in countries so wide apart as Norway and Western India.

Hansen has further extended our knowledge, by the detection of amyloid degeneration; but no true leprosy kidney-disease is yet known. See Appendix A., pp. iii and xii.

\* Respecting the testes, it is to be noted that an organ seemingly quite healthy, may yet contain the peculiar leprosy elements. This is a remarkable circumstance, and should be further considered; and here, I may introduce an extract from my memoranda of the post-mortem of a young leper, dated Bergen, 23rd September 1873, "testes were in appearance quite natural, but on microscopic examination, there might be seen amongst, and perhaps within, the seminiferous tubes, some enormous, ovoid, granular masses (figure), besides smaller ones;" these were recognised by Hansen as the characteristic structural-elements of leprosy; they must have become mixed with the seminal fluid, and, as a speculation, one might ask if they could have any influence upon the dynamic properties of that secretion, such, for instance, as might affect the qualities of the impregnated orum? In the absence of other information, the following remarks from Kaposi, may be added:—According to Virchow, Oldekop, and Hansen, the testicle undergoes certain changes; so also does the epididymis, according to the last two authors

and Koebner. The former (according to Virchow) presents a thickening of the tunica vaginalis and albuginea; and groups of round cells in the substance of the organ. Some observers have found the testicles to be ill-developed in persons affected with leprosy before the age of puberty.

With regard to the female organs of generation, I have found no other information than the following:—  
"Not only is the peritoneal investment of the ovary and uterus covered with tubercles, but the inner surface of the womb is also the seat of an irregular tubercular infiltration, which encroaches even in the muscular substance itself, and in the Fallopian tubes, there is a beaded deposit of the same character." D. and B., *loc. cit.*, also Plate VI. of that work, which shows that the changes here referred to were probably of a strumous character.

† Coagula are rarely found outside the heart; sometimes one sees in both arteries and veins, a thick, blackish, and viscous state of the blood, and in such cases we have found sanguineous effusions, not only in the cavities of the body, but also amongst the muscles; and all the viscera seemed as if they had been dipped in blood. In these instances death had quickly supervened. (*Tub. Lep., p. 219.*) Similar observations are stated by the same Norwegian authors, under the head of anæsthetic leprosy, and they add that, whilst the heart may be filled with black, clotted blood, the vessels of the skin and muscles may be almost empty, whence their very pale hue. It is otherwise in the vessels of the cord and cranial cavity, for here they are usually congested, and the larger sinuses at the base of the cranium are generally quite gorged with black, thick blood.

These remarks apply to the ordinary aspects of the blood in leprosy bodies, but during life, certain chemical examinations of the fluid were made, and are recorded in the large treatise on Spédalskhed. They will be afterwards referred to in the chapters on the Pathology of Leprosy. At present I notice that not much information is gained by simple inspection of the blood, but there should always be stated the presence or absence of marks of scorbutus, and extensive organic disease, whenever the ordinary physical characters of the circulating medium are recorded. The mode of death, too, it is important to note with respect to the occurrence of coagula.

A syphilitic taint was as often absent, as present. In one case (complicated with syphilis), the opaque cortex of the enlarged inguinal glands, contained large granular cells and masses (almost like myeloid cells), which bore a resemblance to those found in the thickened leprous skin. Once (A.L. No. 2), inflammation and suppuration had occurred in the axillary glands, and blood vessels, the corresponding hand was distorted, &c.; this patient died of albuminuria, but there was no reason, I think, to suspect pyæmia; the blood was generally fluid. The inguinal glands contained a yellowish firm material, in the case where fibrinous deposits had occurred in the kidney and spleen; and they are not unfrequently enlarged when ulceration, &c. is present in the foot.\*

With regards to the condition of the *Blood Vessels* in the distorted hands, &c., on several occasions they were carefully examined, and to all appearance were unchanged, certainly not diminished in calibre: in an injected specimen, the size had run freely into the capillaries of the skin and Pacinian corpuscles, nor have I ever seen any reason to infer, that deficient arterial supply is the cause of the atrophy, or ulceration.

The state of the small *Muscles*, is what might be anticipated. I have found those of the little finger, entirely converted into fibrous tissues; no fatty degeneration of the fibres was observed. The *flexor carpi ulnaris* (supplied by a diseased ulnar branch), has been seen undergoing a similar conversion; but the muscles of the fore-arm, generally, and those of the leg, are seldom much changed. Nor, during life, is their action greatly interfered with; the leper making use of his hands and feet (such as they finally become), to the last.†

\* The remarks of the older Norwegian authors are here appended:—The glands of the neck, both superficial and deep, also the bronchial glands, may be swollen, and they are sometimes the size of a hen's egg: They are either firm or soft, and their substance either of pale or dark colour. These changes are only met with when the disease has lasted a long time, or when it has pursued an acute course. . . . The mesenteric glands are very often swollen, being as large as a nut, and on section they may be found to be softened. . . . (Tub. Lep.) The axillary and inguinal glands, both superficial and deep, are often more or less swollen. . . . And this enlargement consists essentially of glandular hypertrophy. They very rarely suppurate, and if so, they secrete ordinary pus. Both afferent and efferent lymphatic trunks, may be considerably enlarged. (Anæsth. Lep.) It will be hardly needful to remark that here, as often at other times, an attendant scrofulous affection does not seem to have been fully discriminated, and the same remark applies to ordinary hyperæmic enlargement of the glands, consequent upon ulceration, &c., of the skin, or necrosis, &c. of the digits. I had not myself distinguished a leprous gland affection; although I had noted the similarity of contents of leprous tubercle and glands, see Plate XII, fig. 4b; but Hansen, having recently paid much attention to both normal and pathological anatomy of the lymphatic glands, has thrown much valuable light upon this subject. In addition to the admirable descriptions which will be found in Appendix A., pp. ii and ix, I append a few translated remarks taken from his prize essay upon these important organs (Kristiania, 1871):—The secondary engorgement of the lymphatic glands in

tubercular leprosy is indicated by a peculiar yellowish colour, which is marked in exact proportion to the amount of leprous disease. The ampullæ and medullary bands present this tint, whilst the gland capsule and the tubercle appear of a greyish hue, and the sinuses also, except when reddened by hematine. . . . This yellowish or brownish colour is most marked in the most superficial glands, and gradually fades away in those placed deeper and nearer the trunk. . . . There is no arrest of the flow of lymph . . . and it appears that most of the poisonous matter taken up from the skin is arrested in the glands first reached, but part passing on, the next series of glands are also involved, and in consequence, again the passage of the materia peccans is checked . . . yet some may reach the blood itself. . . . Microscopic examination shows the presence of true leprous elements in these glands. Leprous glands may be at the same time in a state of amyloid and tubercular (strumous) degeneration.

† Respecting the condition of the blood-vessels, besides the notes in the text, allusion may here be made to incidental complications such as local phlebitis, (inflammation by continuity of tissue) &c.; see Case 5, M.L., and Case 3, A.L., in my tables. I have elsewhere referred to similar remarks of Danielssen and Boeck, who mention thickening, &c., of the coats of the veins in the arm, in tubercular leprosy; they add the fasciæ and the muscles, and also the bones themselves are never attached in this form of the disease. With regard, however, to the anæsthetic variety of the complaint, these authors remark:—If the curvature of the fingers has recently come on, it readily yields when the contracted tendons are divided; but when it has been of

## SPECIAL AND MINUTE EXAMINATIONS.

*Morbid changes which the Nerves undergo in Leprosy.*—It is here that interest chiefly centres. In order to render these changes intelligible, the normal structure, as well as anatomical distribution, of the nerves should be recalled to mind; and the more clearly those facts are collected, the better will the connection between many of the symptoms of leprosy and its attendant morbid alterations be understood.

First, then, I observe that a healthy nerve is uniform in diameter, of an opaque, whitish or yellowish colour, and rather lustrous hue; of moderate consistence, and more or less flattened; and its branches retain the same general characters, as far as they can be traced with the scalpel. When of moderate size, such nerve will be found to consist of several 'funiculi' (cords or strands), readily visible through its coat; which not only run parallel to each other, but frequently communicate, so that numerous plexuses are formed within the nerve-trunk itself. These complicated intra-neural plexuses are particularly evident in the larger nerves, and their significance has been rather overlooked, I think, by anatomists: for such an interchange of nerve-tubules is hereby effected, that it becomes impossible to trace far, those of an individual funicularous. Hence it is clear that disease of a single strand, may lead to symptoms anywhere in the area supplied by the whole nerve. Each funiculus is provided with a sheath (neurilemma), and is itself composed of clusters of nerve-tubules similarly isolated; one or more of these secondary bundles may be, alone, diseased of leprosy. The nerve-tubules are classed as large (motor?) and small (sensory?) according to their size; and there is no question that the latter may be affected to the exclusion of the former, so that disease of even a compound nerve may cause anaesthesia alone. The elemental nerve-tubules, I find to be in absolute (†) contact; their contents more or less clear and refractile, and semi-fluid or soft; in the mass, the tubules have a yellowish tint, and by transmitted light they are opaque.\*

On the other hand, the diseased nerve is swollen, but not abruptly so; and of a dull reddish grey or semi-translucent aspect; it is rounded and firm. Its coat of connective tissues is but little changed; the funiculi, alone, being the seat of disease. These, enlarged and grey in colour, impart a streaked or marbled appearance to the main trunk, and when the nerve is

long duration, there is present not only a tense state of the muscles, but the ligaments become shrunken on the curved side, and only when these are as well divided, can the bent member be made straight. The joints are not especially implicated in leprosy. Respecting the condition of the bones of the digits, some special remarks will be presently submitted.

\* With regard to this arrangement in the sciatic nerve, Bichat observes, "I once employed myself in tracing attentively and to some length all its filaments, and I found that those which above composed the exterior cords were below for the most part those of the centre." He also remarks that this communication of the nerve-cords does not take place in the roots of the spinal nerves, but only outside the vertebral canal. *Anat. Gen. trans. by Coffyn, p. 136.* Dissection of a diseased nerve shows exceedingly well these intra-neural plexuses, as preparations in my possession have evidenced.

† Not having made use of certain re-agents and of aids to investigation more recently acquired, I was not fully

acquainted with the character of the matrix or connecting medium of healthy nerve-tubules; although, as is mentioned further on in the text, it was long since my opinion that the leprosy formation "might be regarded as having its beginning in this scanty inter-tubular matrix." As it is of some importance, with reference to our conceptions of the true nature of the leprosy nerve-lesion, to be aware of the structure of the investment-tissue of the nerves, I here append a few notes taken from the descriptions of M. Louis Ranvier (*Archiv. de Physiol. t. IV. 1871-72*). The author correctly remarks that the connective tissue of nerves exists under three forms. 1. The peri-fascicular, or outer, common investment and binding medium of all parts belonging to these organs; histological characters as ordinary connective tissue; adipose vesicles blood-vessels and lymphatics are intermixed. 2. The sheath of the nerve-bundles, or funiculi; the so-called neurilemma; but, from its characteristic structure, not inaptly named the lamellar sheath,\* from it the

cut across, they start up, separate and firm, almost as if previously under some degree of tension; in the healthy nerve, they rather droop. On further examination, the clusters of nerve-tubules are found to have mostly disappeared, their place being taken by a clear, albuminoid deposit, which has separated and compressed them. Imbedded in this new material, are both granular cells and fibres; the latter being arranged round each tubule, and thus 'mapping out,' as it were, the affected area into rounded or polygonal spaces, in each of which lie the remains of one, or two, altered nerve-tubules. The following extract is from notes of the first case, which I had occasion to examine:—

Generally, the nerves are rounded and cord-like, semi-translucent and firm; the strands are not clearly seen from the outside, they are enlarged; the whole nerve seems shortened and tense; its smaller branches, and at intervals, the trunk itself, appear atrophied and translucent. For minute examination, it is not possible to make a transverse section of a healthy nerve, that will maintain itself erect, the unconnected tubules which compose the funiculi falling aside under the least pressure; while in the diseased nerve, each segment stands upright, and will even bear considerable pressure without being displaced; here, the tubules imbedded in a firm material, do not separate from each other . . . . the funiculi of a healthy nerve have an opaque white tint, derived from the refractive contents of their nerve-tubules; while in disease, they are grey, brownish, and translucent, owing to the separation and compression of the tubules by a yellowish deposit, partly clear, partly granular. See Plate X., fig. 8.

Thus, it will be seen that enlargement and diminished opacity, are the fundamental changes which the nerves exhibit. The general cellular investment—the ordinary seat of neuromatous swellings, and of inflammatory and other formations—is here but little altered: the amount of enlargement varies from just above the normal size, to more than twice that; the colour may be grey, reddish-grey, reddish-brown, or, very rarely, a dead, opaque white: the consistence of all degrees, from almost flabby to semi-cartilaginous, but generally firmer than natural; marked vascularity is uncommon; adhesions have been found, but only under exceptional circumstances.

As probably, in all cases, a consequent of this state (*viz.*, from either wasting or absorption), the affected nerve-trunk may become smaller in size than natural; and such change occurs, either above or below the seat of enlargement.

The cutaneous nerves are altered in a similar manner, but, as might be anticipated, are sometimes less rounded and firm than the larger trunks.

The morbid changes just described, do not occur indiscriminately in the course of the nerves, but make their appearance at certain selected spots; these are, for the compound trunks, where they are most superficially placed, for the cutaneous nerves, immediately after they have perforated the deep fascia. As regards the former, the nerve-trunk above the 'locus morbi' may be unchanged; below, it is usually atrophied, but occasionally almost normal in appearance and structure: the apparent extent of disease may be limited to

septa pass off which separate and hold together the collections of nerve-tubules within. 3. The sheath, investment or matrix of the individual nerve-tubules; the intra-fascicular tissue, or so-called perineurium. Now, the structure and arrangement of the elementary tissues, belonging to the second and third of these forms are in general terms the same; here fat vesicles and coarse bundles are wanting, and there are present only thin, elastic membranes, or flattened fibres, and endothelial cells. The former are extremely delicate, homogeneous laminae passing in various directions, and in places separated from each other by 'lymph-spaces,' which

(995.)

may be seen to contain pale corpuscles like those of blood, and like, too, the round cells mentioned by Hansen and myself; these spaces are lined by the endothelial cells which resemble flattened epithelium, being large, of irregular form, and provided with a single, oblong nucleus. These structures are seen to be in immediate contact with the nerve-tubules (or nerve-fibres as they are commonly called), as well as to compose the neurilemma of their common fascicule; and probably all observers would now agree that in them begins the morbid changes belonging to leprosy nerve-disease.

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two or three inches, but it is often considerably more. In both sets of nerves, the terminal branches will be found atrophied and pearly in aspect; being, in well-marked cases, evidently incapable of performing their functions. A very interesting fact connected with the nerves of compound function, is recorded in the TABLES (A.L. III. & IV., No. 2; M.L. IV., No. 4, &c., see also Plate IX., fig. 3,) viz., that the sensory or cutaneous segment, alone, may be diseased, being traceable by the eye for some distance upwards in continuation of the altered cutaneous branch, after it has joined the main trunk; this observation supported as it is, by other facts, also shows that the morbid changes proceed as might have been anticipated from the periphery towards the centre.\*

The following list, together with Plates X. and XI., and the TABLES, which contain a brief description of the appearances in each case, some comparative measurements, &c., will further serve to elucidate the general features of leprosy nerve-disease. I shall presently describe its microscopic characters.†

A LIST OF THE NERVES FOUND DISEASED IN LEPROSY.

| Name of Nerve.  | Place of Disease.                  | Parts supplied.                       |
|---|------------------------------------|---------------------------------------|
| <i>Supra-orbital</i> (cutaneous) - -                                  | After emerging and onwards         | Skin of brows, forehead, &c.          |
| <i>Infra-orbital</i> (cutaneous) - -                                  | After leaving its foramen          | Cheek, nose, lip, eyelid.             |
| <i>Mental</i> (cutaneous) - -   | Ditto                              | Lip, chin, &c.                        |
| <i>Superficial cervical</i> (cutaneous) - -                           | After piercing the fascia          | Side of neck.                         |
| <i>Great auricular</i> (cutaneous) - -                                | Ditto                              | Lobule of ear, &c.                    |
| <i>Small occipital</i> (cutaneous) - -                                | Beyond its origin                  | Skin behind the ear, &c.              |
| <i>Descending branches of cervical plexus</i> (cutaneous).            | After piercing the fascia          | Skin of chest, shoulder, &c.          |
| <i>Circumflex</i> (compound function) cutaneous branches.             | Ditto                              | Skin of shoulder, arm.                |
| <i>Internal cutaneous</i> (cutaneous) - -                             | Ditto                              | Inner part of arm and forearm.        |
| <i>Lesser do.</i> - -   | Ditto                              | Inner part of arm.                    |
| <i>Intercosto-humeral</i> (cutaneous) - -                             | After piercing side of chest       | Ditto.                                |
| <i>External cutaneous</i> (cutaneous) - -                             | After piercing the fascia          | Outer part of forearm.                |
| <i>Musculo-spiral</i> (compound function) its cutaneous branches.     | Ditto                              | Back and outer side of arm.           |
| <i>Radial</i> (cutaneous) - -   | Ditto                              | Back of hand, outer side.             |
| <i>Median</i> (compound function) - -                                 | Above elbow and above wrist        | Three outer fingers (palmar surface). |
| <i>Ulnar</i> (compound function) - -                                  | At elbow, above wrist, and in palm | 1½ inner fingers (palmar surface).    |
| Its <i>dorsal branch</i> (cutaneous) - -                              | After piercing the fascia          | Back of hand, inner side.             |
| <i>External cutaneous</i> (cutaneous) - -                             | Ditto                              | Outer side of thigh.                  |
| <i>Middle cutaneous</i> (cutaneous) - -                               | Ditto                              | Front of thigh.                       |
| <i>Internal cutaneous</i> (cutaneous) - -                             | Ditto                              | Inner side of thigh and knee.         |
| <i>Long saphenous</i> (cutaneous) - -                                 | Ditto                              | Knee, inner side of leg and foot.     |
| <i>Popliteal</i> (compound function) - -                              | In popliteal space.                |                                       |
| <i>Peroneal</i> (compound function) - -                               | Ditto.                             |                                       |
| <i>Short saphenous</i> (cutaneous) - -                                | After piercing the fascia          | Back of leg, outer side of foot.      |
| <i>Musculo-cutaneous</i> (compound function), its cutaneous branches. | Ditto                              | Front of leg, dorsum of foot, &c.     |
| <i>Posterior Tibial</i> (compound function) -                         | Above inner ankle                  | Heel and sole of foot, &c.            |
| <i>Plantar</i> (compound function), their cutaneous branches.         | In sole of foot                    | Sole and toes (plantar surface).      |
| <i>Anterior Tibial</i> (compound function) -                          | Dorsum of foot                     | Inner toes (dorsal surface).          |
| <i>Internal Pudic</i> (cutaneous) - -                                 | Beyond perineal fascia             | Skin of penis, &c.                    |

\* The following has recently (1862) been noticed in a subject brought for dissection to the Medical College, Bombay. The left external popliteal nerve, and the musculo-cutaneous as far as the dorsum of the foot, were enormously but irregularly enlarged, and of very firm consistence, all the funiculi being converted into tough fibrous tissue; but, in addition, the central part of each strand had undergone fatty degeneration, so that long white streaks were visible on the outside, giving the appearance of *Filaria* being imbedded in the nerve, and, on section, a soft opaque substance was seen in the axis of the strands. Even at this extreme stage of disease,

a few clusters of almost healthy tubules could be detected. The specimen was interesting, as showing a further stage of nerve-disease, viz., that of *fatty degeneration*; it is possible that even *ossification* of the fibrous material may occur, and the nerve-trunks be thus converted into bony rods. The corresponding nerves in the opposite leg, and some others examined, were not affected. The skin of the corresponding foot was shrivelled, but the toes were not wasted or deformed, nor was there seen any ulceration of the skin.

† In the account of their earlier researches, the following remarks of Daniëlszen and Boeck, are (*loc.*

This enumeration, which is founded upon the tables hereto appended, is so far imperfect, that it does not include many other cutaneous nerves, supplying the skin of the trunk, and some parts of the head and extremities, but these I have seldom attempted to examine: very much, indeed, is left for future research. The place of disease, as above given, is that where the changes were most advanced, and probably first commenced, subsequently, the 'locus morbi' becomes more diffused, by extension. There is little to be said on the comparative liability of any nerve to disease, as in cases at all advanced (and such only have as yet been investigated), almost the whole of the nerves named in the above list, were found to be implicated. It may be inferred, however, that the Ulnar and Radial nerves in the upper, and the Musculo-cutaneous in the lower extremities, are oftenest affected; they supply the dorsum and inner side of the hand, and the dorsum of the foot: and, perhaps, least often of all cutaneous nerves, the branches of the fifth cranial nerve on the face, have been found diseased.

*Microscopic Examination.*—Taking the tissues of the nerve in succession, from without inwards, it is found that its coat or sheath (connective, adipose, and vascular), and the investment of the funiculi themselves (neurilemma of connective tissue), are either both unchanged, or the latter may be slightly thickened and marked by fusiform granular masses, or more distinct oval granular cells of full size; on its inner surface accumulations of granular matter or nuclei are apt to occur, and here the septa pass off, which map out so curiously the area of the diseased funiculus. These septa are composed of a nucleated fibrous tissue, very distinct and clear; the cells, varying in size, are granular; they have occasionally appeared to be free, and when small, at first sight they resemble the ends of the wasted nerve-tubules, as seen in a transverse section. The space enclosed by these septa is polygonal in shape, and from  $\frac{1}{100}$  in. to  $\frac{1}{200}$  in. in diameter; it is occupied by a clear homogeneous refractile substance, in which the altered nerve-tubules are imbedded. The latter are usually much changed, their medullary sheath corrugated, and contents granular, uniform (?), and firm; their diameter very irregular, according to the amount of compression they have undergone, and when this has been considerable, it occasionally seems as if the tubules were emptied, their collapsed and folded walls alone remaining: in still more diseased funiculi mere granular streaks, or lines of minute nuclei (?) only, are seen; lastly, all traces whatever of the tubules may be wanting, the whole of the space they occupied being converted into fibrous tissue, and that without their undergoing fatty degeneration, previous to complete absorption. Whether the axis-cylinder of the nerve-

*cit.*) to be found. Referring to the frequent infiltrations of the skin, it is stated that the sub-cutaneous nerves are also thickened by deposition of lardaceous matter on their outer surface; and their interior, with the nerve filaments, are encroached upon by it. It is proper to notice in this place, that, often enough, the nerves are changed in quite another way; and then, not only are the superficial branches affected, but those more deeply seated; and because this alteration is secondary or accidental, it is often found, not only in the two forms of leprosy, but in other affections, such as tumours, aneurisms, &c. The sheaths of the nerves, and their prolongations, also their cellular tissue, are thickened to a great degree by an albuminous mass, singularly dense and firm, in which the nervous filaments, are, as it were, enveloped. This thickness may attain a size double the normal; and assuredly it is due to a *neuritis*, which attack the sheath and its cellular tissue. All this is the consequence of considerable neighbouring ulcerations; of large tubercular infiltrations, or of the necrotic processes; this is why, also, such alteration of the nerves occurs in the most advanced period of leprosy, and is

revealed by very severe pain, increased at night, in the parts where the inflamed nerves are found. (Tub. Lep., p. 218.) Again, after describing similar infiltrations of the skin, in anæsthetic leprosy, it is remarked, "the nerves which pass through this infiltrated tissue, as well as those situated more deeply, are excessively swollen; their sheaths are filled with a tenacious, firm, albuminous mass, in which lie the nervous filaments; such alterations have been mentioned under the tubercular form, and we regard them as a consequence of ordinary neuritis!" (*loc. cit.*, p. 282).

These extracts include all the details which are given in these early writings. I have said that my observations, in India, were altogether independent; and Daniellssen had subsequently to 1848, undertaken further inquiries, which were made known in Europe, at about the same time as the Bombay researches were published in the Local Society's Transactions. What fuller details respecting this important subject, Daniellssen had to communicate, may be seen in Appendix C, to which I would invite close attention.

tubules is especially affected, or not, I cannot say. With regard to the origin and progress of the nerve-disease, it appears that first of all a clear material (possibly albuminous) is deposited between the nerve-tubules, and in this, cells and subsequently fibres are developed; and the deposit itself may become fibrillated. The cells are often large ( $\frac{1}{2000}$ — $\frac{1}{1000}$  in. long diameter), but I have also found them very small ( $\frac{1}{8000}$ — $\frac{1}{4000}$  in.), clear, round, and very numerous; this is a variety worth notice as possibly indicating rapid progress of development. (See Plate XII., fig. 7.) The deposit might be regarded as having its beginning in the scanty inter-tubular matrix which it is probable always exists, at least in the larger nerves.\*

\* In his Memoir on Anæsthetic Leprosy, Danielsen furnishes a description of the minute characters of leprous nerve-disease, as exhibited in two sections made by Prof. Virchow at Bergen, in the summer of 1859; and the figures there given in illustration of this account will be found, upon comparison with my own, to be sufficiently alike to demonstrate the identity of this nerve-affection in Norway and India. Subsequently, Virchow described more fully the morbid changes in question (Geschw. ij., B. p. 522, fig. 179) in the following terms:—"When examined under the microscope, even a low power suffices to show the chief microscopical features very distinctly. The loose connective tissue (the external nerve-sheath) which serves to hold several nerve-fasciculi together, is scarcely altered in the least; at most, the walls of the blood-vessels contained within it are thickened. The nerve-sheath proper (the neurilemma) is usually more or less changed in appearance, though in different cases, to a very unequal extent, the alteration being, in some instances, very slight, whilst in others, neurilemma is transformed into a very hard callous mass. The most important changes, however, are more deeply seated in the septa within the nerve-fasciculi, and in the interstitial substance, properly so-called, between the nerve-fibres (the perineurium). They sometimes commence close beneath the neurilemma, in which situation we find a highly refracting material deposited, and from thence they are continued along the larger septa which sub-divide the fasciculi of nerve-fibres into a number of still smaller fasciculi. If we now make use of a higher magnifying power, it at once becomes evident that the darker coloured material which fills the parts mentioned is composed of densely crowded cells, 'nuclei' of Carter; and that these not only correspond to the direction of the larger connective tissue septa, but are also situated around and between the primitive nerve-fibres. There thus results a very distinct picture, each nerve-fibre forming, as it were, a circle, in the centre of which is found the axis cylinder, and around which is disposed a network of leprous cells. When the affection has lasted some time, I have observed two chief modifications; first, a fatty metamorphosis, well marked, proceeding from the leprous cells and leading to the production of the great granule cells, so that with a low power these places appear altogether black; there is, then, evidently a retrogression, and it cannot be doubted that, in these cases, the deposit is capable of being resolved and completely removed, with the re-instatement of function, provided this absorptive process takes place early enough. But, in the interval, there very often occurs another modification,

and that is the total atrophy of the primitive nerve-fibres. Like Carter, I have never seen this take place by way of fatty metamorphosis; the first thing which I have seen being the destruction of the medullary sheath, which is reduced to mere fragments of myelin, which gradually become smaller and finally disappear; there, too, nothing can be seen of the axis cylinder." The concordance of this description with that given in the text will be found, on careful attention, to be very considerable indeed; I may add, that, my 'nuclei' would now be called 'cells.'

More recently, Hansen has made some remarks of interest, and the following extracts are here introduced, in order to complete this notice of an important subject. He states (Appendix A., p. viii)—entirely corresponding with the skin and eye-affection, is that of the nerves; here, too, are found round cells, especially alongside the vessels lying between the nerve-fasciculi: and subsequently cells are to be seen between the nerve-tubules themselves, their retrogression is the same as in the 'tubercles' found in the skin; and since the sheaths and neurilemma thus became thickened, and shrink, just as if by a scar, it is most probably at this stage that atrophy of the nerve-tubules first becomes general throughout the whole thickness of the nerve-trunk . . . . in order to detect the disease in the least affected nerves, recourse must be had to microscopic scrutiny; there it will be seen that the peripheral layer is principally affected; there is no thickening of the neurilemma, and very few nerve-tubules ever get atrophied . . . . the nerve-disease is precisely the same in the tubercular cases, when anæsthesia has showed itself—the so-called mixed form of leprosy—as in the purely anæsthetic. . . . Previously (page iii) Hansen had observed in a diseased ulnar nerve, "the same characteristic elements as in the leprous tubercles of the skin;" and from all the preceding observations, it may be concluded that leprous nerve-disease is to be considered as equally peculiar as other forms of organic change, in leprosis. I shall, however, consider more fully in a subsequent chapter the essential nature of these morbid changes. Hansen and Bull give a view of ciliary nerve-fibres taken from a part affected with the leprous eye-disease, so fully described by Hansen and Bull; it is said that the anatomical changes in the parts of the eye affected by Irido-cyclitis, and those attending the formation of nodules in the Iris, are in all essential points the same as are found in the equally characteristic leprous nodules situated in the Cornea.

Lastly, I would here remark, as a fact of the greatest interest and importance with respect to the pathological

These observations unequivocally demonstrate, the limited extent of the morbid process in the nerves themselves, so that some of their components may continue to perform their functions, while others certainly could not; it seldom, indeed, happens in a compound nerve, that some of the funiculi, or parts of them, are not in a sufficiently normal condition, but to the unaided eye, all may seem equally diseased: and on the other hand, a nerve may appear healthy enough, and yet a segment of it, be decidedly ineffective. Histologists have not sufficiently determined the microscopical characters of *motor*, *sensory* and *sympathetic* nerve-tubules, to enable pathological inquirers to settle a question like the present; but it would appear, from the symptoms and the special tendencies of leprous nerve-disease, that the last-named elements of a compound nerve, are those peculiarly affected.

Hitherto, I have not seen any traces of the fatty disintegration, or degeneration, of nerve-tubules along their tracts, central or peripherad; which is described by Waller and others, as occurring after section of a nerve. I assume that disease begins, not at the periphery of the nerves, but at certain elective points, below which, and sometimes above, the trunks become atrophied; but it is quite possible, as regards the cutaneous nerves, that it may be otherwise, as the wasting below the seat of lesion is not always that of mere atrophy, but rather such a conversion into tough fibrous tissue, attended with no diminution of size, which would indicate previous effusion or deposit between the tubules. There is, evidently, a distinction to be made between leprous nerve-disease, and such mechanical injury as might equally interfere with the conduction of impressions; as both symptoms, and consecutive local changes, point out.\*

*Pacinian corpuscles*.—In the hand and the mesentery—the foot has not been specially examined—these little bodies have sometimes, but not invariably, been found to be enlarged, their pearly tint somewhat changed, and their consistence firm. My notes contain the following examples:—

An elderly man affected with leprosy for six years, died in a state of great debility. The hands are much distorted, thumbs nearly gone, fingers shortened and bent, a deep sore over the cunei-

inquiries now under consideration, that, in leprosy, a nerve may be, if slightly, yet decidedly and even rather considerably diseased, without there being visible to unaided vision, and on ordinary inspection, any marked changes. Doubtless an experienced eye will perceive a morbid alteration which might often escape detection; but the rule will be a good one, to examine with the microscope in all cases, the condition of the nerves at certain selected localities, where they are more commonly diseased.

\* This paragraph stands as it was originally written, and upon the several topics it embraces some comments are here needed.

First, with reference to later changes which the nerve-tubules undergo in advanced disease, many details will be found in the description of the figures in Plates X. and XI., which may serve to supplement the memoranda in the text, respecting the successive alterations which the parts of the nerves, and the neoplasm itself, are found to present in various instances, and, hence, further notice of this subject is not in this place required. Next, I have not mentioned amongst the terminations of leprous nerve-disease, that subsidence and final resolution of all morbid material, which is said to be followed by restoration of the nerves to healthy state and function; and I do not know that either Daniellssen or Virchow, who advert to these occurrences, have substantiated their opinions, by minute examina-

tion of nerve-trunks which appear to have been once affected, and to have since regained their normal properties. Until this scrutiny has been made, I hesitate to admit that a decided onset of specific leprous-disease, can take place without leaving marks behind. There may be, I think, enough outward general resemblance, *e.g.*, in the smaller filaments, between a healthy nerve and one that has been enlarged but has become less swollen by subsequent absorption, to render it desirable that the minute structure should be investigated, whenever it is wished to ascertain the real state of parts; for in the last-named case the resumption of normal size, &c. of the trunk, by no means implies that the essential parts of the individual nerves are restored. Respecting the situation in the course of the nerves, at which disease seems to begin, I have above simply recorded what I had seen, and the experience of other observers has evidently been a similar one, *see*, for instance, Appendix C. There remains, however, the doubt raised in the preceding paragraph, namely, whether the nerve-filaments beyond, or at the peripheral side of, spots decidedly diseased, which have the appearance of being in a normal state, are really so or not; for, in accordance with what is known in other cases, one would expect to find atrophy of the essential parts of the unused nerve-fibres, whatever be the condition of the sheaths or other accessory parts.

form bone; the nerves are enlarged, grey, and tough; the Pacinian corpuscles appear very numerous, are larger than usual, some being  $\frac{1}{2}$  in. in long diameter (or double the normal size), and closely aggregated on the shortened digital nerves; this is especially evident in the stump, which is all that remains of the thumb; it would seem that this clustering together, is owing to their not having been removed, by molecular disintegration, like the other textures of the digits, but driven back, as it were, by the advancing process of absorption. Change of structure—it is not uniform, some corpuscles are simply hypertrophied, the number and size of their capsules being increased, but the central nerve fibre is either much atrophied, or absent; in others, a large deposit of granular matter with numerous nuclei, is seen in the central parts, and at the two ends; this imparts a semi-opaque appearance, and sometimes a tortuous or spiral tube is present in the midst, which has rather the aspect of the displaced and elongated nerve-filament. *Vide* Plate X., fig. 14. The blood vessels are very well seen in a specimen I have injected, they are probably more numerous and larger than natural (date Sept. 1860). 2.—A similar case, the hands less distorted. When compared with healthy specimens, the corpuscles are found to be larger, their capsules coarser and less regular, and the central parts confused, the nerve-filament not being seen: there is a granular deposit, furnished with nuclei or cells, sometimes large and granular, or smaller and more numerous, scattered between the capsules in the middle and at the ends. 3.—Hands little distorted. The corpuscles are not much enlarged, but the granular nucleated deposit and altered nerve are distinct. 4.—Disease in the hands and feet, and in the nerves much advanced. The corpuscles are quite distinct, but doubtfully changed in size, or possibly smaller than usual; as might occur from atrophy, either primary or subsequent to enlargement.

From the above memoranda it may be concluded that these bodies undergo in leprosy similar alterations to the nerves, being first enlarged by the deposit of a granular material, which subsequently acquires nuclei, and is finally converted into fibrous tissue, after which gradual wasting takes place; their functions must be interfered with from the first, but what particular symptoms would indicate this, is not known, since the use of the corpuscles themselves, is yet only matter of speculation.

*Tactile corpuscles.*—The papillæ of the smooth, atrophied, wrinkled skin of benumbed surfaces, are either much diminished in size or wanting; indeed the smoothness and absence of cuticular markings (as at the tips of the fingers, palm, &c.), is evidently owing to their absorption. In one case, I found the cuticle thin, soft, and dark, the cutis red and soft, its papillæ much fewer (on comparison with a corresponding healthy part), generally shorter, attenuated and inclined; every one contained capillary loops, none tactile corpuscles, so that it may be inferred that those papillæ especially administering to the sense of touch, are particularly affected in anæsthetic leprosy. The preparation was from M.L. No. 7, and it offered a striking contrast to the healthy one it was compared with.

*Changes in the Skin and Mucous Membranes.*—These compound tissues are specifically affected chiefly in the tubercular and mixed varieties of leprosy. On the hard palate and tongue, and in the larynx, the *mucous membrane* is frequently the seat of marked tumefaction, or more distinct tubercles, small and pale in colour; the latter I find to present the same characters as tubercles in the skin. In the larynx, the deposit does not extend below the 'rima glottidis;' and it has been found absent in the Schneiderian membrane, as well as the pharynx, where if the tonsils be enlarged, it is not from 'tubercles;' tumid glands may be seen in the soft palate, &c. My attention has not been directed to the other mucous surfaces, as they never presented to the eye, sufficient evidence of morbid change to call for minute examination.\*

\* The information additional to the above, and to that contained in the cases and tables, which I have at hand, is contained in the following extracts:—

The mucous membranes are affected almost like the

skin, but only at a later date, and the changes they undergo pass more quickly through their several stages; hence it is not so easy to trace them. The pituitary membrane may be tumefied, or the seat of deposit;

In the *Skin*, disease is also limited to the dermoid and subjacent tissues, and it consists in the deposit of a plasma, in which granules and nuclei subsequently appear: the nerves, vessels, and appendages of the skin, being necessarily implicated, thence result many of the symptoms previously described. This deposit is obviously of the same character, as that found in the nerves; and the similiarity forms, in my opinion, clear proof of the unity of leprosy, for the pathological changes are also the same in the eruption. The following extracts from my notes, will furnish their minute anatomical characters:—

M.L. CASE 1.—A section of skin of left cheek, which was reddened, thickened, coarse in aspect, rather lighter in colour (it is often darker), and somewhat shining. The entire substance of the skin is occupied by a reddish deposit varying in thickness from  $\frac{1}{2}$  to  $\frac{1}{5}$  in. arranged in vertical patches, investing and compressing the sweat-glands and hair follicles: an isolated patch of the granular and yellowish deposit, may sometimes be seen in the sub-cutaneous tissue on the outside of a sweat-gland. The sebaceous glands are distended, and appear to the eye as opaque white dots (they subsequently become atrophied and destroyed): the hairs are thin and scanty (have been noticed as paler in colour). The free surface of the cutis is slightly convex; papillae not here seen (but readily in sounder skin around): the cuticle is little changed (often thinned and loaded with pigment); apertures of follicles and gland ducts enlarged. The new formation consists of a homogeneous material, rendered almost transparent by acetic acid, and disposed in layers, as would appear from the disposition of its nuclei and granular masses; these are of a yellowish tint, granular aspect, size and form irregular (sometimes large pigment cells are seen). In some cases distinct cells are visible with an indication of a nucleus, but in most, no distinction of parts can be seen in the granular masses: (the nuclei or cells sometimes appear to be branching out into fibres). In isolated places, the deposit occupies the meshes of the areolar tissue, as if it had been effused there. Acetic acid renders these features more evident: ether only appears to make the presence of nuclei in the granular masses more apparent, but has otherwise little effect. See Plate XII., figs. 3 and 5. Such are the ordinary microscopic features of leprosy tubercles or tumefaction: the following is a variety corresponding to that noticed in the nerve deposit:—

M.L. CASE 4.—Skin of forehead: the patient had a decided leonine expression, without there being any large or distinct tubercles; and the brows were most affected. Hairs very scanty to the eye, but, under microscope, many small ones are seen, seldom furnished with sebaceous glands. The deposit is not very distinct, but there is a reddish-grey appearance beneath the cutis which indicates its presence; it seems to be arranged in the usual manner, but the masses are less distinct or isolated: it follows the vessels and ducts, and surrounds the convoluted sweat-gland: its colour is not so decidedly brown as common: + acetic acid and glycerine, the matrix is seen to be clear, homogeneous, scanty; the nuclei very numerous, more or less oval, tolerably uniform in size ( $\frac{1}{1000}$  to  $\frac{1}{500}$  in.) and devoid of nucleoli and, generally, of granules, edge defined; they differ from the nuclei of the connective tissue, which they somewhat resemble, by their closer aggregation, irregular arrangement, colour, and more refractile appearance, and they do not seem to branch out into fibres.

ulcers follow, which may spread to neighbouring parts. In the intestinal canal, too, ulcers may be found, which have passed through all the coats but the peritoneal; they are isolated, round, the size of a shilling, edges slightly raised, and base equal in area to the top; the entire intestine may be perforated. . . . The tubercular infiltrations and ulceration of the larynx are described in full; it is said that in the mucous membrane of the trachea and larger bronchi, numerous scattered tubercles may be met with. The mucous membrane of the uterus may be studded with tubercles. (Tubercular Leprosy, D. and B., *loc. cit.*, p. 220.) The mucous membrane of the mouth, esophagus, and stomach, was remarkably pale in advanced cases, but not otherwise changed. Ulcerations,

circumscribed but penetrating, were sometimes seen on the septum nasi. (Anæsthetic Leprosy, *loc. cit.*, p. 288.) For some other remarks of interest, see Appendix A., p. xii, and also description of the figures in Plate XII., I have always had the impression that the position and extent of the mucous surfaces involved in leprosy, may be contingent, first, upon continuity of texture with the skin, and next upon nervous supply from the fifth pair, or, possibly, some other sensory cranial nerve; but as the deposition of tubercular matter seems to be determined, on the face, by the fifth, I had intuitively applied the idea to the instance of the mucous membranes. It is evident that fresh anatomical information is much wanted with reference to the mucous membranes.

The lobule of the ears present the same characters as the skin elsewhere, viz., an abundant, reddish, firm deposit, furnished with numerous granular nuclei and oil-globules, &c. I need not however enter into further details, only remarking that this new formation must obviously interfere with the functions of the skin, both as a secreting and a sensory organ; its tendency to surround the vessels, glands, and ducts is a feature worth special notice, and its microscopic structure is probably also characteristic.\*

\* The epidermis is only secondarily involved by either ulceration of the tubercles, a sure attendant skin-eruption; but the derma, or corium, is always involved, and it is the earliest seat of the peculiar, pathological products. Whilst the patches are still of periodic recurrence, there is only to be seen a slight tumefaction, which finally, when it becomes stationary, assumes a more striking aspect. This tumefaction occupies the entire thickness of the corium; and on making a section, the cut surface appears rather red, and is firm to the touch; if pressed between the fingers, there exudes a viscous, sanguinolent fluid. When the tubercles are formed, the cut surface appears rather brown; but it is difficult to make out the cutaneous structure. The corium is here harder, and on pressure, gives forth only a very trifling amount of serosity. Lastly, when the tubercles are completely developed, and have begun to soften, the derma has altogether lost, in the affected part, its primitive form, and its cut surface has a yellowish-white, granular aspect; if compressed, there exudes a quantity of grumous matter, of similar tint. The sub-cutaneous cellular tissue is more or less affected, according to the age of the tubercle; it becomes infiltrated, thickened by a lardaceous, often gelatinous, mass; is firm and adherent to the corium, so as to be blended with it. . . . the tubercles rarely reach below to this tissue; and softening was never seen in the latter; serous effusions may be present. Here, too, the sub-cutaneous veins, especially in the extremities, become thickened. Veins like the cephalic, basilic, the saphena, &c. may acquire the dimension of the little finger; their calibre hardly changed, their internal surface normal, but their outer coats thickened by a lardaceous substance, which imparts a very firm consistence; on emerging from these infiltrated tissues, the veins regain their normal aspect. The deeper layers of the cellular tissue and the muscles were always found in a normal state; the bones are never attacked in this form of disease. (Traité de la Spédalskhed—Tub. Lep., p. 218.) The skin is but little changed; only there is some atrophy where formerly bullæ and cicatrices existed. When the disease is fully developed, and when paralysis, both of skin and muscles, has reached a state of perfection, the skin is everywhere much thinned (atrophied), in many places hardly equal to a millimetre (.039 in.) in thickness; the fat beneath the skin and between the muscles quite disappears; the muscles are greatly atrophied. There may be seen in several spots on the face, also on the hands, a thin layer, like gelatine, and in which traces of wasted muscles may be perceived. Where ulcers have been present, there is infiltration and matting of the tissues. . . . *loc. cit.* (Anæsth. Lep., p. 281.)

I have above, at page 16, briefly described the minute

anatomical characters of the skin-eruption of leprosy so far as they are known; and of the more important nodular infiltrations and more limited growths which, characterise the so-called 'tubercular' form of leprosy require an appropriate notice in this place. For the fullest description of these skin-affections, however, I must refer to Hansen, in Appendix A., pp. v and i, and on comparing the respective accounts now alluded to, including that given below, it will, I think, be seen that the statements in the text include most of the structural features of skin-leprosy as revealed by the microscope in the hands of other observers. "In the younger tubercles, the cellular infiltration is not uniform, but consists of small foci, which are most numerous around the thick-walled blood vessels, cutaneous glands, and hair-follicles, whilst the intermediate connective tissue only contains isolated cellular infiltrations, and is here and there quite free from them. Blood vessels exist in great numbers immediately around the accumulations of cells, though very few are found within them. The older and larger tubercles consist entirely of such cells, and are delicate, fibrous matrix or network. The nodular structures contained within them are quite destroyed, the hair-follicles are atrophied, and contain thin distorted hairs, or only irregular masses of epidermis: the papillæ are either imperceptible, or still distinctly visible, but filled with cellular elements. In tubercles which are becoming flattened, the papillary layer of the skin is quite smooth, or altogether absent, the epidermis is thinned, and forms a uniform layer over the infiltrated corium. Here and there in the latter, there are colloid globules, either isolated or arranged in groups. Within the firm infiltration, the connective tissue of the corium is very scanty. On the other hand, the *musculi arrectores pilorum* are sometimes met with, in a hypertrophied condition. . . . the skin and sub-cutaneous tissue beyond the infiltration, are normal: in some instances, however, there is a fibrous layer of connective tissue of greater or less thickness, surrounding the small-celled infiltration." (Kaposi in Hebra. Dis. of Skin, Syd. Soc. Trans. Vol. IV., p. 172.) As a final remark, I observe that the anatomical changes to be found in the skin, will vary according to the age of the neoplasm, to its condition of growth or decay, and to the rate at which internal changes are proceeding: even the position of the new growth, and the physical characters of the cutaneous region involved, will serve to modify appearances. Of the view to be taken of these characteristic, intruded structural-elements, a few remarks will be afterwards offered; but in conjunction with the present notes, I would recommend a reference to Appendix A. for many details of interest.

*Changes in the Bones of the Hands and Feet.*—If it be allowed that several local deteriorations of structure, in leprosy, are, directly or indirectly, the result of deficient innervation, there will here be found conclusive evidence of the nutritive dependence of even the osseous system, upon nerve influence.\* In accordance with what is observed during life, the digits of the extremities are most affected; the terminal phalangeal segments, which support their pulps, seem to become atrophied at the very commencement of the symptoms, and the other rows in succession; also the metacarpal and metatarsal bones; all in a similar manner. To these segments the more characteristic changes produced by interstitial absorption are limited; they are, briefly atrophy of the shaft, part or whole, disappearance of the head or distal end with persistence of the bases or proximal ends of the bones. The carpal bones in the hand are more seldom altered, but I have noticed a rarified condition of the 'ossa, cuneiforme, and 'unciforme' (particularly its process), and the 'os pisiforme' has sometimes been enlarged, or carious; these bones, it will be remembered, are placed at the inner (or ulnar side) of the wrist; and corresponding to the 'unciforme,' the two inner metacarpals have been seen to be unusually slender, when the others were unchanged. As the ulnar nerve is constantly, and chiefly, diseased in these cases, the explanation of the limited atrophy now referred to, seems obvious. In the foot, the distal articular surfaces of the three 'ossa cuneiforme' and the cuboid, are sometimes found rarified or distorted; or the latter may be carious, corresponding to the two outer toes, supplied by that Plantar nerve answering to the ulnar, in the hand. This unilateral absorption of the bones of the hand and foot—i.e. of the inner or outer digits, alone—strictly accords with what is observed during life; in one very striking example I examined, all the outer side of the foot, in front, was wanting. Occasionally, a general diminution in size of the whole hand, or foot, is witnessed; and then the bones will be found thinned, porous, light in weight, grey in colour, and marked with large apertures or depressions; such was the condition, to some extent, of the specimen represented in Plate X., fig. 18c. Anchylosis is not uncommon, between the bases of the metatarsals, and them and the tarsus; or between the corresponding parts of the hand: roughening, or outgrowths, do not commonly occur. The 'ossa sesamoidea' have been noticed as small; and the bones of the fore-arm and leg are occasionally rarified in the shaft, especially the latter, and, as well, porous on the surface.

A reference to the accompanying illustrations, will afford some idea of the alterations in form and size, which the small, long bones of the extremities undergo, in consequence of this interstitial absorption; the curious pointed remnants of the phalangeals and metatarsals, and the very characteristic appearance of the remains of the great toe and thumb, are well worthy of notice. I am not able to say, why absorption should be most advanced at the distal end of these bones; the peculiarity cannot be connected with the direction of the nutritive canal, for this differs, while the progress of absorption is the same, in the two sets of bones; the cancellous tissue seems to suffer most, but in young subjects, the epiphyses have not been found especially affected.

The second method, by which destruction of the bones is caused, is that of 'caries' or 'necrosis,' which generally occurs at the first or second joint of the digits, extrusion of the fragments taking place on the dorsal aspect: the usual consequences, as swelling, ulceration, &c. attend this process, which, as already stated, I am inclined to regard as incidental rather than otherwise; and, as figs. 8 and 9 show, interstitial absorption may precede or accompany

\* The bones are affected only when the nerve-trunks of compound function, or those supplying the deeper seated structures, are diseased.

it. Marks of vascular excitement, are seldom very evident, even in this condition, and the periosteum is not red or thickened.

*Microscopic appearances.*—Four sections, horizontal and vertical, of two metatarsal bones, altered by extensive interstitial absorption, when mounted in Canada balsam, exhibited the following appearances:—The compact osseous tissue forming the attenuated remains of the shaft, was permeated by *channels* opening at the tip, or on the outer surface, and ending either in rounded extremities, or communicating with Haversian canals; the smallest were only  $\frac{1}{1250}$  in. in diameter, and frequently passing off from the latter, in a radiated manner, pursued an irregular more or less longitudinal course, often inosculating with other channels or Haversian canals; they reminded me of the tracks of boring insects in wood and shell. The largest channels, sometimes not unlike irregular cancelli, may perhaps be best described as elongated and branching Haversian *spaces*; some were  $\frac{1}{6}$  in. across, and enclosed several Haversian systems in their area; from them passed off smaller channels, in various directions, which were not unlike dilated Haversian canals, but as with the larger, although bearing a general resemblance to normal structures, were too irregular in their disposition to allow of confusion, and yet sufficiently methodical not to be mistaken for mere cracks or fissures. The bone cells were but little changed, occasionally on comparison with those of healthy bone (of the same part) they seemed small; it did not appear that the minuter channels were connected with them in their origin. The canaliculi being generally invisible in the balsam, I cannot say if any morbid change had occurred in them, probably not. The cancellous tissue forming the base of the shortened metatarsal bones seemed only 'rarified.'

The appearances thus briefly described, if, as I believe them to be, accurately interpreted, are of considerable interest. I am not aware if such have been previously noticed, but they seem to me, to show the way in which interstitial absorption occurs, very clearly. Adopting the views of Messrs. Tomes and De Morgan, this process may be said to be, a modification of the ordinary method by which bony tissue is removed, for the purpose of being replaced, in the course of normal nutrition: it might be termed *molecular destruction*, the tissue absorbed not being restored as it usually is.

Such are the results of my inquiries into the structural Pathology of Leprosy: but I am fully aware of many deficiencies in these observations. I would particularly point out, as a subject requiring further investigation, the first commencement and progress of the nerve-disease, and an endeavour should be made to ascertain whether the vaso-motor nerves are primarily affected or not; the condition of the sensory nerve-trunks above the seat of lesion I have not sufficiently examined, and that of the small blood-vessels in the atrophied parts requires further notice.\*

\* In thus bringing to an end the present reproduction of my original observations, I must repeat another remark, namely, what is here submitted is a condensed form of the material, which had been wholly acquired in the dissecting room. Not the least profitable result of the present chapter, may, however, be the indication

it must furnish, of both the necessity and the direction of future inquiry; and it is this consideration which has chiefly sustained me, in the task of again going over the subject, in every detail. The following Table and the illustrations are, in addition to the text, essential sources of information.

TABULATED NOTES OF THE HISTORY, SYMPTOMS, AND POST-MORTEM EXAMINATION OF 16 FATAL CASES OF LEPROSY; WITH THE DISSECTION OF THE NERVES OF THE TRUNK AND EXTREMITIES.

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N.B.—In the Tables the diameter of the nerves, both healthy and diseased, is indicated by numbers which represent the *twentieth parts of an inch* as marked on the dial of the Aphemetric compass; they have been allowed to stand un-reduced on account of better showing, at a glance, the relative size of the nerves. The diameter of healthy nerves in corresponding position to the diseased, is expressed in the headings of the several columns concerned; and that of the diseased nerves is shown in opposition with the several nerves named in the columns themselves.

## FATAL CASES.]

## ANÆSTHETIC

| No. | Caste.  | Age.        | Duration of Disease. | Hereditary Influence and Remarks.  | Commencement and Course.   | Extent, &c. of Anæsthesia.   |
|-----|---------|-------------|----------------------|--|--|--|
| 1   | Muss.   | 30          | 7 months?            | Not known. Died of dysentery and exhaustion. Native of Dacca.  | Began in right foot, spread to opposite foot, then hands and face.   | None on the face: hands, and feet, extending up the fore-arm and leg: it is most complete in the former, both surfaces being affected.   |
| 2   | Christ. | 29          | 3 years              | No hereditary taint. Syphilis four years since. Treated with iodine and arsenic for some time before albuminuria and fever came on, then had quinine, diaphoretics, and antimony: finally stimulants. Died comatose. Came from Tellicherry, where leprosy is common. | Eruption first on body, then numbness of the feet, hands and face; the fingers and toes became distorted and partly destroyed. At an early period, the skin of the face acquired a bronze tint, and became a little swollen on the nose, cheeks, and ears. | Doubtful if present in the spots, particularly on the cheeks and ears: back, lateral surfaces, and nates, &c. on the genital organs, but not their mucous membrane, probably. Upper extremities,—left hand completely benumbed, and also inner part of fore-arm. Right hand—anæsthesia very slight. Lower extremities—loss of sensation in right foot, and leg as high as knee. On left side confined to foot. |
| 3   | Hind.   | 35          | 7 to 8 years         | Not known. Is a labourer, from Hyderabad in the Deccan. Died exhausted? phlebitis.   | Not known  | Hands and feet, it is impossible to ascertain the precise extent.  |
| 4   | Muss.   | 50          | 10 years             | None. Is a sailor, had syphilis 12 years since and was treated with mercury. Native of Bombay.   | Began with swelling at the sole of the right foot, near the great toe.   | Is present in the hands and feet, extending a short distance above the wrist and ankle.  |
| 5   | Hind.   | Adult       | Unknown              | A pilgrim. No history obtainable before death.*  | Not known  | Not known  |
| 6   | Christ. | 23          | 12 years             | Died of dysentery. History unknown.  | Not known  | Not known  |
| 7   | Hind.   | Adult.      | 10 years?            | From Ratnagerry. No history known.   | Not known  | Not known  |
| 8   |         | No account. |                      | No history known   | Not known  | Not known  |

\* It is to be regretted this is so frequently the case.

## LEPROSY.—TABLE (I.)

[J. J. HOSPITAL.

| Present State.  |
|---|
| <p>Very thin and weak. There is slight depression of the nose; hairs on eyebrows scanty. There are superficial ulcers on the shoulders, hips, scrotum, and the fingers and toes, with partial destruction of the latter, on the right foot the great toe having disappeared. All these parts looked puffed and shining, as if from the application of oil. He complains of pains in the joints. Urine is pale, sp. gr. 1003, plentiful, slightly alkaline, and unaffected by heat and nitric acid. [Case referred to in last Volume of Transactions, &amp;c., Appendix, p. xxviii.]</p>   |
| <p>Numerous light-coloured oval or circular spots, varying in size from an 8-anna piece to palm of hand, having a reddish slightly-raised edge; over this skin is roughened and on extremities looks scaly: they are present on the face, trunk, and limbs, and are occasionally symmetrical, as on the mammae (Baras). Is of spare habit. Muscular power of limbs somewhat impaired. Upper extremities—left hand, palm shrivelled, fingers atrophied and distorted, last phalanx of thumb gone. Right hand, middle and little fingers rather shrivelled, the former has lost a phalanx and half; ring finger also contracted. Lower extremities—right foot and leg: former contracted, great toe atrophied, skin shrivelled and dark: a small sore on the sole:—left foot, little toe only atrophied, skin is shrivelled: a sore on the sole. Nothing to be seen in the throat: voice unaffected: sense of smell deficient. Manner dull and heavy, answers questions carelessly. A month before his decease, there supervened depression, fever, and anasarca, with fullness of the abdomen; a sense of heat in the body and aching pains: then dyspnoea came on, and he finally died rather suddenly. The urine was then high coloured (blood?) sp. gr. 1009, contained much albumen, and a scanty brownish flocculent deposit: he attributed the change to the medicine (iodine) he had been taking. Afterwards it became of a lighter colour and was plentiful. Under the microscope were seen pale, clear casts, others slightly granular, nuclei (?): blood corpuscles, numerous delicate spherical cells with a distinct spherical nucleus, and sometimes yellowish granules; others like epithelial scales. No distinct oil globules were seen.</p> |
| <p>Very weak and reduced: suffers from fever. No affection of the face and trunk. Upper extremities—right hand, much distortion, anaesthesia at the front and back, at the outer side, including the thumb and two next fingers. Left hand—much distortion: numbness everywhere, except a little at the outer side. Lower extremities—right foot, it and the leg are swollen and painful, cannot say where sensation is most deficient. Left foot, benumbed on the dorsum and sole only. Extensive sloughing and suppuration in the right foot: and phlebitis of the superficial veins in the leg, &amp;c.</p>  |
| <p>No marks on the face: very doubtful light spots on the trunk. Upper extremities—right hand, light spots and distortion: the phalanges of some of the fingers are gone, and the thumb is shortened: left hand, light spots, thickening, and distortion: small dark blisters on the sides of the fingers. Lower extremities—right foot, the second toe is gone, and there is a large sore on the sole close by: retraction of the toes with shortening and distortion. Left foot, toes thickened, some shortening, and great toe contracted, and fourth toe almost gone: a recent sore on the sole.</p>  |
| <p>Emaciation. Superficial excoriations on various parts of the trunk and limbs: great distortion of the hands and feet, with destruction of several fingers and toes.</p>  |
| <p>Body in fair condition. Hands and feet alone affected: their being distortion and partial destruction of the fingers and toes.</p>   |
| <p>Exceedingly reduced. Slight flattening of the nose; swelling of the ears; ulcers over the knees and ankles: atrophy and ulceration of the hands and feet.</p>  |
| <p>Emaciated, particularly lower limbs; hands are atrophied, skin smooth, and glistening toes are shortened and thickened, skin rough and shrunken: a "femoral tumour."</p>   |

the patients being admitted in an almost dying state.

[1886796.]

POST-MORTEM APPEARANCES.—TABLE (II). ANÆSTHETIC LEPROSY.—TABLE (II).

| No. of Case. | Brain.  | Spinal Cord.   | Sympathetic.  | Heart.   | Lungs.  | Intestinal Canal.   | Liver.   | Spleen.  | Pancreas.                            | Kidneys.   | Lymphatics, Glands, Muscles, Blood.   | Remarks.   |   |
|--------------|---|--|---|--|---|---|--|--|--------------------------------------|--|---|--|---|
| 1            | Membranes injected, healthy. Substance soft and wet, marked by 'pinacæ'; in floor of ventricles, and in cornu dentis of cerebri, both on left side, very small extravasation of blood surrounding sub-stance not softened.  | In the arachnoid were several small white masses of fibrinous nature, in floor of ventricles, and in cornu dentis of cerebri, both on left side, and in dorsal and lumbar regions, some were close to posterior roots of spinal nerves, and not in a position to press on them, other membranes and substance of cord quite healthy in appearance. | Appeared healthy in abdominal ganglia normal. At the root of sensory secondary enlarged. Pinacæ were seen.                                | Healthy, firm cavities. Pericardium not opaque. Aorta free from thrombosis.  | Adherent. Healthy. Pleura not opaque.   | Healthy. Intestines collapsed. Peritoneum not opaque.   | Rather small, adherent, on convex surface.   | Enlarged surface mottled and pockered, substance congested, no deposit, serous coat clear. Gall bladder small, congested, viscid bile. | Normal.                              | Normal.  | Capsule not adherent. Small, outer surface smooth, mottled with large white patches through central substance and were defined.   | Lymphatics and glands not diseased. Blood congested. Muscles pale.   | Body injected, not firm, no tubercles seen before examination. Much swollen from anæmia. Urine abundant, turbid, brown. |
| 2            | Membranes pale, little sub-arachnoid fluid. Pachymenium glabrous. Substance of normal consistency, but softened in middle of dorsal region, where it had a reddish, fibrinous, little enlarged, pinacæ; little sub-arachnoid fluid in lower part; arteries at base healthy. | Membranes healthy, pale, except pinacæ. Substance of normal consistency, but softened in middle of dorsal region, where it had a reddish, fibrinous, little enlarged, pinacæ; little sub-arachnoid fluid in lower part; arteries at base healthy.  | Nothing abnormal seen in abdomen.   | Large substance pale but not diseased. Valves healthy, cavities dilated and free from thrombosis. Pericardium clear, it contained some serum. Aorta healthy. | Compressed, and upper lobe of left lung solid and light-colored, but regulating secretions. No adhesion to sides. Pleurae and bronchi healthy.        | Stomach contained limited digested. Intestines filled with soft contents. Peritoneum clear, its cavity contained fluid. | Enlarged surface mottled and pockered, substance congested, no deposit, serous coat clear. Gall bladder small, congested, viscid bile. | Somewhat congested, substance healthy.   | Soft and pulpy.                      | Normal.  | Capsule slightly adherent. Both considerably enlarged, surface mottled and pockered, highly granular. Central structure more abundant than usual, and encroaching on medullary, cerebral pabs, and tubercles. Striae renal capsule healthy. | On the left side, abscesses near tubercles seen. Glands near tubercles were inflamed. Blood mostly from anæmia. Urine abundant, turbid, brown. | Examined 30 hours after death.  |
| 3            | Membranes—dura-mater thin arachnoid fluid abundant. Pachymenium glabrous. Substance soft, ventricles a little reddish serum. Vessels healthy.   | Membranes healthy, pale, sub-arachnoid fluid abundant. Pachymenium glabrous. Substance soft, ventricles a little reddish serum. Vessels healthy.   | Left sub-arachnoid space normal, no enlarged pinacæ; on examination no tubercles found. Gault healthy.                                    | Healthy, cavities contained clots, Aorta free from deposit.  | Healthy, adherent.  | Normal.   | Enlarged surface mottled and pockered, substance healthy.  | Healthy.   | Soft.                                | Normal.  | Capsule normal. One enlarged, and its colour mottled, as if from deposit. Surface of both smooth.   | Muscle pale.   |   |
| 4            | Membranes—dura-mater pale, adherent to arachnoid along the vertex. Substance rather soft, especially about septum lucidum, some reddish serum in the cornu dentis. Origin of cranial nerve healthy.   | Membranes healthy, pleurae vascular below. Substance softened places in lumbar region, and reddish tint of grey consistency, some reddish serum in the cornu dentis. Origin of cranial nerve looked quite healthy.   | Healthy. Nerves in thorax contained clots, Aorta free from deposit. No enlarged pinacæ; on examination no tubercles found. Gault healthy. | Small. Great vessels healthy.  | Healthy, adherent.  | Healthy. No cavity of Pericardium.  | Healthy.   | Healthy.   | Soft.                                | Healthy.   | Capsule not adherent. Small surface smooth mottled, with pale spots as if from a stony deposit. Spinal capsule healthy.   | Glands healthy, muscles pale, blood clots small.   |   |
| 5            | Membranes—arachnoid slightly opaque. Substance rather soft and wet, little serum anywhere.  | Membranes and substance of spinal cord healthy, but softened in portions, in all parts normal.   | No membranes.   | Mitral valve covered with reddish fibrine, Aorta healthy.  | Right lung indurated, lobes and slight pockering at apex. Left lung—adhesion at apex; some contraction and pockering of pleura, a few firm tubercles. | Healthy. No cavity of Pericardium.  | Healthy.   | Healthy.   | Slightly enlarged, surface pockered. | Healthy.   | Capsule not adherent. Small surface smooth mottled, with pale spots as if from a stony deposit. Spinal capsule healthy.   | Glands healthy, muscles pale, blood clots small.   |   |
| 6            | Membranes healthy. Substance slightly congested, but otherwise healthy.   | Membranes and substance of spinal cord healthy, but softened in portions, in all parts normal.   | No membranes.   | Healthy.   | Healthy.  | Healthy.  | Healthy.   | Enlarged, considerable deposit of yellow fibrous substance, thickening of coats.   | Normal.                              | One healthy. In the other was a considerable deposit of yellow fibrous substance, thickening of coats. | Yellowish firm deposit in inguinal glands.  |  |   |
| 7            | Both membranes and substance appeared healthy.  | Membranes healthy, but softened in portions, in all parts normal.  | No other notes.   | Healthy.   | Adhesions on both sides, right lung wasted, bloody serum in pleura. No tubercles.   | No notes.   | Healthy.   | Healthy.   | Normal.                              | One healthy. In the other was a considerable deposit of yellow fibrous substance, thickening of coats. | Glands of a deep yellowish color, enlarged in inguinal glands.  |  |   |
| 8            | Membranes healthy. Substance the same, but softened at the fornicæ and septum lucidum.  | Membranes healthy, but softened in portions, in all parts normal.  | In the abdomen healthy.   | Healthy.   | Adhesions on both sides, right lung wasted, bloody serum in pleura. No tubercles.   | No notes.   | Healthy.   | Healthy.   | Normal.                              | Capsule easily separated. Small, surface pale and smooth.  | Glands of a deep yellowish color, enlarged in inguinal glands.  |  |   |

## POST-MORTEM APPEARANCES.] ANÆSTHETIC LEPROSY.—TABLE (III.)

## Cervical Plexus.

| No. of Case. | Auricularis Magnus.  | Superficial Cervical.   | Occlipitalis Minor. | Descending Branches.        | Remarks.  |
|--------------|--|---|---------------------|-----------------------------|---|
| 2            | Soon after emerging for the space of an inch, enlarged and reddish-grey. | Lower branch atrophied at commencement, but where it lay over the Sterno-mastoid much enlarged and transparent.<br>} then 2},<br>beyond this atrophied.<br>Normal size = 1. | Slightly thickened  | Not affected in appearance. | Left side of neck. During life the case was bemused, but the upper part of the neck was not so; the lower part may have been.<br><br>In case 7, the auricularis magnus was diseased in the usual manner, being large, soft, and reddish grey, and streaked. |

## Brachial Plexus.

| No. of Case. | Plexus.  | Internal cutaneous = 1}.   | External cutaneous = 1}.  | Median above = 2 below = 4}.   | Ulnar at elbow = 2}.   | Its dorsal branch = 1-1}.   | Musculo-Spiral.  | Radial = 1}.   | Remarks.  |
|--------------|--|--|---|--|--|---|--|--|---|
| 1            | Not affected   | *  | *   | Above = 2} Below = 6}.   | Above elbow = 2} opposite = 6 below = 2  | *   | Cutaneous branches.  | *  | *Were small and transparent, and very difficult to trace.<br><br>Skin appeared thinned.<br><br>In case No. 7 the ulnar nerve was diseased at the elbow.   |
| 2            | Left side Normal.  | Just after emerging for about an inch thickened reddish and transparent — below this rather atrophied. | After emerging very much thickened, &c., and so for some distance.      | In the arm = 2 middle of forearm = 1} at wrist = 6 and diseased.   | Above elbow = 2 opposite = 6} Red and marbled, below = 2} reddish and transparent.                             | Rounded and more transparent than usual.  | Outer part, the continuation of the radial along diseased. | At elbow = 1} and atrophied; just after emerging near wrist = 3 and diseased.  | Notice the relation of the cutaneous branches of the ulnar and musculo-spiral to the main trunks themselves, showing that part of a nerve may also be diseased, while the entire trunk appears to be so; or one part may be more diseased than another. |
|              | Right side   | Diseased   | More transparent than usual.  | Enlarged and whitish at elbow, but not transparent.  | Considerably enlarged at elbow, but little changed in appearance, atrophied in forearm, looks normal below.    | Much diseased, also the strands which join the main trunk for some distance, very striking. | -  | Considerably diseased after emerging.  |   |
| 3            | Left side  | Right side   | Right side  | Right side   | Right side   | Right side  | Right side   | Right side   | Two enlarged lymphatic glands at the right elbow which may have compressed the internal cutaneous.  |
|              | No apparent change, and microscope reveals none decided. | Much diseased, near axilla = 1} soon after = 3 swollen and red, below opaque in patches.               | Evidently diseased, after emerging = 2} some strands may be unaffected. | Near axilla = 3 looks streaked, in forearm = 2 almost normal, near wrist = 5 opaque and whitish.                       | Near axilla = 2} at elbow = 4} reddened, in forearm = 1} being atrophied, near wrist = 2} looks almost normal. | Just after emerging = 1} round and transparent.   | -  | Soon after emerging = 1 in forearm = 2} red, swollen and semi-transparent.   |   |
|              |  |  |   | Left side.   | Left side.   |   |  |  |   |
|              |  |  |   | Enlarged above, firm, round, streaked, smaller below.  | Less affected, large as far as elbow, small afterwards.  |   |  |  |   |
| 4            | Right side   | On the arm it is diseased.   | Diseased, cord-like and vascular.                                       | In arm = 2} little changed, at elbow = 3} rounded, streaked, in forearm = 2 grey and atrophied, at wrist = 4 diseased. | In arm; grey and rounded, at elbow = 3} in forearm = 2 and atrophied.  | Slightly enlarged, round and transparent.   | -  | Above = 1 turning backwards, below = 2 swollen and grey, afterwards pale and atrophied its strands could be traced along outer side of musculo-spiral. | Pacinian corpuscles were enlarged on some fingers, but digital nerves look atrophied and pale. Radial nerve most diseased. Distortion, and destruction of fingers, but not thinning, extent of lesion being less than might be anticipated.             |

## POST-MORTEM APPEARANCES.] ANÆSTHETIC LEPROSY—TABLE (IV.)

## Lumbar Plexus.

| No. of Cases. | Anterior Crural = 3½.   | Ext. Cutan.                 | Mid. Cut.                   | Obturator. | Long Saphenous.                        | Remarks.  |
|---------------|---|-----------------------------|-----------------------------|------------|--|---|
| 1             | †   | *                           | *                           | †          | *                                      | †† Did not notably differ in appearance when compared with corresponding nerves in a non-leprosy subject.<br>*** Were somewhat increased in size. |
| 2             | Small on both sides, right side = 2½, and transparent, left side = 3. | Little changed -<br>Ditto - | Little changed -<br>Ditto - | - - - -    | Little changed -<br>Slightly atrophied | In case 4 the long saphenous was found atrophied in the leg; in case 5 the anterior crural was found slightly atrophied, none other examined.     |

## Sacral Plexus.

| No. of Cases. | Plexus.         | Great Sciatic = 6 above.                                    | Popliteal = 3.  | Peroneal = 2½.  | Posterior Tibial below = 2½.  | Plantar Internal = 2 External = 1½. | Musculo-cutaneous (cutaneous branch) = 1½.   | Anterior Tibial at ankle = 1.  | Short Saphenous 1 below.                                      | Remarks.   |
|---------------|-----------------|---|---|---|---|-------------------------------------|--|--|---|--|
| 1             | Little changed. | Firm, round grey, 5.  | -   | Near bifurcation 4½.  | Above = 2½ and round, below = 5.  | Internal = 3½. External = 2½.       | Before emerging semi-transparent between the muscles = 1, after emerging = 2½ colour opaque white, firm, terminal branches small and atrophied.  | Small above increasing below, at ankle = 2 and very large on dorsum of foot.             | Above 2, below 1½.  | * In case 5 the anterior tibial was found diminished in size and transparent; no other examined. In case 7 the posterior tibial at the inner ankle was diseased, being enlarged and streaked with blood-vessels, but soft and greyish in colour.   |
| 2             | -               | -   | Right side<br>Above of natural size, below 3½ and 4½.<br>Left side.<br>Looked normal. | Right side<br>Above = 3 afterwards increasing in size.<br>Left side.<br>Above normal, except that part continuous with musculo-cutaneous, for some distance up the thigh. | Right side -<br>Near ankle = 3½ round and firm.<br>Left side.<br>Near ankle 3½ diseased, but less changed in appearance.  | -                                   | Right side -<br>Atrophied above, and for some distance below, on leg and foot.<br>Left side.<br>Before emerging = 1½-2½ and diseased.  | Right side -<br>Diseased 4<br>Left side.<br>Less in size than usual, but round and firm. | Diseased 3½.  | In accordance with the comparative degree of numbness and distortion observed during life, the nerves of the two limbs were found changed to a different extent; the greater the disease in them the greater the distortion, &c.   |
| 3             | -               | -   | -   | -   | Right side -<br>Greatly enlarged, when traced downwards it was found to pass into slough on foot, its coats thickened, and partly destroyed, but strands not affected, vascular in parts. | -                                   | Right side -<br>Before emerging thick, round and transparent, soon after = 2, and much congested (inflamed?), below whitish and diseased above ankle = 3 it passed down to the sole on the dorsum of the foot. | Right side -<br>Small in size near the ankle.  | -   | Superficial sloughs on dorsum of foot, and extensive suppuration, &c. in the sole. Both posterior tibial and musculo-cutaneous nerves passed towards, and into, the midst of these disorganised parts. These facts probably stood in relation of cause and effect. Long saphenous vein filled with pus, all on the right side. |
| 4             | -               | Divided high up, inner part seemed large, outer diminished. | Above, cordlike and firm, but little changed in appearance, = 3½ below = 4½.          | At first flattened = 3½ opposite head of fibula, thicker reddish, striated, = 4½ from this part Ext. Saph. arose.   | Near ankle = 4½ very firm, round and of dead-white colour.  | -                                   | Near head of fibula transparent grey, = 7 at emerging = 1½ and flattened, then larger, and reddish near ankle, afterwards again atrophied, the outer division most diseased.                                   | Atrophied above, thin and adherent, so dorsum of foot larger.                            | Decidedly enlarged and changed before perforating the fascia. | It would seem that the enlarged nerves lose some of their peculiar appearance towards the periphery, as if absorption took place of the diseased deposit, or its conversion into white fibrous tissue, producing a less striking appearance than the deposit at an early stage, though not less characteristic.                |

FATAL CASES.]

(1.) MIXED LEPROSY.—(Anæsthetic and Tubercular).

| No. of Case. | Sex. | Age. | Duration of Disease. | Hereditary Influence and other Remarks.   | Commencement and Course.   | Extent, &c. of Anæsthesia.   | Present Symptoms.   |
|--------------|------|------|----------------------|---|--|--|---|
| 1            | His. | 25   | 6 months.            | No taint, comes from Rajasthan; had syphilis 4 years ago; temperate habits; died of Cholera.                          | No specially premonitory symptoms; had fever, began on face and spread.                          | More or less over all the patches; no other notes.   | On the face are reddish-brown, raised, shining patches, particularly on eye-brows and lower lip, imparting a homine expression; the ears are but little changed, and eye-lashes remain. On the trunk is a scanty eruption possibly erythematous; no patches, but small tubercles scattered about, especially on the extremities, the same eruption is also distinct reddish tubercles; little distortion of hands or feet. The patient is an intelligent, well-developed man. The extremities are oedematous, skin rough and dry, marked with light patches, no distortion of fingers. Subject to fever, when these patches are aggravated (?), testes small, a chancra (?) on penis. Weak but not much emaciated; intelligent. There is incipient tendinitis with bowing of forefoot, knees, nose, and cheeks, and ears; no tubercles on palate; voice natural; no eruption on trunk. There is enlargement at the elbow of left ulnar nerve, with flexion, atrophy, and tenderness of the bony part; little finger much shortened, skin of palm curiously drawn aside; probably partially affected by the disease; a similar part affected though the foot looks swollen, browned, and too rubbery. The patient died suddenly in a convulsion, some time after admission, death preceded by some fever and intense leucæmia. Urine plentiful, light coloured, cloudy, a scanty white deposit sp. gr. 1012, albumen doubtful. |
| 2            | His. | 15   | 7                    | Not known; lived on the coast; died of Cholera.   | Not known.   | Not ascertained with precision; states that all parts (face included) feel numb, arms and legs heavy.  | On the face are reddish-brown, raised, shining patches, particularly on eye-brows and lower lip, imparting a homine expression; the ears are but little changed, and eye-lashes remain. On the trunk is a scanty eruption possibly erythematous; no patches, but small tubercles scattered about, especially on the extremities, the same eruption is also distinct reddish tubercles; little distortion of hands or feet. The patient is an intelligent, well-developed man. The extremities are oedematous, skin rough and dry, marked with light patches, no distortion of fingers. Subject to fever, when these patches are aggravated (?), testes small, a chancra (?) on penis. Weak but not much emaciated; intelligent. There is incipient tendinitis with bowing of forefoot, knees, nose, and cheeks, and ears; no tubercles on palate; voice natural; no eruption on trunk. There is enlargement at the elbow of left ulnar nerve, with flexion, atrophy, and tenderness of the bony part; little finger much shortened, skin of palm curiously drawn aside; probably partially affected by the disease; a similar part affected though the foot looks swollen, browned, and too rubbery. The patient died suddenly in a convulsion, some time after admission, death preceded by some fever and intense leucæmia. Urine plentiful, light coloured, cloudy, a scanty white deposit sp. gr. 1012, albumen doubtful. |
| 3            | Per. | 40   | 1 year.              | None known; had syphilis a year before the rash; nose came on; native of Goa; died of Albugo, scurra and jaundice.    | First numbness of the hand, after thickening of the nose, face, and ears.                        | Two inner fingers and palm of left hand, the latter in pronation not lower to sense of touch.  | On the face are reddish-brown, raised, shining patches, particularly on eye-brows and lower lip, imparting a homine expression; the ears are but little changed, and eye-lashes remain. On the trunk is a scanty eruption possibly erythematous; no patches, but small tubercles scattered about, especially on the extremities, the same eruption is also distinct reddish tubercles; little distortion of hands or feet. The patient is an intelligent, well-developed man. The extremities are oedematous, skin rough and dry, marked with light patches, no distortion of fingers. Subject to fever, when these patches are aggravated (?), testes small, a chancra (?) on penis. Weak but not much emaciated; intelligent. There is incipient tendinitis with bowing of forefoot, knees, nose, and cheeks, and ears; no tubercles on palate; voice natural; no eruption on trunk. There is enlargement at the elbow of left ulnar nerve, with flexion, atrophy, and tenderness of the bony part; little finger much shortened, skin of palm curiously drawn aside; probably partially affected by the disease; a similar part affected though the foot looks swollen, browned, and too rubbery. The patient died suddenly in a convulsion, some time after admission, death preceded by some fever and intense leucæmia. Urine plentiful, light coloured, cloudy, a scanty white deposit sp. gr. 1012, albumen doubtful. |
| 4            | His. | 25   | 2 years.             | None known; never had syphilis; labourer from Herat (coast); has lived mostly on salt fish and rice; died of Cholera. | Light spots on the skin which (?) stain of the nose followed, hands affected within last year.   | There is marked numbness of the entire hand, the fingers, limited below by the body of the thumb, the scap, behind the ears and in the neck. Back of right hand, except thumb; left hand, on front and back of three inner fingers and adjoining forearm. No difference of temperature to touch.   | On the face are reddish-brown, raised, shining patches, particularly on eye-brows and lower lip, imparting a homine expression; the ears are but little changed, and eye-lashes remain. On the trunk is a scanty eruption possibly erythematous; no patches, but small tubercles scattered about, especially on the extremities, the same eruption is also distinct reddish tubercles; little distortion of hands or feet. The patient is an intelligent, well-developed man. The extremities are oedematous, skin rough and dry, marked with light patches, no distortion of fingers. Subject to fever, when these patches are aggravated (?), testes small, a chancra (?) on penis. Weak but not much emaciated; intelligent. There is incipient tendinitis with bowing of forefoot, knees, nose, and cheeks, and ears; no tubercles on palate; voice natural; no eruption on trunk. There is enlargement at the elbow of left ulnar nerve, with flexion, atrophy, and tenderness of the bony part; little finger much shortened, skin of palm curiously drawn aside; probably partially affected by the disease; a similar part affected though the foot looks swollen, browned, and too rubbery. The patient died suddenly in a convulsion, some time after admission, death preceded by some fever and intense leucæmia. Urine plentiful, light coloured, cloudy, a scanty white deposit sp. gr. 1012, albumen doubtful. |
| 5            | Muc. | 35   | 5 years.             | No known taint; several attacks of erysipelas; died of dysentery and exhaustion.                                      | Fever; pale patches on the body, small and not benumbed; no traces of them now.                  | Upper extremities, left side, anæsthesia in forearm and both surfaces of hand, right side slight numbness in forearm and hand. Lower extremities extending to above middle of both legs, feet and toes anæsthetic, on the sole, but when these are placed on ground a cutting or pricking sensation is excited; no feeling of heat, the benumbed parts feel cold.                                      | On the face are reddish-brown, raised, shining patches, particularly on eye-brows and lower lip, imparting a homine expression; the ears are but little changed, and eye-lashes remain. On the trunk is a scanty eruption possibly erythematous; no patches, but small tubercles scattered about, especially on the extremities, the same eruption is also distinct reddish tubercles; little distortion of hands or feet. The patient is an intelligent, well-developed man. The extremities are oedematous, skin rough and dry, marked with light patches, no distortion of fingers. Subject to fever, when these patches are aggravated (?), testes small, a chancra (?) on penis. Weak but not much emaciated; intelligent. There is incipient tendinitis with bowing of forefoot, knees, nose, and cheeks, and ears; no tubercles on palate; voice natural; no eruption on trunk. There is enlargement at the elbow of left ulnar nerve, with flexion, atrophy, and tenderness of the bony part; little finger much shortened, skin of palm curiously drawn aside; probably partially affected by the disease; a similar part affected though the foot looks swollen, browned, and too rubbery. The patient died suddenly in a convulsion, some time after admission, death preceded by some fever and intense leucæmia. Urine plentiful, light coloured, cloudy, a scanty white deposit sp. gr. 1012, albumen doubtful. |
| 6            | His. | 20   | 6 years.             | Father lately became a leper (anæsthetic variety); he is eldest son; comes from Rajasthan (coast); died of Cholera.   | No premonitory symptoms; commenced with thickening of skin and numbness in nates.                | All parts of face slightly benumbed. Upper extremities, left side, anæsthesia in forearm and both surfaces of hand, right side slight numbness in forearm and hand. Lower extremities extending to above middle of both legs, feet and toes anæsthetic, on the sole, but when these are placed on ground a cutting or pricking sensation is excited; no feeling of heat, the benumbed parts feel cold. | On the face are reddish-brown, raised, shining patches, particularly on eye-brows and lower lip, imparting a homine expression; the ears are but little changed, and eye-lashes remain. On the trunk is a scanty eruption possibly erythematous; no patches, but small tubercles scattered about, especially on the extremities, the same eruption is also distinct reddish tubercles; little distortion of hands or feet. The patient is an intelligent, well-developed man. The extremities are oedematous, skin rough and dry, marked with light patches, no distortion of fingers. Subject to fever, when these patches are aggravated (?), testes small, a chancra (?) on penis. Weak but not much emaciated; intelligent. There is incipient tendinitis with bowing of forefoot, knees, nose, and cheeks, and ears; no tubercles on palate; voice natural; no eruption on trunk. There is enlargement at the elbow of left ulnar nerve, with flexion, atrophy, and tenderness of the bony part; little finger much shortened, skin of palm curiously drawn aside; probably partially affected by the disease; a similar part affected though the foot looks swollen, browned, and too rubbery. The patient died suddenly in a convulsion, some time after admission, death preceded by some fever and intense leucæmia. Urine plentiful, light coloured, cloudy, a scanty white deposit sp. gr. 1012, albumen doubtful. |
| 7            | His. | 35   | † 10 years.          | No taint, never had syphilis, comes from Deccan; died of exhaustion from chronic dysentery.                           | First, tubercles on face, then on body, afterwards hands benumbed, severely suffered from fever. | Of most parts of trunk and of ears, of upper extremities and hands, of lower extremities and feet, so in legs and feet, of many parts of trunk, including the back. It is not apparently altogether limited to the palm patches.   | On the face are reddish-brown, raised, shining patches, particularly on eye-brows and lower lip, imparting a homine expression; the ears are but little changed, and eye-lashes remain. On the trunk is a scanty eruption possibly erythematous; no patches, but small tubercles scattered about, especially on the extremities, the same eruption is also distinct reddish tubercles; little distortion of hands or feet. The patient is an intelligent, well-developed man. The extremities are oedematous, skin rough and dry, marked with light patches, no distortion of fingers. Subject to fever, when these patches are aggravated (?), testes small, a chancra (?) on penis. Weak but not much emaciated; intelligent. There is incipient tendinitis with bowing of forefoot, knees, nose, and cheeks, and ears; no tubercles on palate; voice natural; no eruption on trunk. There is enlargement at the elbow of left ulnar nerve, with flexion, atrophy, and tenderness of the bony part; little finger much shortened, skin of palm curiously drawn aside; probably partially affected by the disease; a similar part affected though the foot looks swollen, browned, and too rubbery. The patient died suddenly in a convulsion, some time after admission, death preceded by some fever and intense leucæmia. Urine plentiful, light coloured, cloudy, a scanty white deposit sp. gr. 1012, albumen doubtful. |

(9986.)

2

[Viscera.

(II.) MIXED LEPROSY.—(Anæsthetic and Tubercular.)

POST-MORTEM APPEARANCES.]

| No. of Case. | Brain.  | Spinal Cord.   | Sympathetic.   | Heart.   | Lungs.   | Intestinal Canal.   | Liver.  | Pancreas.            | Spleen.   | Kidneys.   | Remarks, &c.  |
|--------------|---|--|--|--|--|---|---|----------------------|---|--|---|
| 1            | Membranes and substance apparently quite healthy.   | Membranes healthy. Substance rather firm and grey, but not so dense as in leprosy. Roots of spinal nerves healthy.             | In the abdomen appeared healthy; a few enlarged glands were probably ganglionic. | Healthy, loose dark color in its cavities.   | Healthy, little congestion, no pleurisy of pleura.   | Quite healthy in appearance, no thickening of peritoneum.   | Somewhat congested and cornu-looking, but no evident disease.   | Healthy.             | Small and healthy.                                    | Capsule healthy, of usual size and colour, cysts in case; minute structure healthy.  | P. M. E. 12 hours after death: urine copious, white, thin, and not affected by heat and nitric acid. P. M. E. 10 1/2 hours after death. |
| 2            | Membranes healthy. Substance soft, but equally so all over the brain.   | Membranes healthy. Substance rather soft, but equally so in all parts equally.   | In the neck and abdomen seemed hardly changed.                                   | Flabby; small cysts in right ventricle, aorta healthy.   | Healthy, no adhesions, &c.                           | Healthy, mucous membrane pale.  | Of natural size and appearance, substance rather soft and pale.   | Red and rather soft. | Large, of purple colour; capsule dense.               | Capsule slightly adherent or thickened, capsule rather large, granular; substance very flabby and soft, s. r. capsular healthy.  | P. M. E. not until 36 hours after death.  |
| 3            | Membranes pale and stained yellow. Substance soft, but equally so all over the brain. Cranial nerves looked healthy.  | Membranes stained yellow. Substance soft, but equally so in all parts of nerves; to all appearance normal.                     | Not specially examined.  | No disease; loose state in right side.   | Slightly emphysematous, margins and apex.            | Appeared healthy, umbilical.  | Of full size, dark colored, smooth surface, serosa coat clear and free of adhesions. Substance mottled, light yellow patches around the light patches were owing to fatty degeneration. | Healthy.             | Very large, friable, free adhesions.                  | Capsule transparent, slightly adherent, enlarged, outer surface smooth, pale; sections, parasitic-like, evidence of a light deposit and fatty degeneration, stained with bile. | P. M. E. five hours after death, urine not secreted by section. Urine unhealthy.  |
| 4            | Membranes pale. Substance everywhere firm and pale; small cysts throughout. Cranial nerves healthy.   | Membranes pale. Substance of a parchmenty healthy appearance. Also roots of spinal nerves.                                     | In chest and abdomen, healthy in aspect.   | Healthy.   | Healthy.   | Healthy in aspect.  | Of rather small size, but particularly healthy.   | Healthy.             | Enlarged, substance friable; no adhesions.            | Capsule normal, small and firm; surface and smooth, colour rather thick.   | P. M. E. very soon after death, rigour mortis.  |
| 5            | Membranes pale. Substance soft and pale, especially in interior, about the optic thalami, not so dense as in other parts. Origin of cranial nerves healthy.                           | Membranes pale. Substance pale and soft throughout, grey matter of very different roots of nerves; roots looked a little thin. | In chest and abdomen, normal; also roots of spinal nerves.                       | Slight opacity of aortic valves and lining membrane of left ventricle; also of pericardium; otherwise healthy. | Considerably congested; no opacity of pleura.        | Peritoneum slightly reddened; it contained a little yellowish mucus; some aneurysmal ulcers in Rectum.      | Large and firm; it contained two small abscesses small with yellowish mucus; one superficial, one deep.   | Healthy.             | Enlarged, firmly adherent; capsule thick and spotted. | Capsule thin and adherent, organs large and firm, outer surface mottled and thick and light colored, spotted with cysts, s. r. capsular healthy.                               | P. M. E. made eight hours after death: decomposition consistent with Urine contained albumen. Phlebocysts in left arm.                  |
| 6            | Membranes healthy. Pulchritudinous bodies large and numerous; base of skull seemed to press on 3rd div. of 5th, which nerve however was not changed in appearance. Substance healthy. | Membranes healthy. Substance firm and healthy; also roots of spinal nerves enlarged.   | Healthy in aspect in cavity of pericardium; of rather firm and enlarged.         | Healthy.   | Healthy.   | Mucous membrane congested in intestines and marked with small ulcers, ecchymoses in stomach and intestines. | Of usual size, mottled, rather filled with yellowish green bile.  | Healthy.             | Healthy, not enlarged.                                | Of usual size, congested, but otherwise particularly healthy state.  | Body contained fat; diet of cholera.  |
| 7            | Membranes healthy. Substance softened. About central parts: posterior cornua of lateral ventricles large; cranial nerve healthy.  | Membranes healthy. Substance rather soft, compressed during extraction of cord; spinal nerves healthy.                         | Sublingual ganglion rather large (no disease detected by microscope).            | Healthy; small copious patches on pericardium.   | Inflammation upper lobe left lung; mucus in trachea. | Mucous membrane congested in intestines and ulcers in Rectum.   | Healthy, the distinctness of brown and yellow substance very apparent.  | Healthy.             | Adherent capsule thickened; texture healthy.          | Capsule not adherent, size small, outer surface smooth, on section no evident morbid change was seen.  | P. M. E. 18 hours after death.  |

## POST-MORTEM APPEARANCES.] MIXED LEPROSY.—(III.)

## Cranial Nerves.

| No. of Case. | Origins.                     | Fifth Pair.   |  |   |  | Remarks.   |
|--------------|------------------------------|---|--|---|--|--|
|              |                              | Gasser. Gangl.  | Supra-Orbital.   | Infra-Orbital.  | Mental.  |  |
| 1            | - - -                        | - - -   | Slightly rounded   | Atrophied?  | Rounded?   | Numbness in patches on face, doubtful if elsewhere.                                    |
| 2            | - - -                        | On left side grey matter, and three divisions atrophied, second and third most. | Frontal n. reddish and slightly atrophied, after emerging on forehead, round grey and firm.  | Looked small and reddish, brs. to nose and lip flattened and red, diseased. | Inferior maxill. not affected, on terminal brs. a slight adherent deposit. | Other cranial nerves healthy, except facial changed as fifth on the face.              |
| 4            | Nothing abnormal seen.       | Normal and main divisions.  | After emerging large reddish and semi-transparent.   | Unchanged in appearance.  | Unchanged in appearance.   | Right side only examined. Numbness of face during life, skin tumefied.                 |
| 5            | Pale and soft, not diseased. | Slightly soft and atrophied?  | On emerging = 2 (normal=1) white and opaque, then red and characteristically enlarged, afterwards suddenly small and pale; nasal br. probably atrophied. | Appeared small, but white though less firm than usual.                      | Perhaps a little reddened and rounded.                                     | Eighth pair healthy. Skin of forehead slightly infiltrated and hairs scanty and small. |
| 6            | - - -                        | - - -   | In several of branches deep red stains were seen which may have indicated deficient nutrition.   |   |  | Other cranial nerves healthy, except spinal access, also stained.                      |
| 7            | Healthy                      | Healthy   | In orbit, round and firm, its brs. diseased, greatly enlarged.   | Normal  | Normal   | Microscopic examination showed nucleated deposit in fibres of sup. orbit. n.           |

## Cervical Plexus.

| No. of Case. | Superficial Cervical = 1.                     | Auricularis Magnus = 14.   | Occipitalis Minor =                         | Descending Branches.  | Remarks.  |
|--------------|---|--|---|---|---|
| 1            | Atrophied                                     | Soon after emerging = $3\frac{1}{2}$ , diseased.   | Slightly diseased rounded, $1\frac{1}{2}$ . | Their trunk of origin vascular.   | Ears but slightly changed in appearance.  |
| 2            | Left side, atrophied?                         | Left side, = $2\frac{1}{2}$ after emerging and reddish-grey, before emerging = $\frac{3}{4}$ and white. Right side, much diseased. | Slightly changed                            | Not notably changed   | Right ear more affected than left.<br>Root of <i>auric. mag.</i> and corresponding spinal nerves and their ganglia, not apparently changed. |
| 4            | Some terminal branches looked red.            | Just after emerging = 2, and changed in usual manner, terminal brs. less affected.   | Probably slightly diseased after emerging.  | Doubtfully affected, perhaps a little large, but opaque.                            | Ears much enlarged and benumbed, no numbness of neck.   |
| 5            | Affected, but not much.                       | Soon after emerging = $2\frac{1}{2}$ , red and round.  | Perhaps a little less in size.              | All probably affected, particularly the clavicular below the clavicle.              | Right side only examined. Ears much enlarged. C. plexus itself looked thin.   |
| 6            | Healthy                                       | Semi-transparent, and strands indistinct = $1\frac{1}{2}$ largest just when reached ear.   | Small                                       | Going to shoulder and pectoral region were decidedly enlarged and semi-transparent. | Phrenic and other muscular brs. not changed. Ears were swollen.   |
| 7            | Decidedly enlarged after piercing the fascia. | Greatly enlarged = $5\frac{1}{2}$ flattened and grey, terminal brs. small.   | -   | All seemed to be healthy.   | Lobules and rim of the ears superficially ulcerated, not greatly enlarged.  |



## POST-MORTEM APPEARANCES.] MIXED LEPROSY.—(V.)

*Sacral Plexus.*

| No. of Case. | Plexus, Gr. Sciatic, &c.  | Posterior Tibial at Ankle=3½.  | Plantar.  | External Saphenous=1.   | Peroneal=2½.   | Anterior Tibial=1.  | Musculo-cutaneous=1½.   |
|--------------|---|--|---|---|--|---|---|
| 1            | Gr. Sc. large flattened, not diseased; cutaneous branches of small sciatic not changed. | At ankle=4, round and red, but not from inflammation probably.   | Rounded and reddened, but so much diseased as the cutaneous nerves of the foot. | The communicating brs. were healthy; the main trunk=1½, after emerging it became reddened and large=4, on dorsum of foot, tough, grey and adherent. | At first=2½; afterwards rounded, red, streaked with vessels=5½ to 8, marbled and semi-transparent. | At first small, atrophied in leg, at ankle red=2, and diseased also its brs. on the foot. | At commencement=1 and white, on emerging=2½, red and irregularly, thick, at ankle 4½, thick and adherent, atrophied at intervals, digital brs. atrophied. |
| 2            | -   | Diseased at ankle  | -   | -   | -  | -   | Diseased in leg and foot.   |
| 4            | -   | Enlarged, red, and soft.   | -   | -   | -  | -   | Very large, red, flat, and soft.  |
| 5            | Gr. Sc. not changed.  | Little changed, rounded? but diseased.   | Reddish, slightly enlarged.   | -   | Little changed; probably large and round.  | The same  | Diseased, but not much altered, round and transparent.  |
| 6            | Small sciatic, cutaneous filaments on thigh decidedly affected.                         | At first=4½, then=3½ in middle of leg=6 and diseased, at the ankle=7 and reddened.                     | -   | Peroneal br.=3, popliteal br.=1, trunk very red and firm like a cord.   | Near head of fibula=3.   | Firm, round=2½.   | At first 1½, after it became larger, flattened, and red.  |
| 7            | Gr. sciatic large, not diseased.  | In middle of leg=4 rather firm, at ankle=9½, it would be difficult to exaggerate this striking change. | -   | Of reddish grey colour, much diseased in whole length.  | Enlarged near head of fibula, and its cutaneous branches.  | Large, red, semi-transparent on dorsum of foot, where are ulcers, sloughing of skin, &c.  | Much enlarged at its very origin, and on emerging more so; atrophied on dorsum of foot.   |

*Lumbar Plexus.*

| No. of Case. | Plexus, &c.                     | Anter-Crural=4.            | Exter. Cutan.=1.   | Middle Cutan.=1½.  | Internal Cutan.  | Obturator.        | Long Saphenous=1½.  |
|--------------|---------------------------------|----------------------------|--|--|--|-------------------|---|
| 1            | -                               | Strands broad and thin=5½. | Atrophied?   | Same   | Same   | Main healthy brs. | Atrophied in leg, below reddish and transparent.                                      |
| 6            | Healthy, also Gento-crural.     | Normal                     | On emerging atrophied below=2; thickened, yellowish, and semi-transparent. | Before emerging, atrophied, lower down=2½ and, and affected in same way. | At first small, below very enlarged=2 thickened and transparent. | Healthy           | At origin 1½ and normal, behind the knee-joint, before emerging=3½ and more vascular. |
| 7            | Healthy and brs. in the pelvis. | -                          | -  | -  | -  | -                 | Enormously enlarged from knee downwards, and brs. over patella.                       |

## FATAL CASE.] TUBERCULAR LEPROSY.—TABLE (I.) [J. J. HOSPITAL.

| Caste. | Age. | Duration of Disease. | Commencement.                                       | Present State.  | Other Remarks.   |
|--------|------|----------------------|---|---|--|
| Hind.  | 20   | 4 years              | By pale spots, especially on face, not now visible. | Much emaciated, and stunted in growth. Well-marked tubercular thickening of eyebrows, cheeks, lips, and chin, and particularly of ears, with loss of hair on the first and face generally, the expression is very characteristic (Serpentina), nose depressed, eyes round and staring, &c.; the skin is smooth, shining, and rather pale in these parts, giving the impression of there being some soft effusion beneath. Voice feeble. Is intelligent enough. No eruption on, or tubercular thickening of skin or trunk, but this is dry and harsh. No distortion of the extremities, which, however, are rather oedematous, and there are large sloughing sores at the ankles close by the Tendo Achillis, also a large circular slough over the right knee-pan. Nipples very small: testes not so. Palate sensation is diminished on brows and cheeks, more so on ears; also back of left fore-arm and left hand, hardly so on right upper extremity. Lower extremities not examined on account of his great debility. Suffers little pain, and has chronic dysentery. | Is not aware of hereditary taint, but knows very little about his family.<br><br>Denies syphilis. Died of chronic dysentery. |

## POST-MORTEM APPEARANCES.]

## Viscera.

| Brain, &c.   | Spinal Cords, &c.   | Sympathetic.  | Heart, Lungs.  | Intestinal Canal.   | Liver.  | Pancreas, Spleen.                        | Kidneys.   | L. Glands, Blood, Muscles, &c.  |
|--|---|---|--|---|---|--|--|---|
| Membranes, pale but clear: pia-mater marked with grey patches of pigment. Substance, pale and rather soft, particularly in central parts, but no morbid appearances. Cranial nerves at origin, pale but healthy. | Membranes healthy. Substance tolerably firm, particularly at lumbar swelling, softened by accident in dorsal region; grey matter seemed healthy, and so roots of spinal nerves. | Both splanchnic nerves near the Diaphragm presented a firm swelling, apparently ganglionic. Semi-lunar ganglia well seen healthy. | Heart healthy, aorta free from atheroma. Lungs slightly adherent but healthy; specks of opacity in pleura. | Mucous membrane pale but healthy, except in rectum, where numerous small ulcers were seen, and patches of inflammation; no opacity of peritoneum. | Healthy in appearance, left lobe rather larger than usual. Gall-bladder contained healthy bile. | Pancreas healthy; Spleen large and soft. | Capsule slightly adherent; size of organs full; surface smooth, and pale; cortical substance pale, but normal in amount. Sup. Ren. capsules healthy. | Glands large and red in lobes, very numerous, soft, and pale in mesentery as if from deposit. Blood coagulated; muscles pale.—P. M. E. made 23 hours after death. |

## POST-MORTEM APPEARANCES.]

## TUBERCULAR LEPROSY.—TABLE (II.)

## Cranial, Cervical, and Brachial Nerves.

| Cranial Nerves.   | Cervical Plexus.   | Brachial Plexus.   | Remarks.   |
|---|--|--|--|
| Fifth only examined, outside the skull, supra-orbital—trunk rather firm, branches apparently healthy. Infra-orbital and mental—healthy in appearance. | Superficial branches only examined.<br><br><i>Auricularis magnus</i> just after emerging acquired a broad flattened appearance and was of a reddish-grey colour being decidedly diseased=2, (normal=14). The other branches as far as traced appeared healthy. | Left side.— <i>Internal cutaneous</i> main branches healthy in arm, but the posterior branches soon became enlarged, reddish and evidently diseased. <i>Lesser internal cutaneous</i> was also diseased soon after emerging from beneath the fascia, and onwards. <i>Ulnar</i> affected in the usual way about the elbow, and again near the wrist; here the <i>dorsal branch</i> was similarly diseased, and equal in size to the main trunk. <i>Median</i> seemed rather large and round just above the elbow, but near the wrist was flattened considerably and diseased.<br><br>Right side.— <i>Internal cutaneous</i> was considerably less affected than on opposite side, <i>ulnar</i> and <i>median</i> diseased to a considerable extent, but not of firm consistence as usual. | When compared with the alterations of sensibility these changes in the nerves afford satisfactory explanation.<br><br>There was generally a want of roundness and firmness in the affected nerves, indicating a slighter degree of disease than usual. |

## Lumbar and Sacral Plexuses.

| Lumbar Plexus.  | Sacral Plexus.   | Remarks.  |
|---|--|---|
| <i>Middle cutaneous</i> affected in a characteristic manner just after perforating the fascia lata, and the branches going to the knee, where, on the right side, was a large sloughing ulcer of round form.<br><br><i>Internal saphenous</i> also diseased below the knee, and its branch to the skin in front of the joint. | <i>Musculo-cutaneous</i> , decidedly but not greatly diseased.<br><br><i>Posterior tibial</i> much diseased on both sides at the lower part of the leg and near the sloughing ulcers the feet. | It may be asked, is there not a causal relation of the diseased nerve-branches to the local destruction of the integument, or at least a predisposition to exhaustion of vitality from any ordinary irritating influence, as the result of nerve disease? |

SECTION II.

GENERAL CHARACTERS AND NATURAL HISTORY OF  
LEPROSY. DIAGNOSIS.

CHAPTER I.—AS REGARDS THE DISEASE.

- |                             |                           |
|-----------------------------|---------------------------|
| 1. UNITY OF LEPROSY.        | 5. COURSE OF THE DISEASE. |
| 2. ITS LOCAL MANIFESTATION. | 6. DURATION.              |
| 3. PRODROMATA.              | 7. TERMINATIONS.          |
| 4. EARLY SYMPTOMS.          | 8. COMPLICATIONS.         |

1. UNITY OF THE DISEASE.

It is now proposed to consider leprosy as a whole, *i.e.*, as a malady in which are found, either separately or combined, the three phases of eruption, tubercles, and numbness, above described. I have already stated that these phases—whilst in a sense chronologically connected—are not to be regarded as so many natural stages of the complaint, and that one or other may predominate for the greater part, or whole, of life. It is further to be observed that although in the fuller development of the disease—as such term would be commonly understood—the tubercular form tends to predominate, and in milder degrees, the eruption or numbness are most apparent; yet in every sufficiently large sphere of adequate observation, every one of these phases is some time or other to be seen. The fundamental subject of the unity of leprosy is, therefore, to be viewed in a two-fold aspect, namely, first as regards the specific characters, and next, as regards the natural varieties of the disease.\*

\* In their treatise on Spédalskhed, the Norwegian authors remark, with reference to this topic:—"The two forms under which this disease shows itself, and which have now been described, have, at first, characters so various that their generic difference, in contradistinction to the specific, was strongly insisted upon. But although we think the morbid unity of the two forms in question, has been fully shown, we may add some considerations which will serve to remove all doubt. Without any certain cause, one of these forms changes into the other; and this phenomena we have often seen, in tubercular spédalskhed . . . . we have also observed some cases, in which the anæsthetic form was converted into the tubercular . . . . ;

" and besides, we also see that the same kind of life, of social conditions, of attention to the skin, and the same physical circumstances, produce in one person the anæsthetic, and in another the tubercular form: that parents attacked with the first, bring into the world children, who, sooner or later, may be attacked with the last; and lastly, that the children of these (offspring of offspring) may, in their turn, be attacked with the anæsthetic form." . . . . These authors add their opinion, that one is not a development of the other: but "that both are independent, morbid forms, which have a separate course and tend to the premature death of the subject attacked by them . . . ." (*loc. cit.*, p. 318): but, as in some other parts of their

*The specific character of leprosy.*—That this malady is the same in all its forms or phases, appears on the following grounds:—*a. Of clinical history.*—Thus one form passes into another, or is accompanied by either one or both of the others, *e.g.*, the eruption is attended by anæsthesia, and sometimes by tubercles. Anæsthesia commonly attends both eruption and tubercles; and, lastly, tubercles are attended by both the other symptoms. These facts have been substantiated in the preceding section of this Memoir, and the general order of phenomena will be presently more fully considered.

*b. Of natural history.*—Parents exhibiting one kind of leprosy may have their children affected with the other forms; in the same family one child may have one form and one another; finally, in the same locality, residents living under the same outward conditions may be affected in various ways.

*c. Anatomical grounds.*—The same characteristic structural elements are found in all three forms: they underlie and account for (as I think), all the signs of the malady, in whatever phase this is seen; and I may add, no other than these are necessarily present.

*d. Historical testimony.*—In all countries where sufficient pains to observe have been taken, the several forms now mentioned have, as a rule, been sufficiently discriminated as belonging to one disease, although predominance of one or other is commonly remarked. Sometimes, however, non-essential points have been so much insisted upon, as to render obscure the more simple and correct inference from observation, and testimony of this kind is, therefore, of but limited value.

Each of the series of phenomena just mentioned is independently conclusive, and may be differently appreciated; but to my mind the uniformity of structural character which leprosy presents, is of all these series, the most emphatic.

2. *The local varieties of the disease.*—A. That the malady is the same in different parts of the globe, at the present day, seems to be sufficiently well established, and it would be easy to collect the concurrent testimony—both direct and indirect—of numerous observers, fully competent to judge of points of resemblance or difference. One illustration may here be referred to in detail:—

*a.* Leprosy in Norway presents certain well-marked characters, which here may be assumed to be typical; and I would add, with regard to the more chronological question of sequence in time, that the malady has now the same characters as formerly, whence a direct connexion of the present and the past.\* *b.* Leprosy in the south of Europe, *e.g.*, in Italy and Greece, presents the same characters as does the disease in Norway, whence an inference of special value, because these southern forms of the malady are known to have been originally introduced from the East—the birthplace of the complaint.† *c.* Leprosy in India (taking Western India as an illustration), is also the same as

book, it is not always easy to reconcile statements of opinion expressed on different pages; and here, I do not suppose that Daniellssen and Boeck intended to lay stress upon a difference or antagonism, which the general tendency of their researches, as well as particular passages which might be quoted, does not certainly either maintain or imply.

\* Respecting this point, it may be enough to remark, that in their sagacious and interesting historical summary, Daniellssen and Boeck (*Traité de la Spédalskhed*, part 1), after quoting the descriptions of old observers, proceed thus:—"After this account, it is sufficiently clear, that the lepra of the middle ages was the same disease as that described by Aretæus, under the name of elephantiasis: in the second part of this work, we shall prove that our spédalskhed is likewise identical

with elephantiasis." I make this single quotation out of the many that might be chosen, simply that the continuity of observation instanced in the text, may remain unbroken.

† The authority I have in mind for the above statement, is the present Professor W. Boeck, of Kristiania, who about the year 1840 visited the countries named, upon a special mission of investigation, and afterwards thus records his opinion—speaking of tubercular leprosy:—"The proper symptoms of the disease are the same in all places, where I have noted them; and this assertion will be found to be confirmed in the appended cases. The only modifications which I have remarked are, 1. That in the southern climates, the women are attacked by ulcers as well as by tubercles. 2. That the *eczema impetiginodes*, which so generally occurs in

in Norway, as I think myself to have ascertained by direct observation. This remark is also noteworthy, because the Oriental forms of complaint have probably existed in times prior to the historic; so here again, chronology and locality combine to add force to the affirmative opinion of the unity of the leprosy, the perpetual unity, as it would now seem. *d.* As regards the New World, or Western continents of the globe, it may suffice to observe that medical observation has established the complete identity of leprosy in these parts with that of Eastern forms. I would add, too, that the disease in the Americas and intervening islands, is an imported malady, which, as might be anticipated, has retained in the West its essential characters, seemingly unchanged.\*

B. This comprehensive unity of leprosy in all its forms, is not inconsistent with a tendency to the predominance of any particular phase or feature, and the fact that certain distinctions have, from earliest times, been made and for a time recognised, is of itself evidence that there occur natural variations of the complaint. It is not possible to write with precision respecting the varieties of leprosy insisted upon in former times—*e.g.*, the middle ages—for obviously they were mostly based upon mere incidental modifications of symptoms; and as regards the present time, it seems to me that all such natural variations as are worthy of the name, may be properly understood to mean unusual predominance of eruption, tubercles, or numbness, respectively. At all events, it is necessary to make some definitions, and those now proposed may be tentatively adopted.

Respecting the existence of varied forms, I remark that illustration on a large scale is offered by Norway and India at the present day; for example, while tubercles are the commonest signs in Europe, the wasting of the digits is most frequent in the East.

The following tables express the result of my early observations in India, and for the sake of comparison, there are subjoined some corresponding figures from Norway, elicited at about the same date. Respecting the former, I noted at the time:—"Such, according to an arbitrary arrangement, was the condition of patients when first seen; sometimes the disease was advanced, sometimes only commencing, and on the more predominant symptoms alone were these distinctions made," and may here observe that the total per-centage of anæsthetic cases corresponding with Danielssen's figures (33·3), would be that of combined eruption and anæsthetic form, namely, 69·4, whence a contrast sufficiently marked. The tendency to predominance of nerve-

"our lepers, is much rarer in the south. Lastly, if it be thought that this disease, whose home is in the warmer climates, is necessarily more developed there, such opinion would not accord with my experience: for I saw it nowhere in the south, so malignant as it is with us, in Norway." This remarkable passage I introduce here, from its connection with the preceding; and shall afterwards more particularly allude to it. Respecting anæsthetic leprosy—his 'smooth' form—Boeck thus writes:—"This variety also remains the same in all climates; and if I may judge from the fewer patients of this kind, whom I have seen in the south, there is no other modification to indicate, than that the *eczema impetiginodes* is a rarer attendant on leprosy, than it is in Norway." From these extracts it will be sufficiently apparent, without the introduction here of cases in detail, that in main features, at least, the unity of the disease remains unimpaired.

(1936.)

\* It is desirable to establish this statement on suitable evidence, but, for the present, I must be content with referring, first, to what seems to be universal testimony, as recorded in all later writers on leprosy; and, next, to experience of observers in England, who have had opportunities of seeing the forms of leprosy contracted by Europeans, or half-castes, in the West, as well as in the East, and who have always recognised the fundamental unity of the complaint, even when originating in widely-separated regions of the earth. I have only to remark that the imported malady still persists in a colder part of North America, and an older form still nearer the pole; whilst in tropical and South America it also prevails, again partly, at least, as an imported malady, being known amongst the Spanish-speaking races as 'morphaea'—a term whose persistence would be worth while tracing, did space allow.

disease in India is likewise shown in the larger proportion of instances of mixed leprosy, viz., 21·5 as compared with 15·1 in Norway.\*

COMPARATIVE FREQUENCY OF THE VARIETIES OF LEPROSY.

TABLE 1.—*In Bombay.*

| Variety of Disease.      | Dispensary Patients. | Poor-house Inmates. | Hospital Deaths. | Total. | Per-centage. |
|--------------------------|----------------------|---------------------|------------------|--------|--------------|
| Eruption - - -           | 5                    | 9                   | 0                | 14     | 7·5          |
| Eruption and Anæsthesia  | 22                   | 26                  | 0                | 48     | 25·8         |
| Anæsthetic Leprosy - -   | 29                   | 29                  | 9                | 67     | 36·1         |
| Anæsthesia and Tubercles | 5                    | 28                  | 7                | 40     | 21·5         |
| Tubercular Leprosy - -   | 2                    | 14                  | 1                | 17     | 9·           |
| Total - - -              | 63                   | 106                 | 17               | 186    | —            |

TABLE 2.—*In Norway.*

| Variety of Disease.          | Total. | Per-centage. |
|------------------------------|--------|--------------|
| Anæsthetic Leprosy - -       | 488    | 33·3         |
| Anæsthesia and Tubercles - - | 222    | 15·1         |
| Tubercular Leprosy - -       | 758    | 51·6         |
| Total - - -                  | 1,468  | —            |

In the absence of sufficient information, I am unable to proceed further for India; but, as regards Norway, the following extract from Dr. Daniellssen's Monograph is very noteworthy. Referring to the diocese of Bergen and prefecture of Stavanger, the author remarks:—"In some districts the anæsthetic form is much more frequent than the tuberculous, and it may not be the result of pure accident that Vos, Lærdal, and Inner Sogn are just those places where the great majority of anæsthetic cases are found." As a conjecture, one would anticipate that in every large province infected with leprosy such a preponderance of one natural variety over the others will be, by and bye, made known; and this subject is one of those needing special attention.† As to the explanation which may be offered of the predominance in question, not much of value is known to me; but I will observe, first, that climate (in its wide sense) is, doubtless, effective. Thus, leprosy is generally a severer malady in the colder

\* The small proportion of cases with eruption alone which was seen, is illustrative of the fact that this phase or type seldom lasts long—loss of feeling in other parts than the patches, following on—and that it is an early symptom of disease, has been elsewhere shown. The tables also indicate what class of patients will be found in dispensary and asylum, respectively. In the original article, it is added at foot:—"Notes of 17 other cases now before me were unfortunately mislaid before this table was drawn up; they would only serve, however, to confirm the results it points to. One was fatal, the patient being a Portuguese female suffering from anæsthetic leprosy, and finally anasarca, &c." In the Madras Leper Asylum (1873) the per-centage of tubercular cases was 41·24; of anæsthetic, 58·76; and in an asylum at Trinidad, in the West Indies, (1870), the number of cases of the anæsthetic, or non-tuberculate, form of the disease was only a trifle more than that of the tuberculate disease, while that of the mixed form was one-third less numerous than either." Milroy, *loc. cit.*, p. 19. Respecting the class of cases admitted into hospital or asylum, in India, or attending as out-patients at dispensaries, a different proportion in the two instances, may be looked for; for, only the more severe forms of disease would probably resort to asylum or, in India, to hospital, whilst earlier and

milder cases would be seen at the dispensaries. That differences exist, however, in the respective proportion of mild and severe leprosy in every large district, I have already intimated; and as regards India, may instance an enumeration quoted at p. 294 of the Bengal Reports: here the totals were of lepra tuberculosa, 1,611; of lepra anæsthetica, 305; showing a predominance of the former kind of disease, which is not in accordance with experience in Western India. In the Jamssetji Jejeebhoy Hospital, Bombay, there was, in 1873, an almost exactly equal proportion of anæsthetic and tubercular cases. The determination of those influences which lead, respectively, to the milder and more severe forms of the leprosy complaint, is a practical point of the greatest importance; and might well be pursued in so wide a field as India presents. In the island of Crete, the proportion of 'anæsthetic' leprosy was lately 42 per cent.

† Respecting the so-called 'lepra gangrenosa' of New Zealand, I am disposed to agree with those who, not having seen the disease, do not think it to be a form of true leprosy. At all events, there does not seem to have been noticed any signs of the leprosy nerve-disease; and in the absence of an authentic diagnosis, no sound inference of any kind can be made.

than in warmer climes.\* It is well known that both epidemic and endemic diseases are influenced by climate, and, for example of the latter, I may again point to India and Europe, with reference to the comparative prevalence of the chief forms of ague. Again, when declining, a disease may offer seeming peculiarities in its intensity or course; leprosy, when spontaneously disappearing, has been said to become wholly hereditary, though I am not aware that then the milder anæsthetic form certainly tends to predominate over the nodular, and this a point for future investigation. On the other hand, a newly introduced disease is likely to assume a severe form, and, probably, it would be found that this remark applied to leprosy in perfectly untainted subjects, such as Europeans living in the tropics; but instances of that kind are really of a complicated order, there being superadded to infection of the system the adverse influence of cold climate. I shall afterwards point out that a sort of natural variety of leprosy is thus induced, which is distinguished by the greater predominance of febrile symptoms than occurs in purely tropical forms of the disease. Lastly, there would be to consider the question of the existence of a natural tendency to vary, whatever may be the meaning of such expression as it is commonly understood; but as I possess no facts of a definite character bearing in this particular subject, it must be left for future consideration.

## 2.—REGIONAL MANIFESTATION IN THE BODY.

Reference is here made (1.) to the actual and relative position of the outward signs of the disease; and (2.) to their distribution on the two sides of the body.

1. *a. Positive.*—The fact is a significant one, that leprosy in all its forms has its earliest and chief manifestations in those parts of the frame which are situated furthest from the trunk, and which are habitually most exposed to injurious external influences. Thus, 'tubercles' are commonest and most developed upon the face and ears; 'anæsthesia' in the terminal segments of the limbs; the 'eruption' also upon the extremities. By their position, these regions are specially exposed to variations of atmospheric temperature, movement, and moisture; and the last named amongst them also to frequent contact with water, soil, plants, animals, and other human beings; by their conformation, structure, distant vascular and nervous connexion with the central organs or trunk, they are most liable to be hurtfully affected by such influences as just named above, and, if modern views be correct, are as well liable to suffer much, or earliest, in any general defect, temporary or permanent, of the central organs of circulation and innervation. This last circumstance I should not, contrary to other opinion, be disposed to greatly insist upon.

\* I have already quoted Professor Boeck's yearly statement to the effect that leprosy is a more 'malignant' disease in Norway than in the south of Europe. I now add, that it is more severe there than in India; and I quote the following remark of Dr. Bakewell (Correspondence, &c., &c., p. 35), with reference to West Indian leprosy:—"The cold of our climate (England) appears in all the cases I have seen here, to have caused the disease to advance much more rapidly than in the West Indies. I was much surprised to find that persons who had every advantage as to diet, cleanliness, &c., had reached the last stage of the disease, more quickly here than the poorest, worst-fed, and dirtiest person in the West Indies, even

where there has been in the latter a hereditary taint . . . Doubtless the diminished perspiration in "cold climates has something to do with this." The unfavourable effect of cold or rigour of climate in leprosy, has always seemed to me to result from the depression of vital power, in cases where nerve-influence is impaired; and in the skin-affections of leprosy, I should suppose that the disturbances of function and circulation resulting from extreme variations of temperature and moisture, would tend to disturb leprosy deposits in the integument, whereby their entry into the lymph and blood-systems is favoured, and thus greater risk to the sufferer entailed. This subject will be again referred to, under the head of Prognosis.

*b. Relative position.*—I have remarked that there is a certain defined connection between the several localities affected by the three phases of leprosy before mentioned; thus, tubercles on the face first appear, where cutaneous branches of the fifth or trigeminal cranial nerve emerge from their bony canals, and are distributed to the skin; especially on the brows, where the supra-orbital nerves come out, are the nodules common. Another capital illustration is furnished by the ears, which are supplied with sensory nerves by both fifth cranial and cervico-spinal nerves, and as regards the lobe and rim of the ear, I have on dissection directly traced filaments from a diseased *n. superficialis magnus* directly into the tumefied parts. On the extremities, the outer side of the limbs is the commonest seat of tubercles, numbness, and eruption, and on the trunk, the posterior surface. In the former case, at least, the cutaneous nerves supplying these parts are, by dissection, known to be oftenest affected; and it has appeared to me that the eruption and tubercular deposit may, as regards their seat, necessarily coincide with the area of distribution of subjacent nerve trunks and branches. In the chapter on Morbid Anatomy, and in Appendix C., this subject is fully illustrated and discussed. Respecting the trunk of the body, there is not so much anatomical information available, and the connection in question has yet to be worked out there. Lastly, what special facts may signally tell against this view of the essential relation of defective nerve-influence and cutaneous changes, not only tactile, but nutritional or more purely morbid, I have yet to learn. For a further discussion of the point, see a subsequent page.

*c. Symmetry.*—In general, the disease is not symmetrical at its commencement, *i.e.*, corresponding parts of the two sides of the body are not simultaneously affected, or, if so, not necessarily in equal degree. When more developed, tubercles and eruptions will commonly be found on both sides of the trunk, and often in clearly symmetrical position. Impaired tactile sensation as a symptom, negative and invisible, and therefore less readily detected than tubercle or patch, is seemingly not so frequently symmetrical as are these; but in reference to practice, it will usually be found that both hands and both feet are simultaneously, if not equably, affected, whenever the complaint is of long standing.

### 3.—PRECURSORY SYMPTOMS OF LEPROSY. PRODROMATA.

Such are the general signs which have been described as heralding or preceding, by distinct intervals, the earliest visible marks of the complaint; and while the discrimination is necessarily to some extent artificial, it is still desirable to clearly distinguish such precursory signs, from those marks which the physician can see and estimate for himself. As I have just intimated, the range of incipient disease will probably be largely extended by future investigations, and to the same extent that of obscure prodromata will be, in a corresponding degree, reduced; but the question now is, are there any, and if so, what are the character of the real precursory symptoms of leprosy? I have reserved the consideration of this interesting topic until now, because, as before stated, I cannot describe these 'prodromata' from my own observation, not having either seen, or elicited from native patients in India, any consistent facts bearing on the subject; and I do not know that my experience has been peculiar. In Norway, however, where leprosy is a severe disease, happening amongst a people exposed to climatic hardships and limited range of diet, and of primitive habits, observers at the present day have concluded that such prodromata are of frequent occurrence, have defined them, and, it should be added, have also been followed in their inferences by physicians living in other countries, where the outward conditions of life are highly dissimilar. Respecting this last-named point, I must, indeed, remark that a sense of uncertainty

has constantly been present in my mind, as to the originality of statements following the Norwegian, respecting the precursory symptoms of leprosy, and this, especially, since my own experience has been so diverse. In short, there are great, if not insuperable, difficulties—both inherent and incidental—to be encountered, in treating this subject; but, inasmuch as the matter is of practical as well as scientific interest; some further remarks will be here submitted.

The following are the most precise data with which I am acquainted:—

In 1842, Boeck recorded that in 'tubercular' leprosy, the disease often begins with prodromata; namely, heaviness, drowsiness, languor, and disinclination for all kinds of exertion; with a persistent susceptibility to cold. These symptoms last from a few months to one or two years; yet may only endure a few weeks, or even a few days, or, on the other hand, they may persist as long as five years. Then the special symptoms show themselves, and these, too, come on in various ways . . . . In notes, it is added, amongst 112 attacked, in 28 the disease began with prodromata. There is, however, reason to suppose that these took place in other instances, but were either not strictly noted, or, on account of the long duration of disease, have been forgotten by the patient . . . . The debility came on so suddenly, in one case, that the man could barely reach home from the fields, where he was working at the time (*i.e.* 12 years before) . . . . For evidence, these are the cases recorded in full; but I am bound to say that the records are only those of hearsay. To the same effect is the account given in the later work of Danielssen and Boeck (Trans. in French, p. 195); the symptoms of dyspepsia being added, as heartburn, want of appetite, nausea, &c.

Respecting 'anæsthetic' leprosy (his *lepra glabra*), Dr. Boeck records, that this form also may begin with prodromata, yet it would almost seem as if they were not so frequent as in the tubercular form: "amongst 42 attacked, have I found them only in 9;" when they appear they are almost the same as above described for that form; namely, heaviness of the body, languor, weariness, tendency to sleep, or there may be as well a sensation of cold over the whole body, or in one part. "Sometimes the disease makes its appearance in a manner, which would lead one to suppose a rheumatic affection." The duration of these prodromata is extremely varying from some few days until two years, which is the longest time for them, I have observed. Afterwards the special symptoms of the disease appear, but then not less irregularly in their first beginning, than in their later course . . . . Then follow the cases observed, in detail. In their later work, Danielssen and Boeck observe (*loc. cit.*, p. 264) amongst prodromata, the general symptoms are in great part the same as were indicated for the tubercular form, yet they are even more stealthy, and they excite in the patient, an inconceivable disposition, which compels him to seek solitude; frequently, there are transitory chills, which strike through the body, and excite a feeling as if everything within him was becoming benumbed. The patient presents a visage pallid and expressive of deep grief; and without directly complaining of anything, he seems to call on all for help. He may remain in this state for months, even for years, without offering any essential change, when upon some part or other of the body, especially on the extremities, there appears one or more large bullæ . . . . In his later publication (1862), Dr. Danielssen equally insists upon prodromata of the kind mentioned above, remarking that they are often so insignificant that they pass unnoticed; he also mentions their occasional similarity to rheumatic, muscular pains, shifting about the body; their dyspeptic character and their subsidence on the appearance of an eruption.

Leprosy in the West Indies is discussed in Dr. G. Milroy's interesting Report, London, 1873; and at page 37 it is remarked:—The date of the earliest actual symptoms, it is generally impossible to determine with precision; they are obscure and faintly marked, and, moreover, are often preceded by a lengthened state of malaise, or of ailing health, without any single pathognomonic symptom. This precursory stage is thus graphically described by Dr. Bowerbank:—The tubercular form is generally preceded for some time, as for several months, by a feeling of debility and weakness. In many, if not in the majority of cases, the sufferer will be found with his general health impaired. Anæmic, pulse weak and small; it will be found, too, that he had previously suffered from some debilitating disease, from the effects of which he had never rallied, such as an attack of yellow fever, typhoid fever, small-pox, scarlet fever, measles, dysentery, &c.; he complains of a feeling of malaise, &c., an indefinite feeling of something wrong, chills like ague, rheumatic pains about the extremities; creeping, pricking sensations of the limb, a sensation (so-called) of pins and needles, stiffness and numbness of parts, a falling asleep of a limb, a hand, a foot, a finger, or toe. These sensations are generally referred back to some sudden exposure, to alternations of temperature, to sudden chills when heated, to coming out of doors after a vapour bath, to exposure during a chilly night in the streets while assisting to put out a fire, bathing at the river-side, &c. Yellow or copper-coloured spots then make their appearance on different parts of the body, and it is for this symptom, in general, that a medical man is consulted; the patient taking them for chloasma (*Pityriasis versicolor*), &c., his surprise is generally very great, on a needle being thrust into these spots, to find he is insensible to pain. "The same premonitory symptoms exist also in the anæsthetic form; and I think the first symptom here, may be said to be shooting pains, like electric shocks along the course of the nerves leading to the hand and foot; a sensation of intense burning pain in the course of the nerves of a toe or finger (these latter I have known to be very intense), a perceptible wasting of the muscles and flattening of the hand and foot, and the fingers and toes, &c., &c."

Lastly, referring to some recorded experience in India (*see* the *Ind. Med. Gaz.*, vols. II. and III.), J. N., writing of the early stages of anæsthetic leprosy, from observation, it would seem, of dispensary patients coming from the hills near

Umritsur (N. India), remarks that amongst the subjective signs of the disease, mental hebetude is one of the earliest symptoms; the drowsiness is almost pathognomonic; all the faculties of the mind seem to come under a benumbing influence . . . the mind is weakened, never deranged . . . these symptoms commonly diminish and sometimes disappear, as the disease advances. . . .

The latest writer in Europe adds to the list of prodromata in lepers, "such persons may even suffer every evening from attacks of feverishness. An outbreak of blebs, representing a sort of Pemphigus must also be reckoned amongst the prodromal symptoms, because the eruption may exist for months or years, before the characteristic signs of lepra make their appearance." (Kaposi, in Hebra's Treatise on Skin Disease, Syd. Soc. Trans., 1874). It would be easy to add to this short series of references, but enough has been advanced for the purposes of illustration.

How much similarity there is amongst the statements above quoted, will be obvious to every reader; yet on account of my discordant experience, I am not, perhaps, in a position to offer a just estimate of their value. The inclusive question is this, are the symptoms now detailed truly precursory of the 'great disease,' that is, are they prodromata either of themselves characteristic, or else made up of common signs arranged in special and invariable order.—Are they on the whole indications which are undoubtedly connected by sequence, at least, with the main malady.—Or, lastly, are they such as resemble the prodromata of other general diseases in character, order, or duration, and may they, therefore, on the ground of analogy, be regarded as characteristic of leprosy? I will here observe, that because such a group of symptoms may appear inexplicable, except upon theories which have failed to be substantiated, one is not called upon to discard the clinical value of these recorded signs of leprosy.

The following reply is one that might be submitted. First, the so-called prodromata are not in themselves characteristic, for the series of phenomena are easily enough explicable upon other grounds than those implied. Next, they are neither uniform in character or degree, nor regular in sequence. Third, their duration in time is extremely irregular. Again, they are not, in many obvious respects, comparable with true prodromata. Lastly, they have no definite relation to the permanent complaint, and they are by no means invariable in their occurrence. Should these last assertions be allowed to have any force, the special value of the 'prodromata' in question, could no longer be sustained.

I have said that the difficulties (perhaps yet insuperable) attending an investigation of this subject are inherent—because true prodromata are but part of the malady;—and they are also incidental—because the physician has to trust to the memory or imagination of a miserable class of sick people, and hence I would ask if, in place of laying stress upon vague symptoms, which are only recounted and never seen, would it not be preferable, in a scientific point of view, to seek an explanation for them in the circumstances under which they are said to occur—in the general condition of the people amongst whom they are found—and by reference to such influences as unsuitable diet, exposure to bad weather, poverty, superstition, bad hygiene, scurvy, debility, and the like? Surely, too, psychological analysis of the faculties of a man who finds he is a leper, and broods thereon, is not a likely means of eliciting trustworthy facts.

On the other hand, it cannot be denied that statements of patients have been credited by their medical examiners, who were in a good position to judge of their seeming accuracy, and who therefore have, *à priori*, a right to be themselves credited by others. The set-off to this view is the very common event of observation and opinion being contested by mental preconceptions of the physician, appertaining to some theory either originated or acquiesced in by himself. However, besides those observations made in India, *e.g.*, sometimes under difficulties of language, and in all localities, tinged with popular tradition and superstition, there are the instances of leprosy occurring in educated Europeans (other than Norwegian), who are able to give an intelligent account of the commencement of their complaint, and in such cases it must be allowed, that there is often a clear statement of premonitory symptoms chiefly referable to the mental faculties.

What value shall be attributed to such instances with reference to the point in question, must be determined in every example, by the skill with which these symptoms are carefully sifted, and freed from connexion with the numerous powerful influences, other than that of leprous disease, which were at work when they came into existence. At such times, it must be owned, fallacies of both observation and reasoning, are likely to abound; but not therefore the less needful is caution on the part of the physician.

Again, with regard to the fundamental points that these prodromata are not always to be detected, or when mentioned, have no evident relation to the main complaint, it has been fairly enough said that they were not observed, or are forgotten; and in accordance with later views of the pathology of leprosy, it has been advanced that in such instances, as well as others, slight and transient, but truly effective, eruptions on the skin may have previously occurred, and have led to later and more palpable development of the disease. A suggestion of this kind does, indeed, furnish a *point d'appui* for future efforts at research; and to the time when such inquiries have been consummated, may further argument be deferred. At present, all that can be advanced with profit seems to be the ultimate fact, that amongst inhabitants of countries and districts infested with leprosy, and in strangers visiting such countries or parts, the occurrence of certain symptoms which have been enumerated, may excite the suspicion that leprosy is about to appear, without, however, affording any clue to the form the disease assumes; but that such prophetic diagnosis is ever practically made use of, seems to me very problematical, because these symptoms have never been demonstrated to be pathognomonic of other than actual leprous states. In other words, it has yet to be shown that the so-called prodromata of leprosy are of very semeiotic or scientific value. That true forerunners of the disease exist and can be recognised, is a hopeful conviction that may well serve to stimulate inquiry, but the idea is one yet to be established on a sound basis.

#### 4.—EARLY SYMPTOMS OF LEPROSY.

These are neither uniform in character nor invariable in sequence. Each of the chief phases of leprosy may, from the first, be distinctly marked; thus, the eruption in one of the earlier forms described above, is sometimes the only symptom noticed for some time, and the nerve-affection not uncommonly exists quite uncomplicated for a longer interval. Tubercles in the face are occasionally the first sign of disease that meets the eye, but usually there will, at the same time, be found spots on the body, either distinctly raised or more like faint discolouration; and attendant nerve-disease is by no means uncommon, even at this early stage. There is not, however, any invariable rule, according to which the order of symptoms in leprosy is regulated, and illustration of the accuracy of this statement will be found in the earlier chapters under Section I. It necessarily happens that here, as in the subject of prodromata last discussed, most of the information which is available is derived from the statements of patients themselves, and is, therefore, at best but somewhat vague.

Respecting the *eruptive* patches (*Lepra leprosa*), I had invariably found that they appeared quite spontaneously, and were unattended with any general disturbance, but that some functional derangements, or even febrile paroxysms, may attend their outbreak, seems to be undeniable from other experience. Very soon after their advent, pains in the limbs, following the course of some nerve-trunks, I have also seen, and commonly affection of the nerves soon comes on. Fresh patches may continue to appear at long intervals and in advanced stages of the malady.

*Anæsthesia* is often detected by accident, and in practice, it is rare to find that constitutional symptoms attend its appearance. Commonly, an eruption on the skin has preceded the advent

of numbness of the hands and feet, yet it is well known that simple loss of feeling may, for months, be the only perceptible sign of leprosy, and that without any very evident changes in the benumbed surface. But there are other marks which have been much insisted upon; thus, it is said that *pemphigus solitarius* occurring on the elbows, knees, hands, or feet, is the very first sign to be noted. I have above expressed my opinion that this symptom is one consecutive to impaired nerve influence, but other observers have regarded it as pathognomonic of 'lepra nervorum' at a stage preceding all others. A febrile state may attend the outbreak of blebs, and thus is completed the series of more or less acute onsets of the disease.

Less hesitation need be had in assenting to the frequent occurrence of a state of hyperæsthesia, or preternatural sensibility of the nerve-trunks of the extremities, as a marked sign of their incipient disease. The consequence is pain in the limbs, aching, lancinating, pricking, or shooting in character, or a sense of mere formication, or only dormant irritability, ready to be excited on least muscular exertion or external pressure. Besides the deep-seated trunks, the cutaneous nerves may become tender and even the surface of the skin may be over sensitive, and that without any marks of hyperæmia, or altered function. It is further stated that the hyperæsthetic condition may last for months or years, continuously or at intermitting periods; but on this matter I am unable to speak from knowledge, and can hardly conceive what is the state of the parts in which such symptom abides. It is, in my opinion, remarkable that the term 'neuralgia' is never mentioned by the Norwegian observers as applicable to this prolonged over-sensitiveness which they describe with such emphasis, and the inference I should draw is that the pains in question are of a rheumatic character. Altered sensation is, indeed, the prominent mark of nerve leprosy; the several modifications of function observed have been already stated, and, as well, the structural lesions found after death. From a consideration of the latter, combined with an acquaintance with the normal properties of sentient nerve-tubules, it is not difficult to understand the more ordinary phenomena of anæsthetic leprosy, so called, but doubtless there is very much more to learn beyond what has yet been elicited. Common sensation may persist in the deeper parts when lost at the surface, but as the natural consequence of exalted function due to progressive structural changes, it may at length disappear in all the tissues. Tenderness in the viscera, and in the spinal cord itself, has been insisted upon (see note at page 33), and it will be a point for future inquiry in India to ascertain if this observation is well founded.

The patches of eruption which so often attend anæsthetic leprosy, are, sometimes, at first hyperæsthetic, and afterwards benumbed; it is stated that their prominent edges will be sensitive when the depressed centre has become devoid of tactile sensation.

*Tubercular Leprosy.*—Respecting the so-called acute onset of this phase of leprosy, having already quoted the Norwegian authorities for its distinction, I would here remark that upon the grounds stated by them, the recognition of this form of nodular leprosy does not seem to be necessary. All that is seemingly implied by it, is a febrile paroxysm more pronounced than usual, but not really indicating the earliest advent of leprosy. This remark will be rendered more clear by the facts stated in subsequent pages; and it will be enough to again draw attention, in this place, to the likelihood that small and limited leprosy formations in the skin really exist, and long precede the more active manifestations of glandular swelling, febrile paroxysm, and fresh deposits all over the body, or in the internal organs. Perhaps the chief point, indeed, in the clinical history of leprosy, which merits close attention on the part of observers is this, namely, the detection and the form of the earliest visible or otherwise perceptible traces of the disease.

The more ordinary advent of tubercles takes place by hyperæmic patches in the skin, varying in form and size, and resembling in general characters 'erythema' so-called; the surface may be more sensitive than usual. At first, such a patch will temporarily fade on pressure; it lasts for some days or weeks, and then subsiding, leaves a slight permanent thickening of the integument. A succession of such events, at yearly intervals or oftener, leads to the production of defined nodules in the skin. These incipient 'tubercles' have been compared to chilbains; and they are said to first appear only in the winter, subsiding in summer.

More rarely, leprous nodules commence and grow in an imperceptible manner. On the face more especially, and the dorsum of the hands, the first deposit assumes the character of a diffused infiltration, congested, raised, bronze or livid-tinted, sensitive perhaps; coarse-looking, and shining in aspect; such a patch may somewhat subside, but thickening remains, and a true specific formation has already occurred. Febrile symptoms are not yet common. The superficially placed lymphatic glands are not commonly swollen; and numbness may be everywhere absent. The occurrence of separate faint discolourations of the skin has been mentioned; and also the occasional co-existence of nerve-disease. On the eyebrows and eyelids, the falling out of the large hairs seated there is an early symptom once much insisted on, but of no more value than other indications of hyperæmia and deposit in the substance of the skin.

From what has now been stated, it is evident that the mode of onset, and the first visible signs of leprous disease, are most variable and obscure. Under such circumstances, it is important to bear in mind the essential characters of the malady; thus, there are two sets of local marks to be looked for, namely, first, a deposit in the skin, attended as usual by exalted functional activity of the part, and peculiar only by position, scantiness, and co-existence with other facts tending to rouse suspicion. Secondly, search is to be made for altered sensibility of the skin in certain regions; and great is the value of this symptom. With regard to the constitutional signs of the disease, or the febrile condition which so commonly is present, according to many authorities, I must refer to the following chapters, as well as the past, and, at all times of difficulty, would suggest a perusal of the cases in point, which are quoted at length in various parts of this work.

##### 5.—COURSE OF THE DISEASE.

Under this head, it is proposed to treat of those phenomena belonging to the disease itself, and not to such intercurrent or superadded affections, are properly to be regarded as complications of leprosy. The former will here include changes of phase or type, and systemic implication, as parts of the natural history of the malady.

If there be no regularity in the form or manner of advent of leprosy, neither is there any in its progress in the body. Using general terms, its course may be said to be slow or rapid, and either simple or complicated. The slow course is the more commonly uncomplicated; the more rapid being attended with some superadded affection, strictly not of leprous character; examples of the former must be sought for almost solely in anæsthetic leprosy, and the tubercular form is that, almost alone, liable to sudden and great exacerbation. The difference thus indicated seems—as regards personal predisposition—to depend upon the larger amount of leprous matter existing in the skin or lymphatic glands, in nodular leprosy; and also—as regards exciting causes—upon such influences as bodily debility, resulting from incidental events, excitement of the system, sudden changes, depressing influences, such as those of season or the weather.

A. Such is a broad view of the subject, which it is now proposed to consider in more detail; and first will be mentioned the changes of phase, to which in its course leprosy is liable, as well as

the comparative prevalence of its chief forms, so far as is known to me; I have here placed in a foot-note the corresponding remarks of the older Norwegian authors, for the purpose of additional illustration; and would venture to recommend a renewed study of the natural course of leprosy, to those who are enabled to pursue that subject.\*

*a. Eruption.*—Some characteristic skin-affection commonly precedes other signs of leprosy; but although for months, or even a year or two, the only visible marks of the disease may consist of a few patches on the back or extremities, whose tint is on the whole dark in the pale skin, but lighter than natural upon the dark skin, and which are benumbed in their depressed centre, but not at the more vascular, raised, rounded margins; yet, as a rule, such form of eruption does not continue to be unattended with nerve-disease, or it may be with nodular deposit. Generally speaking, the former is that phase with which the milder skin-affection becomes associated. The leper spots are not quite permanent; and in very old cases, hardly a trace may remain of them. Atrophy of the skin is a common sequence; and this is generally attended with impaired sensation. Perhaps some of the large, ill-defined, benumbed patches to be on the trunk

\* " We have frequently seen the tubercular form of leprosy become changed into the anæsthetic. When the tubercles are but little developed, the disease may yet have lasted a long time, there happens sometimes, quite suddenly, a febrile paroxysm, attended with shivering and very irregular exacerbations, and accompanied by violent headache, burning thirst, dry skin, and a small pulse at 100. These symptoms commonly cease in the course of a few days; and the patient then complains of marked agitation in all his limbs, and at the same time of excessive sensibility of the skin, especially in the extremities, which may last for several months, and oblige him to keep to his bed. Gradually the tubercles diminish in size, assume a paler colour, whilst the sensibility increases, and emaciation of the frame sets in. Thus, a long period, even an entire year, may pass away, and during this time there is seen a wasting away of the tubercular mass. The skin becomes more and more faintly tinted; and at last the tubercles altogether disappear, the hyperæsthesia becoming almost unbearable. Soon this excessive sensibility ceases, and where it was present there supervenes a loss of feeling which gradually tends to become complete. The skin is now pale, rather dry and flabby; in place of the faded tubercles, there may be seen some rounded cicatrices. There is not the least trace of the tubercular form, which has now been succeeded by the anæsthetic form, henceforward to advance as usual, and persist during the rest of the patient's life. The tubercular form has disappeared for ever, and we have never seen it return, although we have had patients under observation for six years after this transition to anæsthesia has occurred. We have also seen that, in certain cases, the anæsthetic form is changed into the tubercular. Thus, when the formation of pemphigus has already long ceased, and hyperæsthesia, too, has passed its height, and when loss of feeling in certain parts has begun, there appears a train of general symptoms, namely, strong fever, headache, some delirium, accompanied with a dry, hot, red, and puffy

" state of the skin; and immediately after these symptoms, a cutaneous eruption, consisting of patches, which are slightly raised, rounded in form, and of bright red colour. After a variable interval; the general symptoms subside. The spots are changed into tubercles and the hyperæsthesia quite disappears. The places in the skin, where anæsthesia at first existed, remain unaltered as regards their sensibility; but tubercles have appeared there, too, and the tubercular form now continues its march as usual, whilst the anæsthetic form is no longer perceptible." . . . . *loc. cit.*, p. 315.

The tubercular form is frequently complicated with the anæsthetic. In about one-sixth of the subjects attacked with leprosy, and when the tubercles are fully developed in the course of the disease, there appears a loss of feeling in the hands and feet, but rarely in the face. The same parts, too, become wasted; yet on the whole, the tubercular form continues to predominate. It is very rare to see the anæsthetic form become complicated with the tubercular; and only in one in twenty subjects have noticed this event. Yet tubercles may be formed in the skin of patients, who suffer from complete anæsthesia; but they never predominate, and the original form takes its usual course. When this complication exists, there may occur a sort of alternative march of the two varieties named; thus when the tubercular form advances, the anæsthetic remains stationary, and *vice versa*. . . . . The anæsthesia and laxity of the skin never increase; the flexion of the fingers does not augment; the necrosed parts do not spread, so long as the formation of tubercles is in progress; but if this process is arrested, then the anæsthetic form renews its course, and a fresh advance in its symptoms occurs. As we have already seen, the conversion of one form into the other takes place only when the disease is in its early stage, and then one form supersedes the other; in the later stages, on the contrary, the two forms while at the same time co-existing, do not tend to supersede each other . . . . . *loc. cit.*, p. 318.

and limbs of aged lepers, may be due to pre-existing leprosy eruption. Since the essential character of this phase of the disease is like that of the nodular form, it is possible to have associated with it rapid subsidence or accessions, attended with febrile disturbance of the system, but the event seems to be a very rare one.

*b. Anæsthesia.*—This feature I have always regarded as being a common connecting link of all phases of leprosy. It certainly may, for a considerable time, exist alone, but not, as I think, for the whole course of the disease. Cases of nerve-leprosy, dating several years back, do indeed show only wasting of the limbs, but still on close examination there will constantly be found upon the trunk and limbs, some marks of a skin-affection, which is not of that kind due simply to impaired nerve-influence, and which really belongs to some one of the several forms described above of 'lepra leprosa.' Such is my own experience, and such the inference from data supplied by Daniellssen, in Norway. As regards its own course, loss of feeling is a symptom which, it is said, may be recovered from and again recur. Under these circumstances no great structural injury can be done to the nerve, because it is evident from the facts which have been already recorded, that the nerve-tubules themselves in well-marked disease, are so surrounded by tough new-formation, that a resumption of their function could then hardly be anticipated.\* Respecting its connexion with the tubercular phase of leprosy, anæsthesia is a symptom which may co-exist at the first, but seems more often to come on at a later period. Instances of both occurrences are frequent enough, at least in India; yet great stress has of late been laid upon the latter of the two, and it is concluded that numbness is a symptom of but limited value, being commonly due to incidental consequences of nerve-disease.†

*c. Tubercles.*—It has already been stated that the life term of leprosy tubercles is a limited one, and earlier or later, degeneration and softening of their inner portions takes place, with ensuing absorption of the entire mass. This process is not necessarily attended with local irritation, but from accident or other causes, inflammation and suppuration may supervene, and an ulcerative destruction of the nodule may also attend it. Perhaps the most interesting fact attending the life history of the nodule, is that mentioned by Hansen, namely, that in the midst of

\* That in the natural cause of the disease, an effusion amongst the nerve-tubules should subside or become less, is as likely an event as falling away of tubercle or eruption in the skin; and, on the other hand, the paroxysmal increase of leprosy deposit may doubtless occur in one case, as in the other, and so lead to recurrence or augmentation of the symptoms. There is, therefore, no difficulty in admitting the accuracy of statements, respecting the restoration of feeling in parts previously benumbed; and none in crediting the asserted good effects of such external applications, as have lately come into use. Equally possible, too, seems the exacerbation and remission of leprosy nerve-disease, but in consideration of the seat and character of this affection, the probabilities seem greater here than in the skin, that structure will be irremediably impaired, and therefore function destroyed. In Norway, it is believed that anæsthesia has a tendency to progress rather than to subside; and particular care is necessary in estimating both degree and change in numbness of feeling.

† Reference is here specially made to the views of Hansen as expressed in Appendix A., p. xiii, &c.; when

combating the opinion that there exists an antagonism between the two chief forms of leprosy, and that one (the anæsthetic) is not a development of the other (tubercular), Hansen submits facts, which, if not applicable everywhere as in Norway, are of the highest interest. No distinction of a simply eruptive phase or type of leprosy is made: the author shows that anæsthesia is a common attendant on nodular leprosy; thus, in 114 cases specially examined, only nine had no loss of feeling, and an earlier observer (Bidenkap) had found numbness in all the nodular subjects he had examined. The rule seems to be, that at some time after the first skin affection, the nerves become affected: it is apparently, the regular course of tubercular leprosy to end with anæsthesia, as the nodules in the course of time disappear, the nerve-disease becomes more marked, and this is the most favourable termination of leprosy, although only a few lepers live long enough to reach this final stage. It results from Hansen's researches that the so-called 'mixed' leprosy has no real existence, as a separate form of disease; and that its proper significance is the same as that of the ordinary tubercular variety.

the softening tubercle, may be seen the growth of new material; so that absorption and formation proceed simultaneously, and according as either predominates, so is the condition of the mass—either increasing or diminishing. Doubtless the tendency is to gradual disappearance of the morbid material per vias naturales, *i.e.*, through the lymphatics, but numerous contingencies arise, which interfere with these safe and slow proceedings, and thence the numerous risks to the leper, who is affected with this tubercular form of disease. These will presently be considered, and I pass on to dispose of the local relationship of the nodular to other phases of leprosy. Portions of the cutaneous surface which have been the seat of eruptive patches, may become the seat of tubercles, but commonly the latter arise quite independently of the former, and in general they do not occupy precisely the same regions of the body. Nor do tubercles usually arise on anæsthetic surfaces, *e.g.*, on the trunk or limbs; yet, on the whole, they are more frequent in places where the cutaneous nerves concerned are known to be frequently diseased.

#### B.—GENERAL OR SYSTEMATIC AFFECTIONS OF LEPROUS OR ALLIED CHARACTER, AND OCCURRING IN THE COURSE OF THE DISEASE.

Having already recorded in detail the more local changes in the body which are perceived in leprosy, I now advert to those general symptoms, whose true character has only lately been the subject of definite study.

For convenience sake they will be considered under the heads of pyrexial or febrile disturbances, intimate complications, and chronic cachexia.\*

\* It is with regard to the detection and correct interpretation of the general symptoms of leprosy that modern observers, in Europe more particularly, have so many advantages in their well-ordered asylums. At former times, and even now commonly in the East, there are no similar opportunities for observation such as these institutions afford.

Respecting more particularly the febrile exacerbations, which are alluded to in the text, the following quotation from Sprengel is of interest (*Hist. of Med.*, trans. by Jourdain, 1815, t. ij, p. 371); when referring to the spread of leprosy after the Crusades, he says:—"The spots which announce this disease in the West, are are pretty much like those by which it commences in the East; but from the first, no Oriental writer had observed confirmed leprosy and its different forms so accurately as did the Europeans after the time of the Crusades; for the genius of observation belongs rather to the West than to the East. It is also very remarkable the French and English authors describe much better than the Arabs, the fever which commonly attends the invasion of leprosy; whether it be that this fever is associated more commonly with the cutaneous affections in the West, than in the East, or whether it be that the European writers took the most pains in their observations." This allusion to the possibly less prevalence of febrile symptoms of leprosy, in Asia than in Europe, points to a feature which may yet be regarded as, in some measure, characteristic of the disease in these two regions of the globe. The importance of the symptom had not come before me in Bombay, and has also escaped other observers in the tropics; but I gladly refer to some able writers in

India, who have seized the point in question in a decided manner. Thus Day, at Cochin (*Madras Quart. Journ. of Med.*, vol. I., 1860), speaking of tubercular leprosy, notes amongst the preceding signs of 'tubercles'—in three native patients, pyrexia occurred at the time of the appearance of the raised, shiny patches . . . ; and respecting the stage of eruption, remarks that it may be very gradual or exceedingly rapid; in one woman, within the period of three months the nose, ears, and face were covered . . . in the later stages of the disease, the eruption of tubercles in natives is rarely preceded by feverish symptoms, but frequently by obstinate itching. In the third stage, that, namely, of breaking down of the tubercles, those tubercles which have been formed become irritable, frequently producing fever, and by degrees breaking down . . . Day mentions a case in which death was preceded by hemiplegia of the left side of the body, delirium, &c., and adds that the most frequent fatal termination of leprosy seems to be by bowel or lung affections . . . He considers that "in both forms of the disease 'Elephantoid fever' is equally prevalent . . . this elephantoid fever is the precursor of elephantiasis Arabum, but generally shows itself in elephantiasis Græcorum, after that disease has existed a longer or shorter period, being apparently present in all adult native lepers." Reference is here made to a kind of fever which the author had properly and accurately distinguished in his own mind, as quite different from ordinary intermittent fever; and I shall revert to his opinions later on (*see General Pathology of Leprosy*), where the remark now quoted will be fully elucidated.

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So far as I know, the natural course of the eruption in leprosy is to spread to a certain extent, and then to fade. Leprous nodules or tubercles—which are more accumulated formations than the patches—also tend to disintegration and final absorption. The nerve-disease is more permanent, but is as well liable to spontaneous subsidence. It is in the changes which occur during disintegration of the morbid materials formed in the integument, that the interest and importance of an acquaintance with leprosy resides. What these changes are, is best shown by the phenomena of ‘tubercular’ leprosy, but it must be recollected that both nerve-disease and eruption occasionally exhibit the same character of sudden accessions or recessions, which are attended with febrile disturbance of the system, and the explanation is essentially similar in all three cases. By anticipation, I would observe that the progress of the leprosy is best and most surely indicated, by the number and frequency of the paroxysmal and constitutional outbreaks which are now under consideration, and hence the need of special attention here.

Under the more favourable circumstances, leprosy matter deposited in the skin—being an extraneous product, little vascular, and tending to early decay—is gradually disintegrated and

Bombay, New Series, vol. 2, 1853-4, Mr. Lisboa wrote thus, the patches of eruption in tubercular leprosy slowly increase, and, “as it were, in successive crops, each crop being preceded in some cases by febrile symptoms more or less intense; then the affected portion of the skin becomes tumid, discoloured, shining, and sometimes over-sensitive, but when the fever has subsided, which takes place within one or two days after the eruption of the blotches, the tumidity lessens, the discolouration becomes rather less deep, and the pain disappears. In some cases, on the subsidence of febrile heat, the eruption also disappears altogether, to re-appear after some time, with or without the same train of symptoms.” A similar series of phenomena is described as occurring during the eruption of ‘tubercles,’ which are also “sometimes preceded by febrile symptoms, but during the intervals of the outbreak of these tubercles, the patients continue free from fever; . . . in the final stage of the disease, the author remarks, that “along with exhaustion and depressed circulation the skin is dry and hot towards evening.” . . . Mr. Lisboa also describes some cases of the disease; and I note in one of these, the record “that during the early part of November and the end of December, the patient suffered from febrile symptoms, headache and itchininess of the body in general, for two or three successive days; and these symptoms were followed by the appearance of fresh patches, tender on pressure, on the back of the ears, face, arms, and hands:” in another case, “from the 1st to the 6th of October, the man suffered from fever, and both his hands became swollen, tense, and painful; on the 7th, he was free from fever and swelling of the hands but fresh tubercles appeared on both hands.”

The independent observations now quoted, will suffice to demonstrate the general identity of the severer forms of leprosy, in India and in Norway; and as regards the West Indies, I have already borrowed an illustration from Dr. Bakewell (see the chapter on ‘tubercular’ leprosy), which is equally striking. It is

not my intention to pursue these comparisons of tropical and northern leprosy, for time and space do not permit of this being done; but I should here briefly refer to the corroborative observations made in England, upon leprosy subjects who have acquired their disease abroad; mentioning those of Mr. E. Wilson in the Leprosy Report of the R. Coll. of Physic., London, 1867; and more recently those of Dr. R. Liveing, in his Goulstonian Lectures for 1873, which will be again referred to. On the whole, I conclude that the systemic disturbances in leprosy, which are evidenced by febrile symptoms, are probably not so frequent in the tropics, as in cold and variable climates: but at the same time, I would remark that other influences than those of changing temperature and moisture, may be equally operative in producing that agitation of the cutaneous system which seems to favour repeated systemic, leprosy infections. That in the drier, central parts of India, leprosy is not necessarily attended with fever, would seem to follow from such statements as the following, which is recorded by Dr. Garden, of Ghazipur (where both kinds of leprosy are very common)—“In no case is there a marked febrile attack, connected especially with the outbreak or development of the disease.” Bengal Med. Rep., 1865, p. 298. Dr. Cayley, of Goruckpore, also remarks (*loc. cit.*, p. 307), “the disease is not usually accompanied by fever, or any specific constitutional symptoms, beyond gradual increasing debility.” I may here add, that, at Madras, amongst 117 cases of leprosy in the asylum there, in 65, antecedent fever malarious in its origin, had occurred: and in 52 cases, the disease had supervened without any febrile action. (Report for 1873, quoted in Med. Times and Gaz. Apr. 1874.) In China, at Canton Dr. Wong mentions the eruptive fever of leprosy, as a distinct form.

The influence of climate upon the progress of leprosy in India, is a subject well worthy of notice. I understand that in Norway, those localities where the milder form of disease prevails, have a drier and warmer climate than usual.

removed by the absorbents, without any immediate hurt accruing to the frame. But when this chronic and comparatively safe process is disturbed, and degeneration be hastened or excretion checked, the lymphatic system may become clogged with a *materies morbi*, and the blood itself overcharged; hence results febrile reaction of the body. Two events follow, namely, either elimination by the cutaneous system, and the metastatic formation of fresh tubercles, patches, and renewed nerve-disease; or else, a still more rapid disintegration of pre-existing deposits takes place; it may even be said that both events can simultaneously occur. Such phenomena are quite explicable upon certain assumptions, namely, the comparative predominance of absorptive and excretive process, and the possibility that the peccant matter may reproduce itself in the blood; these hypotheses and some other events have, however, yet to be elucidated, and their discussion will be resumed in a subsequent chapter. In the same place, too, will be mentioned what is known of the character and analogies of the ordinary fever of leprosy.

As matter of observation, the febrile reactions happening in the course of leprosy, may occur under the following conditions:—

1. Rapid introduction into, or retention in, the blood of disintegrated leprosy-matter. This is probably, the common occasion.
2. Arrested secretion from leprosy sores.
3. Absorption from leprosy wounds, &c.
4. Specific deposits in the internal organs.
5. Tubercular (strumous) deposits in the viscera.

Respecting the *first* class of cases now referred to, it is to be observed that the reality of the events named, is matter of inference rather than of observation; that is to say, there is no proof positive (so far as I know) of the existence in the blood of such disintegrated matters, as are herein supposed to cause the febrile symptoms. The deductions from clinical study have, however, seemed to very competent observers sufficiently well-founded, to warrant the propagation of those views of consecutive, systemic infection which will be presently discussed from the theoretical point of view.

Some idea of the frequency with which simple febrile attacks are found to occur in Norway, during the course leprosy, may be gathered from the fact that in official records (*see* Table, p. 142), from one-fifth to one-third of the total sickness to which lepers are liable, has been included under the heading, 'Fever with or without eruption.' The kind of illness thus implied does not appear to be of a fatal character, for no death is entered amongst the 350 occasions included in these official tables.

Further, in the light of these valuable northern records, I am disposed to interpret other data derive from both Eastern and Western tropics, as being essentially of the same character and import. Thus, in the list of affections intercurrent with leprosy, as lately reported from the leper asylum at Madras, there are entered as prominent items 'febricula' and 'ague;' and here, too, not as a fatal complication. And again, at the leper asylum in Trinidad, West Indies, amongst the intercurrent diseases of leprosy, much the more common entry is 'intermittent fever,' and 'twice, malignant intermittent fever.' It is by anticipation, I add, that the 'febricula' and 'intermittent fever' here named, probably correspond to Day's 'elephantoid fever,' and to the 'fever with or without eruption' of the Norwegian observers; but these brief statements alone, seem of themselves to point to a common character and import. For other remarks, *see* the chapter on General Pathology.

Now follow some instances which I have selected in illustration of this subject, from Dr. Danielssen's later triennial reports; and several examples may be seen in the foregoing description of tubercular leprosy, and, as well, in the notes below.\*

Under the present head, I should myself include those febrile paroxysms which occur, as a rare event, at the onset of tubercular leprosy; those which seem to happen at change of type of the disease; and those which are due to general disturbances of the circulation, innervation, &c., arising from such causes as external conditions (*e.g.* of climate), internal deteriorations (functional or organic), or lastly from the action of some drugs. What other classes of influence should be added to this list, will be subject for future inquiry.

*CASE. Eruption: Fever mild or absent.*—Adolf Monson, 17 years, suffering from the anæsthetic form entered the hospital at Bergen, in December 1867. A little to the left of the median line of the brow, there were three clustered, flattened, rounded, brownish red spots, the size of peas, and on the right side of the forehead, parallel with these, were several other similar spots. In the right eyebrow a brownish, rather elevated spot, the size of a bean; the left eyelid was brownish coloured and infiltrated. On the upper lip, two, and on the left side of the lower lip one spot of dimensions and nature as on the forehead. On the cheeks very similar spots. On the right side of the chin and beneath the lower jaw a livid spot one and half inches long by one inch broad; and on the neck round, flat brownish spots, varying in size from a pea to a fourpenny bit. On the left shoulder a larger patch, round, brownish-red, and having a lighter-tinted central part. On the left side of the chest midway between the mamma and upper arm a reddish spot, the size of a florin, with a paler centre, and dry, chapped skin. On both arms large, oblong patches from three to six inches long, and two to three broad; and as well smaller, circular ones, no larger than a pea or a nut. All these spots present a dirty, brownish-red colour, and generally having a paler centre and skin dry, scaly. On the hips and lower limbs large spots, circular or four-sided, or irregular in form; the size of the hand down to that of a hemp seed; with well-marked liminary margin and paler centre; the largest upon the thigh and seat. Sensation upon the places where there are spots, a little diminished. Inguinal glands the size of a walnut: the axillary and cervical glands also somewhat enlarged. Otherwise in good health. He took internally

\* Other instances noteworthy from their interesting character and careful record are those of Liveing (*loc. cit.*, p. 104 and p. 126). The first was an instance of tubercular leprosy, acquired in the Mauritius; beginning with brown spots which resembled syphilitic blotches: two years afterwards—April 1872—when in England, he had a feverish attack and the lobes of the ears and bridge of the nose, were red and painful, the appearances being somewhat like those of gout: there were also red patches on the body: urine pale, 1,020, free from albumen; pulse, 112; temperature, 103° F. In two or three weeks, the raised patches began to subside, and after a longer time, they had gone, leaving no *apparent* changes in the skin, but increased pigmentation and slight thickening about the nose and cheeks. In January 1873, the legs became red, swollen, and tender; patches of eruption appeared on the arms and hands, and in March 1873, he had another slight eruptive attack, attended with the usual constitutional disturbances.

The second case was that of a young man, born in India, who, two and a half years after his return to England, found some brown patches on his arms and face, there being also some slight constitutional disturbance: next year the feet became swollen and the constitutional symptoms lasted two months. Afterwards, the tubercular deposits gradually increased and became very marked: the urine was acid 10·16, and free from albumen. "On March 30th, at 9 p.m. his pulse rose to 108 and temperature to 102°; early on the morning of the 31st he had a shivering fit, and on the same evening his pulse rose to 144, and tempera-

ture to 104·2°, as may be seen in the following table." This febrile attack, which lasted for some days was coincident with the formation of new sores on the face and arm; and with enlargement and pain in the glands of the right groin. It was, in fact, a good illustration of the effect produced by the absorption of morbid material from the open sores, which in his case existed on the right foot, the "softening of one set of nodules, production of another." The portion of Dr. Liveing's table just referred to is the following:—

| Date.        | Nine a.m. |       | Nine p.m. |       |
|--------------|-----------|-------|-----------|-------|
|              | Pulse.    | Temp. | Pulse.    | Temp. |
| 1873.        |           |       |           |       |
| March 28 - - | 86        | 97·2  | 94        | 99·   |
| " 29 - -     | 90        | 97·4  | 84        | 97·   |
| " 30 - -     | 80        | 97·8  | 108       | 102·  |
| " 31 - -     | 108       | 101·4 | 144       | 104·2 |
| April 1 - -  | —         | 99·4  | 112       | 102·  |
| " 2 - -      | —         | 99·2  | 148       | 105·2 |
| " 3 - -      | 98        | 100·  | 108       | 104·2 |
| " 4 - -      | 108       | 100·  | 108       | 101·2 |
| " 5 - -      | 108       | 100·2 | 100       | 102·4 |
| " 6 - -      | —         | 99·4  | 100       | 101·  |
| " 7 - -      | 96        | 98·8  | 84        | 100·2 |
| " 8 - -      | 84        | 98·   | 108       | 98·4  |
| " 9 - -      | 100       | 98·   | 96        | 98·4  |
| " 10 - -     | 96        | 97·4  | 72        | 98·   |

Dr. Liveing remarks that in both of his cases, "we notice a more or less abnormally low temperature, which remains pretty constant, except during the febrile attacks from which they occasionally suffer."

carbolic acid and had a vapour bath weekly. The 20th April 1868, there is the entry, that the spots have in the last eight days become considerably extended, are more elevated, and have a more intense red colour. In both face and limbs have appeared fresh, small, circular spots, which are rather elevated, of deep-red tinted and accompanied with lancinating pain in the fore-arms along the course of the ulnar nerve, and in the legs along the peroneal nerves. No febrile disturbance. Temperature and pulse normal. He was ordered cuppings on the limbs, and to continue the carbolic acid and baths.

The spots then faded in succession, and he became stouter. The entry of the 12th of April 1870, is as follows: Excepting on the legs where there still are to be seen traces of spots, these latter are everywhere subsided. Inguinal glands, especially on the right side, are swollen. In the place of vapour baths, he now began to have tepid sea-baths thrice weekly. The 23rd May, he had a fresh outbreak of spots on both face and limbs; the spots were, tolerably elevated, rose-red, and the outbreak was unattended with febrile disturbance. From 25th May to 11th June, the temperature of the body was measured, and was found to be more commonly under than over 37° (C.); the pulse also was tolerably slow; and on the 20th June the augmented patches had subsided. September 5th, there was again a fresh eruption without fever, subsequently to his having some days before caught cold; on this occasion however, the outbreak was much milder; and both temperature and pulse continued to be in their normal state.\*

Danielssen also describes a second similar instance; and on both remarks, that the eruptions were essentially limited to the skin; the internal organs were probably unaffected, and, therefore the prognosis in these cases is still favourable.

*CASE. Repeated Eruptions and Febrile Paroxysms.*—Ole Bottelsen Fjære, 17½ years old, admitted into the hospital at Bergen, in June 1868, being affected with the 'mixed' form of leprosy. His condition was as follows:—Frame delicate; colour of skin very dark, especially on the face and neck; on the forehead the skin was smooth and shining; on the temples and above the eyebrows a dark tinge in the skin; on right side of upper lip and beneath the nostrils, a small raised brownish patch; on chest and back, in parts, brownish spots, of size from a hemp seed to a pea; in the outer side of right arm, near the hand, a nodule, the size of a fourpenny bit, and covered with a small crust; on the thighs and legs nodular infiltration, and scattered nodules the size of a pea or nut; on the nates, &c. are seen some deep brown irregular patches, which are not raised above the skin; and on the front of the right leg a large nodule covered with a scab. Sensation good everywhere; the inguinal lymphatic glands somewhat swollen. In other respects he was in very good health, and continued so until April 1869, having, in the meantime, taken internally carbolic acid, and used a vapour-bath weekly. On 1st April he complained of headache, nausea, some thirst and noises in the ears, together with feverishness; tongue coated; pulse 120. Next day the condition was unchanged, except that he had now diarrhoea, which was treated with an opiate. On the 6th and 7th, diarrhoea rather better; he was depressed; pulse, 124; temperature, 40°-41° C. He had quinine mixture (gr. xxxii—aq. ʒ viii: a tablespoonful every second hour). On the 8th and 9th, pulse rose to 128, temperature, 40°-40.5° C.; sleeps well; and on 10th he had, in the morning, an outbreak of nodules on the thigh and leg; the nodules were of various size and distinctly raised above the level of the skin; the pulse then sank to 124, and the temperature in the afternoon to 36° C. The general condition was, next day, much better; pulse, 102; but the temperature had again gone up to 38.6°, and continued to rise until 39.2° C. On the 12th he had two shivering fits, but on the next day was well, appetite improved, sleep good, tongue clean, bowels regular; yet the pulse ranged between 120 and 132, and the temperature was never below 39.2° C., but commonly was as high as 40° C. and occasionally as 41° C. The 16th, 17th, and 18th several bright red and raised spots were to be seen upon the legs, after which the pulse again sank to 102 and the temperature to 35° C.; but this amelioration did not last long, for both again began to rise and the first was 120-136, the last from 38.5°-41.2° C., the general state, meanwhile, being very good, except that on the 26th, in the afternoon, he had a shivering fit, which lasted some minutes, quinine being then given. On the 28th and 29th fresh outbreak of spots, and the former ones more elevated, red, and rather tender. The pulse then sank to 112, and the temperature to 38.0° C. During the whole of May there were frequently small outbreaks of spots, sometimes on the face, sometimes on the limbs; the pulse was rarely over 120, and the temperature which, on the whole, kept very high, only three times reached 41° C.: all this time he was losing flesh. In the beginning of June there was some cough, for which

\* I regard this lad's case thus described by Danielssen, as much resembling those often seen in the East, from both the character of the eruption, so clearly indicated in the description, and from the non-attendance of marked febrile excitement on fresh outbreaks of spots. It is true that this last-named feature is unusual; but the present instance still retains its value with respect to this point, for the patient was all the time under strict supervision, and the data are therefore quite trustworthy. Here, then, is evidence that leprosy eruption (during the summer months, I note), is not

necessarily attended either with marked fever, or apparently, with internal deposits; but it must be added that there probably was present some kind of constitutional disturbance (which will by and bye test our powers of diagnosis); and as regards deep-seated changes, that nothing certain is known. In fact, Danielssen now seems to be disposed, on the strength of Hansen's observations, to regard visceral lesion as not uncommon in cases resembling the above; see following notes.

he had some doses of cynogloss pulv. gr. iv; there were no physical signs of any lung-affection. The pulse was now less frequent; went down to 96, and the temperature showed a tendency to sink. The cervical and inguinal lymphatic glands were considerably swollen, and on the 8th he had a slight rash of small red spots on the backs of the hands and fingers. Subsequently, his condition began to improve; the pulse in the morning was 88-112, in the afternoon, from 100-120, and the temperature only once approached 41° C., was six times 40° 40' 7" C., and below 38° C. on 16 occasions. On the 27th June he began to get up a little, and by July 5th his convalescence was established; he was again making flesh. Later in the year, however, a fresh eruption of nodules began, which, with longer or shorter intervals, persisted until his death on 5th July 1870. During the last months of his life he was also troubled with diarrhoea.

The above is a pretty good illustration of the eruptive condition which lepers are liable to, and which may continue many months, or even all the year through. It is only when localisation of the deposit takes place in greater abundance or to greater extent, that remissions of longer duration occur, and the organism seems to have rest after the morbid materials have ceased to irritate, and through means of violent hyperæmia and rapid depositions in the skin or in the internal organs, to have become separated or located in the body. Not so rarely, these persistent eruptions terminate fatally. They are, as already shown, frequently attended with strong fever, under which a great part of the organic tissues are consumed, as is shown by the rapid emaciation and extraordinarily abundant elimination of urea. When a fatal issue takes place, the internal organs of the body are always found to be implicated; and either leprosy deposits in the spleen and liver will be met with, or a wide-spread tuberculosis has become developed. Whatever theory is adopted as adequate to explain the circumstances of these eruptions, the facts seem to suggest that nature, at that time, is attempting the elimination of some material which has become inimical to the organism. Something of this we recognise from experience of several other diseases, and particularly of the so called exanthemata. The thermometer seems also likely to render some service in leprosy, especially in these eruptive stages; and from what has already been ascertained, it may be said that when the measurements of temperature at time of eruption, persistently remain at and over 39° C. (102.2° Fah.) their significance is not limited to the cutaneous integument alone, but that important internal organs are also then implicated. (Remarks by Dr. Danielssen.)

*CASE. High temperature in Leprosy: Tuberculosis.*—Ole Larsen Hestad, 16 years of age, entered the cure-department in April 1868, suffering from the mixed form of leprosy. He was of delicate frame and sickly aspect. Eyebrows almost wanting: face puffy, skin of forehead glistening, but not thickened. On the outer side of both arms ill-defined, deep brown patches, blending with each other, so that the sound skin appears as lighter spots only, and on the thighs the same appearance of patches having boundaries which could not be defined. On the left patella are seen some flattened nodules of the size of hemp seed or small silver coin. The skin of the legs and feet has a marbled aspect, is indurated, dry and somewhat scaly. The inguinal and axillary glands are rather swollen, particularly the first-named. Otherwise his health was good. Carbolic acid was administered internally, and he had vapour baths weekly. In June there was a slight eruption of nodules attended with febrile disturbance, which was of short duration. On September 5th, a fresh eruption of nodules on the face, accompanied with rather smart fever: the nodules were red and tender to the touch, pulse 140, temperature rose to 39° C. In the course of the month he had two other outbreaks of red spots, on both arms and legs, and during this time the pulse was constantly between 130 and 140, and the temperature commonly between 39° and 40° C. On 1st October he complained of pain in the left side, on percussion a tympanitic sound under the left clavicle; otherwise a dull sound over the whole left lung in front as well as behind: at apex cavernous breathing, and behind the shoulder some râles; respiration frequent, but not laborious or spasmodic. Cough rather frequent, and sometimes so violent as to induce vomiting: expectoration very scanty. Digestion good, full diet, sleeps well, and only seldom night-sweats. The whole month of October passed without any eruption of the skin, but both pulse and temperature continued to be as high as in the preceding month, the cough increased, the phthisical symptoms progressed: strength failing, much emaciation, and death at the end of November. The temperatures were not taken after October, because of the inconvenience attending their measurement.

There can be no doubt in this case, that the high temperature was essentially connected with the internal state, because localisation of deposit in the skin was not considerable. Autopsy revealed a wide-spread tuberculosis of the body.

One of the latest examples recorded in the Bergen reports is the following; and particular attention is invited to the remarks appended by the recorder himself.

*CASE. Eruptions: fever.* Isak Entrøen, 33 years, entered the leper hospital at Bergen, 30th August 1871, suffering from the nodular form. Both eyebrows, especially the inner part, pale reddish, and somewhat puffy. The back of both hands as far as the wrists, tumefied from infiltration of nodules. The axillary glands on both

sides somewhat swollen. Sensation good. Left leg, the middle part of the front and outer surfaces insensible to slight touches; below, the feeling is quite natural, and so the other foot. Just at the anæsthetic part, there is found a large white scar, caused by a fall about three years since: the patient noticed loss of feeling after the healing of the wound, which occupied several months. The skin on both legs is rather puffy, tense and shiny, the inguinal glands are also tumid. Not quite a year ago, the hands and feet begun to swell, and at the same time his face became puffed up. The tumefaction has been greater than it is now, especially in the evening. He has been a fisherman for ten years; has no leprosy in his family, as far as can be ascertained; and he does not know that he has been in special contact with lepers. In the urine, there is 8 per cent. of albumen. To have a warm sea-bath daily. In the course of the year, he complained of pains in the arms and legs, which were relieved by cupping. The 23rd of January 1872, he began with baths of Kreuznach-water, and discontinued them on the 11th of March; no apparent change in the disease having taken place. The 1st April, he had an outbreak of livid, raised spots on the legs, also a swelling of the right eyebrow, which was red and tender, accompanied with alternation of heat and cold, and with thirst: temperature  $40.2^{\circ}$  C.; pulse 100. To have acid mixture. The 2nd, the spots more elevated, red and tender: temperature  $41^{\circ}$  C.; pulse 110. 3rd and 4th, the condition about the same, only temperature and pulse a little lower, 40 and 90. On the 6th, the nodular infiltration of the right eyebrow more marked; in the left one, too, a nodule has appeared, every evening a smart chill, lasting two hours and succeeded by heat. Temperature  $40^{\circ}$ , pulse 100. To have quina sulph. 0.3 grains (five grains) in the evening. Next day, he was somewhat better; the nodules in the eyebrows smaller: temperature sunk to  $37.5^{\circ}$  C., pulse 85. On the 8th, further diminution of the nodular infiltration of the eyebrows: several of the spots on the legs are hæmorrhagic, being almost black, with a yellowish green halo around them. Temperature  $39^{\circ}$  C. On the 9th, the swelling of the eyebrows almost entirely subsided, desquamation. The fever is considerably less, temperature almost normal. On the 14th, the eruption is completely over; some of the spots (the hæmorrhagic ones) upon the legs, have left behind slight thickening of the skin. Temperature and pulse normal. Health very good: to discontinue the quinine and the acid mixture. On the 23rd, again cold paroxysm and eruption of tubercles on the arms and legs, temperature  $39.5^{\circ}$  C., pulse 90. On the 24th, fresh shivering fits, the eruption continues, but is not more severe, temperature  $39.6^{\circ}$  C., pulse 100, to have quinine five grains, in the evening. On the 26th, no fresh shiverings; general condition improved, temperature  $38^{\circ}$  C., pulse 85. The 27th, state favourable. The 28th, the eruption is past, no chills, is free from fever, temperature and pulse normal. All the spots and nodules, which had made their appearance during the eruptive attacks, have entirely subsided and left no trace behind, but the patient is languid and considerably emaciated. To discontinue the quinine.

Referring to this case and a similar one previously recorded, Daniëlsen observes that in neither of them was the skin eruption so marked as to indubitably lead to general disturbance, unless the internal organs had been at the same time affected. But in both, there is ground to suppose that the spleen has suffered; and if one considers how peculiarly often post-mortem examinations reveals leprosy neoplasms in the spleen, it may well happen that here one has that beginning which frequently eludes attention. No considerable increase of volume of the spleen can have taken place in these cases, since none could be detected on percussion; but neither was there here, too, much more than the commencement of leprosy spleen disease. Quinine was of much use, whilst in eruptions where the spleen is presumably not implicated, it has little or no effect.\*

The subjects of internal deposits and high temperature, &c., as associated with the constitutional disturbances now under notice, will be immediately discussed; I now conclude these remarks on pyrexia and fever with the following brief summaries.

From the cases which have now been described, and from earlier observations, it is, I think, sufficiently apparent that the severer and more rapid forms of leprosy are commonly, if not invariably attended with pyrexial exacerbations, concurrent with which are such symptoms as subsidence of nodules or eruption in the skin, swelling of the corresponding lymphatic glands, and deranged nutrition of the body, and following which may be fresh deposits in the skin, or signs of visceral lesion; or, as a very rare event, no recurrence of the complaint. A rise of temperature

\* In a succeeding case of eruptive fever benefited by quinine, the author remarks, "besides the marked eruption on the skin, it is somewhat probably that the spleen also has been attacked, or as the strong chills, the general perturbation, and the circumstance that quinine manifestly checked the febrile disturbance."

Although it is not my intention to criticise these admirable essays of Daniëlsen, either in this place or in general, assent to speculations based only on surmise or inference is not to be implied from silence; and such conceptions are mentioned here only as tentative aids to future experiment and research.

is, therefore, an indication of movement in the system, either of leprous matter, or of strumous disease excited by its presence. An eruption unattended with increased heat, is said to be of comparatively short duration and harmless results; whilst a high temperature, *e.g.*, one at or above 104° F., is to be regarded as evidence of visceral lesion (probably strumous), and of danger to the patient. The distinction in bedside practice of leprous and strumous deposits within the body, does not seem to be possible by aid of thermometer alone; but I conclude that the very high temperature, which attends acute tuberculosis exceeds any such morbid elevation of bodily heat as occurs in leprosis, about as much as does the extent of tissue involved in the two cases, and it has been repeatedly shown that pure leprous lesions are comparatively scanty in amount, and of themselves do not immediately cause death. It will be noticed, from some of the cases above quoted, that nerve-disease is not beyond the influence of these febrile movements; and for other information respecting the relations of temperature in leprosy, I would refer to the Cases and Tables, and to Appendix A.; p. xvi., &c. Of the great emaciation of the frame, which sometimes attends the pyrexia in leprosy, several examples are afforded in the cases I have quoted; and there is attendant increase of urea-formation.

It may be useful on leaving this topic of 'leprous fever,' properly so-called, to thus briefly sum up its chief features; it is often well-marked, usually of continuous type, but frequently rather remittent or paroxysmal; headache, chills, and nocturnal exacerbations are not uncommon. The duration of the fever is very various, but although the symptoms subside on the appearance of an eruption on the skin, it is yet to be remarked that an eruption may occur without febrile symptoms, and that it is not possible to dissociate the latter, when they are at present, from some internal deposit of either leprous or strumous character. In Norway, the fever of leprosy is noted in official tables as 'fever with or without eruption,' and the interpretation of this phrase seems to refer to fever with either outward or inward deposit, no discrimination being attempted as to the nature of the deep-seated neoplasm.

It is further to be observed that the fever may come on at any stage of leprosy after the first appearance of the disease; it is even said that the malady may commence with fever, but some definite information seems here to be required. More to be noticed is its usual connexion with that form of the disease, characterised by abundant leprous formation, *i.e.* the tubercular, although fever may appear in other forms or types of the malady, as has been above shown.

On examination of the Norwegian records, I notice that leprous fever is most frequent in asylums situated furthest north; that, for example, at Trondjheim it occurs all the year through, being most common in the spring; while at Bergen it is comparatively less frequent, and happens at a somewhat later season. Perhaps the range, or sudden and severe alternations of temperature and moisture, are more concerned here, than the mere degree of cold, &c. For the tropical asylums I have no comparable data, which is much to be regretted.

Of the nature of the leprous fever, something will be said in the chapter on Pathology.

The *second* of the causes inducing febrile reaction, which has been named, is that alluded by the older Norwegian authors in the following terms (*loc. cit.*, p. 213):—

Certain chronic ulcers, commonly on the legs, seem to exert a direct influence upon the course of tubercular leprosy; when early formed, and while free discharging, they are beneficial; but they are hurtful when their secretion greatly diminishes, or when they quickly close up. Then, the ulcerous surface becomes red, puffy, painful, and it secretes a small quantity of yellowish, viscid fluid, quite transparent; its margins become tender, and the patient complains of the limb, the inguinal glands swell up, and then slight and transitory feverishness is felt. Cicatrisation begins, and in eight days a wide surface may be healed over, and the patient is glad

of this result. But soon the body begins to suffer, lassitude, severe headache, mental trouble, thirst, sometimes vomiting, strong fever, a pulse full and frequent; then there follows deep sleep—a precursor of death, if tubercles do not begin to be formed again, or the ulcer do not re-open . . . . . Again, under the head of anæsthetic leprosy, the same series of phenomena is adverted to, in connexion with deep ulcers, situated in the sole of the foot, only instead of an outbreak of ‘tubercles’ following suppressed secretion, there happens an extension of the anæsthesia. The inguinal are affected as usual in this case also. In the course of some brief inquiries, I have met with the expression of views similar to those indicated in the above remarks; and, as is well enough known, such were once commonly maintained. However little acceptable these notions of the ill results of suppressed ulcerous discharges may be, with regard to prevalent pathological doctrines, there is yet sufficient precision in the passages just quoted to prove them to be based upon actual observation; what is the correct interpretation of the phenomena in question, cannot, perhaps, be positively asserted.

The *third* method of advent of fever in leprosy, is also one indicated by Danielsen and Boeck, who in the following terms refer to the cases in question (*loc. cit.*, p. 276):—

Acute necrosis happens if a finger or toe, previously deprived of feeling, the finger swells, and is not very painful to touch, but it is the seat of lancinating pains, worse at night, extending to the whole limb, accompanied by swelling of the glands, and generally by great general re-action. This is evidenced by intense fever, with severe chills, headache, delirium, thirst, cardiac oppression, vomiting, extreme debility. An abscess has formed, and it burst, when relief to the constitutional symptoms quickly follows.

Respecting these phenomena, it does not appear that special stress need be laid upon them, because there is no evidence that the form of fever here seen is peculiar to leprosy, and Hansen (vide Appendix A., pp. xii-xiii) has shown that in the necrosed parts, there is no new formation leprous of material, from absorption of which contamination of the system might ensue. The other point to be noticed, refers to the swelling of the lymphatic glands concerned; which here occurs as well as in more purely specific changes; and it is now clear that such swellings may, in leprosy, indicate either ordinary irritation, or the peculiar irritation of disintegrated leprous matter; or, possibly, a combination of the two kinds of local disturbance. But again, Hansen has been at the pains to show, that the minute structural changes in the glands entirely correspond to the form of addition, which they may have received; and by the microscope it is possible to learn whether such additions are leprous, strumous, or inflammatory, or of mixed character.

I now come to the interesting subject of the acuter visceral affections of leprosy, as these are revealed by febrile disturbance of the system. Judging from the information which I have been able to collect in Norway, it might seem that this topic should be deferred to the head of ‘complications’ of leprosy, because the visceral affections alluded to, are almost invariably of strumous nature; but as a matter of convenience, at least, such distinction need not be enforced. I have, indeed, made an artificial separation between “fever with internal deposit of purely leprous character,” and “fever with deposits of tubercular (strumous) or mixed nature;” and, in theory, the separation may hold good; but while it must be admitted that in the course of leprosy, there shall possibly occur febrile disturbance with the formation within of purely leprous deposits, it is not yet demonstrated that such event occurs. In fact, almost all that can be advanced in support of the fourth series named in the list above, has been already stated under the first heading; and it is obviously impossible to make direct observation of its validity, during life, while after death, scrutiny has always (so far as I know), revealed something more than leprous growth alone. Clinical experience, too, has not yet elicited a means of positively discriminating one form of visceral deposit from another; or, more strictly speaking, of distinguishing the leprous formation from the strumous (or tubercular) deposit, which is so often associated with it; and only on autopsy,

can it be with certainty learnt, what was the character of the lesion, which raged during the last days of life.

I therefore dismiss the class of cases now referred to, as needing further study; and proceed to consider that series—the *fifth* on the list—in which the nature of the internal deposit is found to be of strumous or mixed character. Afterwards, a brief summary of the entire subject will be offered.

“It is not so very seldom that, simultaneously with an eruption on the skin, there occurs a deposit or neoplasm in the internal organs; which is sometimes attended with inflammation and much general suffering, but more frequently without any very marked symptoms, and and under more prolonged deposition. In this last instance, especially, does the thermometer furnish aid, since precise observation of altered temperature-relations, keeps the attention steadily fixed upon the possibility, or probability, that what occurs in the skin, takes place also in the interior of the body. Amongst such new formations as the skin-eruptions seem to entail, ‘tuberculosis’ is one of the commonest. And the more attention has been here paid to this point, conjoined with closer scrutiny, the more am I convinced by post-mortem appearances, that tuberculosis is not, as I in my first dealings with leprosy imagined it to be, an extremely rare complication; but on the contrary, so frequent a one, that out of three autopsies of lepers, it will be found in two.\* In my statement of the triennial period, 1862-64, I intimated the existence of such an intimate relation between tuberculosis and leprosy, that there might possibly happen a metamorphosis of one into the other, without either being wholly superseded, since they may, as we know, thrive side by side. I will now furnish further instances, from which may, perhaps be drawn evidence in favour of the opinion, that tuberculosis is not a specific disease, in the sense that it needs a special virus—the so-called tuberculous material—to call it forth. Nothing that may contribute to clear up this important point in the development of tuberculosis should be withheld; but to avoid prolixity, I will give only a summary of my observations.”

*1st Observation.*

Ole Olsen Svaberg (male), 23 years old, admitted into hospital in November 1849, with tubercular or nodular leprosy. He had a robust frame. In the face, but little infiltration of nodules. On the upper and lower extremities, large and small nodules in the skin, which upon the outer side of the left thigh had attained a considerable size; and of which a few were in a state of ulceration. The disease has become developed within the course of two years. His health is good. For four months, he took tartar emetic in increasing doses, and later, iodine of iron: also sometimes vapour baths, sometimes baths of sea water. Occasionally, he complained of pains in the arms and legs; and found relief in cupping. On the 25th May 1850, the inguinal glands in the left groin were swollen and tender; and on July 9th also those of the left axilla. On the 25th January 1851, there was an eruption of nodules in the arms and legs, attended with febrile disturbance; and on February 16th it is reported, that these nodules had disappeared. He had become rather anæmic, and hence took steel with benefit; and regained his robustness. But on the 19th June, commenced a fresh eruption over almost the whole body; the fresh nodules in the skin were very red, turgid, and tender; the face flushed and swollen; great febrile disturbance, with headache; on the 9th July, the eruption ceased, but several nodules had begun to soften, and his strength was somewhat reduced. Visection was practised twice in the course of three weeks. On the 13th he complained of periodic chills, alternating with sweating at night; and on the 22nd, he felt a fixed, stabbing pain in the left breast; but respiration rather frequent. The pain was relieved by cupping; but the febrile state persisted, and he complained of languor. Percussion elicited a dull sound on both sides of the chest; fine crepitation in both lungs. The 10th of August, diarrhoea, following the exhibition of tartar emetic in small doses; it was checked by laudanum. On the 17th, a fresh eruption of tubercles, especially upon the hands and feet, and attended with diarrhoea. On the 25th, the diarrhoea was checked; but the eruption continued, and also the febrile disturbance. He had tightness of breath, and a little dry cough. On the 16th September, it is remarked:—There is constant outbreak of nodules, the older subside and fresh ones appear, especially upon the extremities; he is feverish, much emaciated and has occasionally watery stools. The 1st of November, lately he has had pains in the back; the eruption of nodules was ceased, and now he complains of a fixed pain in the right breast which impedes the breathing, and is accompanied

\* These emphatic remarks seem to furnish an explanation of many of the pathological results which are recorded in the great work of Daniëlsen and Boeck (1848); for appearances which are strictly due to tuber-

cular, *ie.*, strumous deposit, were attributed, at that time to the leprosy itself. Now, however, a discrimination has been made.

with slight cough. On the 3rd, the pains were relieved after cupping; the cough subsided presently, but diarrhoea set in, which became worse towards the end of the year; whilst the eruption had almost ceased. In the middle of January 1852, the evacuations were becoming more natural; but again there appeared an outbreak of nodules, and the diarrhoea soon increased, and remained persistent until his death on February 18th, in a very emaciated condition.

The post-mortem examination which was made 24 hours after death showed, amongst other things, firm pleuritic adhesions on both sides of the chest; and miliary tubercles in the false membranes. In both lungs, but particularly in the left, a multitude of miliary tubercles. The omentum considerably studded with tubercles, both miliary and of larger size; with a conglomeration of them at one spot, not unlike the pancreas in appearance. The peritoneum at its lower part beset with large and small tubercles; and that part covering the large intestine, was hence so much thickened, that its layers could hardly be separated. The mesenteric glands not swollen.

"On comparing the changes detected after death with the history of the complaint, it seems clear enough that whilst leprosy, with its frequent eruptions, raged on the exterior of the body, so did tuberculosis in the internal organs; and there were no indications that the latter was anything but a secondary condition supervening on the former. If we now apply the theory which of late years has been put forth respecting the manner in which tuberculosis appears and is developed, it may not be denied that cases like the foregoing are readily explicable in the adoption of a self-infecting process. It will be recollected that after leprosy has existed for  $2\frac{1}{2}$  years in this man, the lymphatic glands in the groin and axilla began to swell. Now Mr. G. A. Hansen, assistant-surgeon to the Lungegaards Hospital, has, in a prize essay on the Lymphatic glands, not yet issued from the press (1870), clearly proved that leprosy lodges in these glands, where the same structural elements are to be found as in the leprous skin and nerves. These leprous elements, which essentially consist of cells of various sizes, sometimes in the form of masses containing numerous fat molecules are the same as those I had already commented on in my earliest work on leprosy, and even stated to be characteristic cell-forms of the disease, but which I later supposed to result from a retrograde process or degeneration. Hansen is now disposed to regard these elements as specifically leprous, since he has found them also in the spleen and liver; and he, too, thinks them to belong to retrograde metamorphosis of structure. If, now, these particles are really due to fatty degeneration, and such certainly seems to be the case, it is evident that their detritus might reach the blood through the lymphatic vessels, and, acting as an irritant, excite the production of miliary tubercles. The effects would be the same as have been ascribed to absorption of caseous tubercular material. Whether the leprous eruptions are consequences of self-infection may be more doubtful; at all events, it is clear that the first outbreak, which often affects the whole surface, must have another origin."

Dr. Danielssen then proceeds to narrate 11 other cases of leprosy, in which the symptoms during life, and appearances after death, would tend to support the views just referred to, and some of his comments on the cases may be here introduced; thus, after case 7, it is remarked:—  
 "On his admission into hospital there was nothing indicating affection of the chest or abdominal organs; he was oppressed by violent eruptions, which culminated in an innumerable multitude of nodules in the skin, and which were attended with great febrile re-action of a very exhaustive character. But in the two last months of his life the peculiar eruptive stage ceased, and the nodules in great numbers began to soften and subside; and from this time were there some signs of localisation in the internal organs. There arose a condition which reminded one of the old views of metastasis, and it seems undeniable that the wide-spread tubercular deposit dated from the time when the softened leprous nodules were undergoing absorption. The leprous dyscrasia was of itself not sufficient to call forth tuberculosis; it led, indeed, to deposit in the skin, and when this had undergone disintegration there first appeared the corpuscular elements acting as a new irritant, and so entailing the production of miliary tubercles."

The eighth observation, or case, described by Danielssen, was that of a boy aged 17 years, and affected with mixed leprosy; the youth was slender-limbed, but of healthy complexion; the disease was supposed to have begun a year before; general health good. For about a month, sub-cutaneous injections of potassic iodide were practised every third or fourth day. On December 5th, 1863 (about six months after admission), general febrile disturbance set in, which continued till the 11th, and was attended with an outbreak of nodules on the face and on the extremities; the nodules were very red and tender; the fever persisted. On the 17th it was noticed that the eruption had increased, the nodules had become enlarged, and on the arm confluent, as well as softer. On the 23rd he

complained of oppressive pain in the head, especially the forehead; an accession of vomiting; appearance rather stupid; tremors in the upper extremities. The 27th, the brain symptoms have lately increased; stools thin, not frequent; a fresh outbreak of spots. The 31st, tremors increased; some subsultus; hearing dull; a little delirium; vomiting continues; sluggish bowels; pulse 100; some cough. The 3rd January 1864, the eruption had come to a standstill. His condition was a little improved; no great pain; but already on the 5th, had he relapsed, and was in an almost soporific condition, from which he could be awakened only by loud speaking. The vomiting persisted; urine scanty; pupils somewhat dilated, rather sluggish; pulse 100, small. This condition remained during the whole of January; and in February he became worse, finally sinking on the 19th.

*Section 17 hours after death.* Body much emaciated; here and there spots marking faded nodules. In the lateral ventricles of the brain, which were much dilated, was a quantity of serous fluid; and the ependyma was thickened and tough; the adjoining brain-substance softened. Fluid in the pleura; no adhesions. On the parietal layer of the pericardium, small patches of exudation; about one line thick, and beset with miliary tubercles. Tubercular deposit in the right pleura; masses of recent tubercle in the same lung; also in the left lung, in the lower lobe. Bronchial glands decidedly swollen, and infiltrated with tubercle. Some miliary tubercles in the costal pleura. Liver enlarged to double the normal size; its peritoneal coat studded with numerous, very small, miliary tubercles, which sometimes encroach on the parenchyma; the liver substance very 'nutmeggy.' Spleen much increased in volume; and its substance filled with large and small tubercles. In the right kidney some miliary tubercles, and some in the omentum. In the lowest part of the ileum, a small tubercle was found in the mucous membrane; the mesenteric glands not swollen.

Danielssen remarks on this interesting case as follows:—

Here it was an acute hydrocephalus (the so-called cerebral fever), which caused the speedy decease of the patient. It is not, indeed, so uncommon that in young leprosy subjects there appears an acute attack of water on the brain, in connection with, or as a consequence of, these violent eruptions; although I have not been able to find any miliary tubercles in the brain itself.\* That the wide-spread tuberculosis, in this case, made its advent long after the appearance of the leprosy, seems to be beyond doubt; and so well was it concealed, that only on making the autopsy was its existence first revealed. Under the violent eruptions many nodules become softened and subside, whilst new ones come forth; and it is precisely this softened 'stuff' which, entering the circulation, presumably supplies the germs of miliary tubercles.

I will now cite another case, the eleventh observation of Dr. Danielssen, in illustration of the subject under notice; and then will give Danielssen's own summary.

A young woman, aged 21, suffering from tubercular leprosy, entered hospital 14th October 1865. She was rather spare, but very well-formed. On the face, a collection of livid nodules, which were partly distinct in the skin, partly blended, and forming a large mass of infiltration. On the limbs, many nodules; those on the thighs and legs, especially having a brownish tinge, were rather soft and fallen in, as it were; a few of them being even more wasted. The lymphatic glands much swollen. Menstruation regular. The disease began a year since, with livid spots and nodules on the lower extremities; otherwise she was quite well. The 14th May 1866, she commenced the meat-cure—animal food, bread and wine. Menstruation had stopped in March. January 1st, 1867, it is noted—the tubercles had everywhere entirely subsided, with the exception of on the right arm, where still one or two, small, faded, and soft ones remained. The skin was free from infiltration. The lymphatic glands were, however, more swollen. No menstruation since March. The meat-cure plan of treatment was suspended. She now remained well, having only some slight pains, now and then, in the legs, which were relieved by cupping. On July 27th there appeared an outbreak of tubercles on the face, attended with febrile disturbance and cardiac oppression, thirst. The eruption lasted till 1st August; then for two days, diarrhoea with colicky pains in the belly; also cough, with occasional vomiting. The physical signs were those of bronchitis, but not greatly implicating the lungs. On the 5th, again an eruption of numerous tubercles, especially on the feet, and attended with fever. The nodules were very tender. On the 16th, she was free from fever; and there seemed to be an arrest of the eruptions. But on 10th October, there appeared a fresh eruption like the last; and she complained of cardiac pains. Now and then she had bleeding at the nose, which rendered her rather anæmic; and on that account preparations of steel were given. Cardiac oppression, and pains in the belly and back, were now the most prominent symptoms; the cough seemed better. On examination of the abdomen on March 3rd, 1868, the liver was found to be somewhat increased

\* Subsequently, a similar, but more marked case of a youth originally affected with anæsthetic leprosy, is recorded by Danielssen, wherein some of the post-mortem appearances are thus described—the lining membrane of the lateral ventricles thickened and studded with granules (miliary), the same granules were found in the choroid plexuses and the arachnoid at the base

of the brain, "most plentifully alongside the veins."  
"The medullæ oblongata was inclosed in a gelatinous exudation which had a greenish tinge, and was prolonged down to the spinal cord." Surely this is the sort of exudation formerly so much insisted in the older work on *spedalskhed*, as peculiar to leprosy. See Appendix B.

in volume. The bleeding from the nose still continued; vomiting occasionally towards evening. The enlargement of the liver continued; the vomitings increased in frequency; the bleeding at the nose more often, and a marked degree of anemia was the consequence. On August 23rd it is noted: frequent vomiting; cough with frothy expectoration; sibilus in both lungs; anasarca in both legs. November 3rd, a slight outbreak of spots on the face. The strength was failing. The liver greatly enlarged; a little ascitic fluid. She died on the 21st January 1869.

*Post-mortem examination* 26 hours after death. Body emaciated; anasarca present. Skin tinged yellow. In the left pleural sac some clear, orange-tinted serum; left lung small; part of the lower lobe being of bluish tint, tough, collapsed and empty of air; its cut surface smooth, and studded with scattered miliary tubercles, the size of a millet grain; the upper lobe of the lung was oedematous. Pleura smooth, except between the lobes and along the border of the upper lobe, where were some soft false membranes, and also numerous small miliary tubercles. Right lung was adherent to the parietes: oedematous, and below, void of air. Several of the bronchial glands had here degenerated into a caseous mass on the left side, they were natural. In the peritoneal sac, much yellowish, transparent serum. Liver very large; weighing 2,180 grains; substance amyloid; and besides studded with leprous deposit, in the form of numerous, very small, yellow dots or streaks. The lymphatic glands in the hilus showed a yellowish-white cortical part, with reticulated markings in the medullary portion (leprous deposits). Spleen large; its capsule smooth; several yellow spots seen through it, and seated in the parenchyma, which was firm; cut surface dry, greyish-red, studded with miliary tubercles the size of hemp seed, some being opaque, others clear; and besides there were numerous very minute, white, opaque dots (seen by aid of the microscope to be leprous deposits). Lymphatic glands in hilus cheesy and containing miliary tubercles. In the substance of the right kidney, which was amyloid, were some miliary tubercles; and in the pelvis was a collection of tubercles, some being cheesy.

Here, too, the tuberculosis made its appearance long after leprosy had shown itself; and as it seems could not overrun all the internal organs, because the latter had also deposited its own material in the liver, spleen, and lymphatic glands. Only after the nodules in the skin had begun to subside, did the symptoms appear, which could lead to the supposition of tubercles being formed in both lungs and abdominal organs; but this process did not proceed far, as the leprous diathesis was still paramount. It might, perhaps, be supposed that when the leprous matter does not undergo a complete retrograde metamorphosis, whereby alone its elements become converted into a detritus, then there will be no great danger of an outbreak of tuberculosis; the leprous malady however proceeding on its own course, to the destruction of the patient. In this case, the spleen evidently was both tubercular and leprous; the left lung and right kidneys tubercular; and the liver leprous and amyloid.

Danielssen's 12th observation is the case of boy aged 17½ years, affected with mixed leprosy; and it is remarked of him, that he enjoyed very good health for more than a year after the first symptoms of the disease showed themselves, and that during this time there could be no question about any considerable localisation in the internal organs. But the violent eruptions took their rise contemporaneously with deposits in the skin, and afterwards along with re-absorption of the deposited and softened leprous material, signs of tuberculosis appeared, which on the occasion of every fresh eruption became more marked.

From the preceding observations it seems to be evident:—

1. That the leprous disease had been present for a longer or shorter time in the body without any other complication.
2. That tuberculosis had first appeared, after the leprous material had for some time been deposited, partly in the skin and partly in the lymphatic glands; and there has undergone certain retrograde changes, whereby the elements of the disintegrated neoplasm might be taken up either by lymphatics or blood vessels, or by both, and in consequence be conveyed to the various internal organs.
3. That the formation of tubercles has stood in a fixed causal-relation, to the leprous material; and that the latter has, therefore, by self-infection of the system induced the former.
4. That self-infection is produced by structural elements, which are wholly different from those of tubercle.
5. That leprosy and tuberculosis may go side by side of each other, and each in its own way effect those several morbid changes, which, as a rule, entail fatal consequences.

I know full well (adds Danielssen), that no perfectly valid proof is here furnished of several of these propositions; thus, for instance, I have not succeeded in demonstrating the presence in either blood or miliary tubercle, of those detritus products which should indicate self-infection and the formation of tubercle; yet if these observations are compared with the experiments made both formerly and of late on the artificial production of tubercle, there will

not be wanting points of connection, which quite justify an analogy being drawn between two series of facts in question.

Under the heading of 'General Pathology,' I propose more fully discussing this subject, and with reference to this last quotation from Dr. Danielssen, I will here only add the following remarks:—(a.) It would seem that men are much more subject to fever, eruption, and tuberculosis than are women (as 20 to 7); (b.) In both sexes, it is the younger persons who are affected, the ages of the patients being in half of the instances mentioned under 20 years, and very rarely over 30 years; (c.) It is also to be noted that the tubercular form of leprosy, is that which is most usually attended with these constitutional changes (in 23 out of 27 cases); again, (d.) The leprosy attack has commonly been mild, of short duration, and consequently slight progress: the general health, too, has been good up to the date when tuberculosis has supervened, and an hereditary tendency to phthisis, &c. is not necessarily present; (e.) The lymphatic glands in the young leper seem to be almost always, if not invariably, affected; (f.) The advent of acute febrile symptoms is sudden and unexpected.

Some of the above-named conditions are, as it seems to me, rather in favour of the independent origin of tuberculosis in certain cases of leprosy, in Norway; and one should know—what I cannot ascertain from the ordinary published data—the proportion of strumous cases in the corresponding non-leprosy population, with other like points, before there can be demonstrated a connection closer than that of coincidence, in the two classes of diseases under notice.

One other case will be quoted, both for its own intrinsic interest, and because I had the opportunity of seeing the man daily for some time before his death, and was present at the autopsy. The microscopic examination I was also allowed to see. Of the strict accuracy of these late records, I need hardly presume to speak.

CASE. *Febrile Accessions and Tuberculosis in Leprosy.*—Elias Knutson Fejen, aet. 25, Elephant. tuberculosa. Entered the asylum on June 20th, 1873. He is well nourished. On the forehead and right cheek many nodules of different sizes and rather soft. On both upper and lower extremities numerous nodules, a few of which upon the thighs and legs are broken down, and have formed ulcers. Taken on the whole, the nodules seemed to be softened and collapsed, and, in consequence, the skin over the spots where they are seated is rather puckered. Sensation is slightly diminished in the hands and feet. The disease began one year since, with an outbreak of nodules on the forehead and attendant oppression of the body. At that time he was servant to the leper named Lars Olsen, and had been a year with him, lying in the same bedclothes, and making use of the same drawers, as his master. He knows of no leper in his own family. For the rest, he is in good health; both thoracic and abdominal organs are, so far as can be ascertained on examination, in a sound state. The 12th August: The nodules have, for the last few days, been somewhat red and tender; he has had headache without febrile disturbance. To-day, he complains of pains in the head, and buzzing in the ears; tongue a little coated; motion scanty appetite good; to have some medicine; a blister to the back of the neck. Evening: Temperature is rather high, 40° C. (104° F.); pulse 96. Morph. acetat.  $\frac{1}{2}$  grain. The 13th: Slept at night, he feels better; tongue moist; the pupils somewhat dilated, the left more than the right, both are contractile; appetite very good. Evening: Temperature 40·5° C. The 14th: There has been an outbreak of nodules in the face and on the legs; headache is less; pupils more contracted; stools almost natural; temp. 41° C.; pulse 100. The 15th: Sleep calm, skin moist; temp. 40° C.; pulse 100; he feels relieved since the eruption. The 16th: During the last 24 hours the pains in the head have increased, there is slight delirium; several thin stools; uneasy sleep; eruption is increasing; temp. 40° C.; pulse 90, somewhat irregular. The 17th: To-day, a little relieved. Sleep good; always a remission in the morning with 1 to 2 degrees lower temperature. Evening: Temp. 40° C. The 18th and 19th: He feels much better; pains in the head less; motions regular; tongue much coated, but moist; eruptions of nodules continue; temperature about 40° C.; pulse 90. The 21st: Condition nearly the same; three scanty stools in the last 24 hours; pains in the head continue; now and then delirium; flushing of the face; temperature 40° C.; pulse 100. To apply cupping-glasses to the back of the neck. The 22nd: Has a fixed look some tremor of the hands, slight impediment in speech; tongue clean; the nodules on the forehead have considerably subsided; temp. 41° C.; pulse 100. The 23rd: As yesterday; to have nitrate of soda 8 gr., water 240, one spoonful every second hour. Evening: Temp. 41° C. Quinia  $\frac{1}{2}$  gramme. The 24th: Slept well; the tremor and hesitating speech are the same; the tongue is somewhat clean; temp. 39·5° C.; quinia repeated. The 25th: Condition unchanged; again quinia. The 26th: No change; the temperature remains at 39·5°, but in the morning

descends to  $37.5^{\circ}$  to  $38.5^{\circ}$  C.; to continue the quinia. The 27th: Tremors have increased. Temp.  $40^{\circ}$  C. The 28th: Motions more scanty, otherwise the same; temp.  $40^{\circ}$  C.; pulse 110. The 29th: Smart diarrhoea; a little dry cough; to resume the former medicine; temp.  $39.5^{\circ}$  C. The 30th: No stool in the night; temp.  $39.4^{\circ}$  C. The 31st: Temp. remains at  $40.5^{\circ}$ ; pulse 104. The 1st of September: Very restless at night; no sleep; no diarrhoea; tremors unchanged, the same fixed, staring look, and anxious, frightened aspect; is perfectly conscious; speaks slowly; temp.  $40^{\circ}$  C.; pulse 110. 2nd and 3rd: Tremors increased; sleep disturbed; temp.  $40^{\circ}$  C.; pulse 110 to 120. 4th and 5th: No particular change. 6th: Dry, hard cough at night. No pain in chest or dullness on percussion; breathing sounds faint; temp.  $39.5^{\circ}$  C.; pulse 120. 7th and 8th: Little sleep; the same tremors; some, but not considerable emaciation; temp.  $43^{\circ}$  C. Pulse 120. The 9th: Cough increases; breathing not much impeded; no other change; to have *Infus. Arnicae*. 10th and 11th: Tremors more marked; speech unintelligible, pulse irregular, 130; temp.  $39^{\circ}$ . 12th and 13th: No particular change, except that the temperature is much lower; pulse remains at about  $120^{\circ}$ . 14th: He complains of the cough, which troubles him: is losing flesh; temp.  $38^{\circ}$  C.; pulse very irregular, and cannot be counted because of the tremors of the hands; now and then slight delirium. 15th and 16th: Consciousness diminished; temp. about  $88^{\circ}$  F. 17th, morning: Temperature sunk as low as  $84^{\circ}$  F., and afterwards went up to  $38.5^{\circ}$  C. Strength steadily failing; speech difficult and more unintelligible. Aphae of the mouth. 19th: Is beginning to sink; tremors excessive; cough has subsided a little; temp.  $38^{\circ}$  C. 21st, evening: Moribund, temp.  $36^{\circ}$ . The 22nd: Died this morning.

*Section* 24 hours after death. Body somewhat emaciated; the only remaining 'nodules' are two on the brows and right cheek. The rest have disappeared, leaving only depressed marks in the skin.

*Cranial cavity.*—The pia-mater somewhat oedematous: the ventricles somewhat distended with almost perfectly clear serum; the ependyma on the septum lucidum considerably thickened. The white substance of the brain very moist, glistening, with a moderate number of puncta. At the base of the brain, nothing abnormal; no tubercles.

*Thoracic cavity.*—Heart much distended with blood, loose coagula, partly separated into clot and serum; apparently dilatation of the ventricle, probably dependent upon the distension. Muscular substance healthy. The flaps of the mitral valve slightly thickened; on the anterior one an excrescence the size of an oat-grain, recent and gelatinous; no incompetency of the valve, and the other flap normal. A little clear serum in the pericardium. In both pleural sacs, also, a little serum; no adhesions. The surface of both lungs, and especially the opposed surfaces of the lobes, strewed with grayish, gelatinous miliary tubercles. Within the substance of the lung, especially in the upper lobes, numerous large and small portions deprived of air, and having irregular, bulging, and dense margins; some are much congested, others grayish and semi-transparent, others again more compact and whiter, with a tinge of yellow. In addition, several clusters of miliary tubercles of gray and translucent aspect at their circumference, and whitish or opaque towards the centre. The lungs were also oedematous. The bronchial glands, especially on the right side, distended with a few cheesy particles, but mostly with miliary tubercles in all stages.

*Abdominal cavity.*—Liver of normal size and consistence; margins of acini faintly pigmented: the inter-acinose spaces whiter than normal, and two tubercles are found on the right lobe. On section, the inter-acinose broader than natural, with only an inconsiderable white tint; no tubercles to be detected in the interior; glands in the hilus somewhat swollen, with marked leprous tinting in their cortical substance; gall-bladder full. Spleen, of normal size and consistence; about a score tubercles scattered in the capsule, and also partly in the substance of the organ; the arterial sheaths distinctly apparent, and not very unusually coloured. Kidneys blanched; anæmic, otherwise of normal aspect. Intestinal canal in the whole normal, if one excepts some parts of the jejunum, where softened tubercles were seen in and around the patches of peyer. Testes, to ordinary inspection, normal. The external lymphatic glands leprous. The ulnar and peroneal nerves also leprous, without being remarkably thickened.

On microscopical examination there was found, in the liver, generally, a dense infiltration of round cells alongside the portal trunks; whether intermixed with these were any brown bodies (leprous elements) is uncertain, but not so in the glands of the hilus, where, on the contrary, they existed in plenty. In the spleen, masses of the brown bodies (cells) of medium size, were to be seen; and as is usual here, many were enveloped in a protoplasmic mass. In the testes, numerous brown bodies, of which many were very large, elongated, and inclosing several vacuoles; an isolation of the tubuli seminiferi, some of them appear to contain small specimens of the brown bodies. The lungs were tuberculous, and in many places there was lobular pneumonia.

Before the leprous eruption his health was good, and there were no indication of that tuberculosis, which also certainly was not present when the other began. But the tendency of leprous nodules to softening and absorption, excited apprehension that an outbreak might follow; and experience has also taught us, that with such, the formation of tubercles lies close at hand. What here was marked from the beginning of the eruption, and seems to call for comment, was the persistent headache and brain symptoms, which accompanied the well-developed febrile state; and hence a diagnosis of hydrocephalus, a complication which is not so very rare in lepers, and is oftenest ushered in by an eruption of nodules in the skin. In this case, the latter did not fully come out, but it no doubt contributed, along with the scattered lobular pneumonia, to the somewhat early death of the patient. Indeed, the eruption was not considerable, and, of itself, could not have caused the great disturbance of the system, the persistent high temperature, had not at the same time important internal organs been attacked. Whether the leprous deposits in

the liver, spleen, and testicles dated from an earlier period of the disease, or took their origin from the time when the skin-eruption appeared, is difficult to determine; but that they were cotemporary with the evolution of tubercles, seems to be beyond doubt.

Passing over (for the time) other less common and intimate complications of leprosy, than this of tuberculosis, I have next to notice the general state of the system, which ordinarily supervenes during the course of the disease. Previously, however, to treating of the leprosy cachexia, I would here introduce a detailed observation of Danielssen, upon the condition of the *urine* in leprosy, because in my brief inquiries elsewhere I have not met with any other statement sufficiently definite to reproduce in this place, and single as this case stands, it is yet not without considerable interest. It might not be easy to dis sever the leprosy cachexia from all its complications, and then to determine the condition of the excretion as the process of decay advances, and, in fact, this has yet to be done. So far as I know, the kidneys are not affected in leprosy, necessarily or primarily; but in the later stages of the disease I found them to have been decidedly changed, as in the so-called granular degeneration; and, during life, it is not so uncommon for albumen to appear in the urine during a febrile attack, or acute eruption. Instances of this latter event have been already mentioned in this memoir, and one here follows.

Reference should be made to the 'morbid anatomy' of the disease, as described in earlier pages, and it may be remembered that 'amyloid' degeneration of the kidneys is not uncommon in leprosy; but purely leprosy changes in these organs are not known.

*CASE. Condition of the Urine in Leprosy.*—Peter Hansen Gidske, servant, 27 years old, suffering from Elephant. tuberculosa and anæsthetos, entered hospital in December 1864. He was a well-made man; growth of hair abundant. On the forehead and above the eyebrows a few round brownish-red, elevated spots, the size of beans, and attended with deep-seated infiltration of the skin; on the chin one of the same kind. On the lower part of the back, and on each side of the spine were some light brown, slightly elevated spots, the largest being a hand's breadth in size, the smaller following the direction of the ribs and separated by intervals, in which the skin retained its natural colour. Upon the outer side of both arms were many small, round, light-brown spots, which alternated with a few nodules; on the left arm opposite to the olecranon, a large rounded, red infiltration of tubercles, with turgescence and elevation of temperature around. Several similar infiltrations are to be seen on the thighs and legs, especially upon the anterior and inner surfaces, and also intermixed with dark blue, less prominent patches. Over the infiltrated places the skin is felt to be thickened. Both nodules and patches were somewhat tender to the touch; otherwise he had no particular pain, or only some tenseness of the skin. The lymphatic glands, especially in the groin, were swollen; feeling good, except in right hand and fore-arm for some inches above the wrist, and here, too, he felt constant, tearing pain. General health otherwise good. For about half a year before he came to hospital, he began to feel pain in the toes, and at the same time there appeared red spots upon the legs. He knows of no cause for the disease; his parents were alive and well; no leper in the family. The outbreak of nodules above-mentioned had appeared some days before his entry into hospital. The 13th December: Infus. folior. digit. grs. x-5viij, one spoonful every third hour. Solut. arsenical Pearsoni, four drops, morning and afternoon; vapour bath twice weekly. 15th: The eruption of nodules is extending on both upper and lower extremities; the right ulnar nerve at the elbow joint is swollen and very tender. 17th: Sleeps badly on account of the pains; to have morph. acet. gr.  $\frac{1}{2}$  in the evening. 21st: Nodules collapsed and pale; temperature of skin reduced; pulse 88 (morning), 72 (evening); at night skin hot and perspiring. 23rd: Nodules much retrograded; tenderness in skin almost disappeared; he feels himself more easy; secretion of urine plentiful; night-sweats continue. 26th: Nodules almost subsided; scarf-skin peeling off; sweats less; pulse 64. 28th: General condition improved; sweats much diminished; pulse 68. 23rd January 1865: Since last date he has been well; pulse ranged between 68 and 72; urine abundant, being from 1,700 to 1,900 c.c.m. in the 24 hours. Every fifth day the dose of Pearson's solution has been increased one drop, so that he at this date took 12 drops morning and evening. 7th February: The secretion of urine has increased in amount to 1,900 to 2,000 c.c.m.; the pulse has occasionally been as high as 84 and rather irregular. From this date the urine every other day, or at longer intervals, was submitted to a chemical and microscopic examination, the results of which are embodied in the following table. March 23rd: A fresh outbreak of nodules upon the fore-arm attended with febrile disturbance and headache; pulse 92. 24th: Eruption on the thighs also; skin hot and parched; headache less; pulse 108. 25th: The eruption augment in both extent and intensity; fever strong; thirst; night-sweats. 26th: sleepless at night; to discontinue the infusion of digitalis and arsenical solution; in the evening to have  $\frac{1}{4}$ th grain of morphia. 27th: Little sleep; much perspiration; the eruption steadily increases and attended with considerable pain and tenderness; urinary secretion scanty; pulse 96; in the morning to have half grain morphia. 29th: Eruption on the face, more marked on the limbs; strong fever, especially in the afternoon; pulse 92; skin wet at night; to take solut. nitrat. soda.

3ij-3vij, one spoonful every second hour. April 1st: The nodules not so intensely red, less tender; fever less; better sleep; copious night-sweats; tongue dry, coated; pulse 88. 3rd: Eruption now subsiding; sweating unchanged; he complains of severe, rending pains in the hands and feet; is somewhat emaciated; tongue dry, encrusted; pulse 96; to have poultices to the hands and feet. 5th: The nights have been more tranquil; fever less; tongue less coated; pulse 92; temperature of skin somewhat lower; pains in the right hands; perspirations unaltered; to apply tincture of iodine to the right hand. 7th: Pains in the hand less; temperature normal; nodules everywhere fallen in; sweats continue; tongue less coated. 9th: Pains in the hands considerably less; tongue clear; on the whole he is better; pulse 100. 11th: Still pains in the hands and copious night-sweats; strength but slight; emaciation; tongue clean and moist; pulse 108; to discontinue the mixture and take solut. chloret. ferric. aëch. four drops thrice daily. 14th: Sleep more tranquil; perspirations less; some new spots on the face; pulse 100. 17th: Much better; pains in the left hand considerably less; night-sweats subsided; pulse 90. 20th: A fresh outbreak of nodules on the forehead, on the right hand and the lower extremities; pulse 84. 24th: Pains much less; hyperæsthesia in the skin of the hands and feet; the last outbreak of spots almost subsided. 27th: During the last 24 hours a few nodules have appeared upon the face and hands; his body is much emaciated; sweats diminished; tongue clean; pulse 100. 11th May: Outbreak of nodules ceased; nodules everywhere subsided; strength increasing; pains in left hand and arm almost gone; hyperæsthesia continues; there is considerable wasting of the muscles of the hand, numbness and flexion of those fingers, which are supplied by branches of the ulnar nerve. 19th, 20th, and 22nd: Again an outbreak of nodules on the face, trunk, and extremities; night-sweats come on, and some febrile disturbance.

The following table refers to the above case.\*

| Date.      | Quantity of Urine in 24 hours in c.c.m. | Specific gravity. | Other Remarks.                        | Chloride of Sodium, p.c. | Urea, p.c. | Chloride of Sodium, gram. | Urea, gram. |
|------------|---|-------------------|---------------------------------------|--------------------------|------------|---------------------------|-------------|
| 1865.      |   |                   |                                       |                          |            |                           |             |
| February 7 | 11·00                                   | 10·18             | Acid, high-coloured deposit of urates | 0·88                     | 1·90       | 9·68                      | 20·90       |
| " 10       | 21·00                                   | 10·18             | " " " "                               | 1·13                     | 1·37       | 23·73                     | 28·77       |
| " 14       | 14·50                                   | 10·16             | " " " "                               | 0·80                     | 1·67       | 11·60                     | 24·21       |
| " 20       | 14·20                                   | 10·17             | " " " "                               | 0·84                     | 1·45       | 11·93                     | 20·54       |
| " 22       | 9·40                                    | 10·18             | " " " "                               | 0·88                     | 1·65       | 8·27                      | 15·57       |
| " 24       | 16·40                                   | 10·15             | " " " "                               | 0·99                     | 1·43       | 16·24                     | 23·45       |
| March 2    | 9·10                                    | 10·19             | Same colour, no deposit               | 1·12                     | 1·88       | 10·19                     | 17·11       |
| " 4        | 14·20                                   | 10·16             | " " " "                               | 0·98                     | 1·77       | 12·92                     | 25·13       |
| " 7        | 13·25                                   | 10·14             | Slight deposits of urates             | 1·05                     | 1·27       | 13·91                     | 16·83       |
| " 9        | 11·50                                   | 10·16             | Very high colour, no deposits         | 0·09                     | 1·66       | 11·38                     | 19·09       |
| " 11       | 13·40                                   | 10·20             | Very acid, many phosphates            | 1·08                     | 2·04       | 14·47                     | 27·34       |
| " 15       | 9·50                                    | 10·21             | Clear                                 | 1·17                     | 2·07       | 11·11                     | 19·66       |
| " 18       | 11·20                                   | 10·20             | " " " "                               | 1·05                     | 2·39       | 11·76                     | 26·77       |
| " 21       | 12·20                                   | 10·17             | " " " "                               | 0·98                     | 1·84       | 11·96                     | 22·45       |
| " 23       | 7·00                                    | 10·28             | Deposit of triple phosphate           | 1·05                     | 3·60       | 7·35                      | 25·20       |
| " 25       | 8·70                                    | 10·28             | High-coloured, clear                  | 0·85                     | 3·48       | 7·39                      | 32·02       |
| " 27       | 6·66                                    | 10·28             | Lateritious deposit                   | 0·12                     | 3·70       | 0·79                      | 23·76       |
| " 29       | 7·00                                    | 10·25             | " " " "                               | 0·13                     | 4·06       | 0·91                      | 28·42       |
| " 31       | 6·50                                    | 10·24             | " " " "                               | 0·23                     | 3·61       | 1·49                      | 23·46       |
| April 3    | 8·50                                    | 10·20             | High-coloured, clear                  | 0·16                     | 3·58       | 1·36                      | 30·43       |
| " 5        | 11·40                                   | 10·21             | " " " "                               | 0·19                     | 3·60       | 2·17                      | 41·04       |
| " 7        | 10·30                                   | 10·22             | " " " "                               | 0·23                     | 3·66       | 2·37                      | 37·70       |
| " 10       | 7·40                                    | 10·25             | " " " "                               | 0·47                     | 3·76       | 3·48                      | 27·82       |
| " 20       | 7·70                                    | 10·22             | " " " "                               | 0·53                     | 3·40       | 4·08                      | 26·18       |
| " 22       | 10·10                                   | 10·24             | Deposit of urates                     | 0·94                     | 3·58       | 9·39                      | 36·16       |
| " 24       | 9·40                                    | 10·26             | " " " "                               | 0·99                     | 3·46       | 9·31                      | 32·52       |
| " 26       | 11·90                                   | 10·26             | " " " "                               | 1·05                     | 3·20       | 12·49                     | 38·08       |
| " 28       | 8·00                                    | 10·25             | High-coloured, clear                  | 0·64                     | 3·21       | 5·12                      | 25·68       |
| May 1      | 7·30                                    | 10·26             | Considerable deposit of urates        | 0·76                     | 3·62       | 5·55                      | 26·43       |
| " 3        | 7·50                                    | 10·24             | " " " "                               | 0·73                     | 3·65       | 5·85                      | 27·37       |
| " 5        | 6·10                                    | 10·26             | " " " "                               | 0·85                     | 3·36       | 5·18                      | 20·50       |
| " 8        | 6·00                                    | 10·26             | Clear                                 | 1·05                     | 2·60       | 6·30                      | 15·60       |
| " 11       | 9·00                                    | 10·24             | Deposit of urates                     | 1·69                     | 2·28       | 15·21                     | 20·52       |
| " 13       | 8·60                                    | 10·19             | Clear                                 | 0·82                     | 1·88       | 7·85                      | 16·17       |
| " 15       | 6·00                                    | 10·27             | Deposit of urates                     | 1·51                     | 2·49       | 9·06                      | 14·94       |
| " 17       | 10·40                                   | 10·22             | Clear, deposit of uric acid           | 1·17                     | 2·06       | 12·17                     | 21·42       |
| " 20       | 8·00                                    | 10·26             | Clear, bad smell                      | 1·00                     | 2·91       | 8·00                      | 32·28       |

\* Danielssen refrains from comment on the above table, but it may here be noted that on March 23rd there was a fresh eruption attended with febrile disturbance; and subsequent to that date, it will be seen that the quantity of urine fell; its specific gravity rose;

Na. Cl. was reduced; urea increased. Afterwards, too, there was commonly a feverish state and often new outcrops of nodules, but the changes in the urine are not so clearly connected.

Danielssen also furnishes some particulars of another instance in which the urine was examined, the patient being a lad affected with nodular leprosy, some of the tubercles being in a state of ulceration. These were repeated eruptive outbreaks, but full details are not given; as regards the urine the chief feature to be noticed was the frequent presence of albumen in it, and that it would seem independently of such eruptions.\*

Respecting the leprosy *cachexia*, a description of this state would be simply a picture of wasting away of the frame, attended with widespread disorganisation of the integument, the establishment of chronic ulcers, and the removal, by necrosis or absorption, of the fingers and toes. Such a degeneration of so important a part of the body as the skin, such a drain—is implied by ulcerations, and such a surcharging with detritus of the circulating fluids, as is supposed to occur in leprosy; these are influences tending to impaired nutrition of the system generally, whence a predisposition to disease ready to be manifested on the advent of many an incidental exciting cause. But besides the outward evidences of disease, there are internal lesions common—if not invariable—which are, by good observers, regarded as peculiar to this disease; such lesions are, however, not extensive, and their influence upon the general health is matter of inference, rather than of fact. Lastly, the frequency of wide-spread amyloid degeneration is to be noted.

In practice, it is, in Norway, found that 'Hectic' or 'Marasmus, the consequence of leprosy,' which is entered as cause of death in nearly 50 per cent. of all fatal cases, is by far the most frequent precursor of decease.

I have not had opportunity of sifting the conditions embraced under this term 'Marasmus'; judging by symptoms, the signs are negative rather than positive, or complicated rather than single, and what is known respecting the attendant structural changes has been already referred to.

#### 6.—DURATION OF LEPROSY.

"The duration of the disease may, when the latter is not extensive, be prolonged to upwards of 30 years, the patient retaining a fair amount of health and vigour: it is, however, generally much less—5, 10, or 15 years being, perhaps, the usual periods; but there is not, to my knowledge, either a uniform termination or limited course, for this disease, and much will depend upon the outward circumstances of the patient." Long before this general statement was made in Bombay, the Norwegian observers had precisely recorded their more ample experience; and as I am not aware of any later data than these, which are either so full or so complete, I have here reproduced the statements of Danielssen and Boeck (*loc. cit.*, p. 330). "In attempting to give an approximative figure of the duration of the disease, some difficulties arise, for we have already seen that lepers are often attacked with other complaints, capable of causing death . . . we here refer only to fatal cases of leprosy happening at St. George's Hospital, Bergen, 1840-47; and we have also excluded a small number of subjects, whose death was due to some other acute malady." A re-arrangement of the tables given, furnishes the following results:—Tubercular leprosy:—Mean duration of leprosy in subjects attacked before the age of 15 years = 9 years; first affected between 15 and 20 = 11 years; between 20 and

\* Van Someren, at Madras, makes the following remarks (*loc. cit.*):—"A few months ago the urine of a hundred of the patients in the Leper Hospital, was subjected to a special examination. In 76 of these, the specific gravity of the fluid ranged between 1,000 and 1,008; and in 24 of them, above the latter

number. In 40 of these cases, the urine was more or less albuminous; in one it was saccharine, and in 37, phosphatic. In 42 it was of alkaline reaction; in 2, acid; and in 56, neutral." The next step will be to ascertain the connexion of changes in the urine with changes in the progress of the disease.

30 =  $10\frac{1}{2}$  years; between 30 and 40 =  $9\frac{1}{2}$  years; between 40 and 50 = 8 years; between 50 and 60 =  $8\frac{1}{2}$  years. Mean duration of 77 fatal cases of tubercular leprosy =  $9\frac{1}{2}$  years. Anæsthetic leprosy:—Mean duration of cases attacked before puberty =  $21\frac{3}{4}$  years; between 15 and 20 years =  $20\frac{1}{2}$  years; between 20 and 30 =  $15\frac{3}{4}$  years; between 30 and 40 =  $18\frac{1}{2}$  years; one case between 40 and 50 = 6 years; and one case between 50 and 60 = 5 years. Mean duration of 24 fatal cases of anæsthetic leprosy =  $18\frac{1}{2}$  years. The authors observe "the age at which leprosy appears does not seem to have any particular influence upon its duration; for when supervening at earliest infancy, it may last as long as when coming on in mature years. So much we can only say, namely, that when it is developed in adolescence, its subjects become the victims of a premature death. Yet this circumstance is decidedly more apparent in the tubercular than in the anæsthetic form." More ample data are still needed to determine, even for Norway—and in other countries the requisite figures do seem to have been made commonly available;—but from those now quoted, I infer that, on the whole, the earlier the disease appears, the longer it lasts. The mean duration of the two chief forms of the complaint, is at the present day hardly different from the above: thus by analysis of the Asylum Returns of Norway, I find eight years is the mean period in nodular leprosy, and 17 years in nerve-lepra. This marked difference is, of course, not without its modifying degrees; but of itself, the distinction is a natural, proper, and most important one to make. The shortest period, and the longest mentioned by the authors quoted, are two years (an old man), and 22 years (a young man), for the tubercular form; and five years (an old subject), and 27 years (a young subject), for the anæsthetic form. No distinction of sex is introduced; and it must be remembered, that many other varying conditions, which it is difficult to estimate apart, render general statements, such as the above, only of limited value.

For future investigation, I would indicate the following requirements:—A knowledge of the conditions attending the quicker, and also the slower, duration of the malady; and an arrangement of these conditions with reference to *a.* the patient; and *b.* the malady. By an analysis of this kind, some correct appreciations of practical use will be obtainable.

#### 7.—TERMINATIONS OF LEPROSY.

The malady may end by resolution, by subsidence, or by death; and each of these will now be briefly discussed.

##### *a. Resolution of the Disease.*

By this term I mean a complete recovery, and final freedom from any visible mark of the original affection, and examples of the kind are certainly of the rarest.

First, as the character of the phenomenon. It will be found, upon inquiry into the history of cases in which it is supposed that leprosy had altogether subsided, that reference is made solely to certain instances of the complaint, where the signs of its tubercular form, when but little developed, have rapidly disappeared under the influence of constitutional disturbance, which is usually interpreted as a feverish attack, or an erysipelatous, &c.; and at this time nodules in the skin already formed, have become absorbed, leaving the patient, to all appearance, quite free from deformity and general ailment.

The conditions under which these desirable events occur appear to be fairly good health, early or moderate age, mild form of disease, and the absence of much structural change in the body. The cause of such resolution of all signs of disease is, evidently, quick absorption of the

nodules—doubtless preceded by equally rapid softening of their substance, and either destruction or elimination of the leprous material—another contingency, however, being equally likely, namely, its re-deposition in other parts of the body. One thing, indeed, is clear; namely, that the nodules in the skin have disappeared. I would here observe that some form of medical treatment may have preceded, in time, these phenomena.

Lastly, there remains to offer an appreciation of the series of events now described. The facts being unquestioned, what is their true value? In reply, I must first observe that, in my opinion, no distinction of cases can be maintained wherein either local or general remedies were or were not used; for it is enough to know that this condition is really an indifferent one, as regards the common character of the phenomena in question. Next, I have to repeat the observation that leprous deposits are to be often, if not invariably, found in the lymphatic glands, the spleen, liver, testes, &c., &c., even at an early stage of disease (see the case entered at p. 131). Now, if the cases recorded in the preceding sections have any value, it consists much in their accumulated testimony to the varying natural course of the leprous disease in the body; amongst them are instances where the previous deposits in the skin had, after an attack of fever, become more or less absorbed—in these cases it is true to return again, or to re-appear, as it were, as strumous deposits; and there is but to suppose such absorption were more complete, in order to realise the phenomenon I am now discussing. Such, then, are the elements of an opinion upon this subject; and I would merely add, that in the history of recorded cases which I have been able to peruse, there has been no longer interval than a few months or a year or two, between these events and their record—an interval of freedom from exacerbation, which I need scarcely say, after what has been already reported in this Memoir, does not nearly attain the longest known to occasionally occur in the natural course of leprosy.\* Here, therefore, appears no guarantee whatever that the disease may not in due course return; and I add, no ground for urging the special value of any method of treatment.

*b. Subsidence of the Disease.*

Under this head, I would include those cases of leprosy wherein the disease seems, at an advanced stage, to have worn itself out, as it were, and to leave the patient free from fresh or active symptoms, but not free from the effects of preceding disease. Such effects are either a skin relaxed and pitted with the peculiar intra-cutaneous cicatrices, which indicate the position of absorbed nodules or 'tubercles'—together with other scars and marks; or they are the mutilations of the limbs and the benumbed patches, with other marks of confirmed nerve-disease—a state which is not necessarily indicative of future ill to the subject, because the nerve-affection is incapable of removal by absorption and therefore persists; and it is known that all traces within the body of true leprous disease may, in these cases, have disappeared. See Appendix A., p. xix.

I notice amongst the Mortuary Returns of the Norwegian hospitals the occasionally entry of 'old age'—see Table p. 142, below—and it is sometimes stated that these patients (who seem to be

\* It is fit to note that the older authors point out a termination of the disease, more favourable than is here intimated; for when treating of the deterrent influence of acute internal inflammations upon nodular leprosy, they observe, "where several inflammations succeed to each other very rapidly, the tubercles may disappear for a long time, and perhaps for ever; and the patient

"then feels himself quite well." (Traité, &c., p. 328.) I have not learnt that subsequent experience has confirmed this statement, but as a matter of fact, the radical cure of leprosy in this way, is the rarest of events, and such must be the case, if modern inquiries have any comprehensive value.

oftenest women) had attained the advanced age of 70, 80, or even 90 years. I presume that these are examples of the event under notice, where an old nodular subject has gradually lost all traces of his disease, and has besides, perhaps, become so enfeebled that his "frame is "unable to support its renewed development." Parallel instances of the kind will be found amongst old strumous subjects, but they are too few to be of great practical import, and they concern a class of cases already almost beyond the influence of medical aid.

#### *c. Mortality of Leprosy: Deaths.*

This important subject requires to be considered in some detail, and as its significance and relationships are very numerous, the following subdivision will be convenient, viz. :—1. The rate of mortality; and 2. The causes of death.

A thorough study of the fatality to man of a constitutional complaint like leprosy, involves more separate topics than might be imagined; and I do not know that all the data needed for such scrutiny, are as yet available: certainly, published official information, however good it may be, does not furnish them. Besides, medical canons suitable for the guidance of investigators do not exist; for instance, where are the formulæ for determining the essential and non-essential feature of a disease? Again, the natural history of a malady is generally its least considered part: thus, its variations in intensity or degree; its natural variations according to season (time) or climate (space), and to the age, sex, and race of its subject—these are topics seldom duly regarded. I daresay the great leprous malady would be as good a sphere as any other, in which to definitely settle many fundamental principles, for it is both in itself highly characteristic, and in its wider scope very comprehensive. It is, perhaps, the oldest known disease of mankind, and yet, owing to its peculiar incidence in former and later times, it is one of the least understood. Existing data to which I have had access, do not indicate the real mortality of leprosy, and I should not, even on this account, attempt to determine the point; but the true fatality of a disease is a subject of itself not yet amenable to logical treatment, as I have above intimated; and in this place all that is possible, is an enumeration of facts collected from various sources.

From what is now to be stated, it is evident that leprosy is a very fatal disease; and from all I can learn, its virulence has not anywhere abated.

#### A.—RATE OF MORTALITY.

This topic is to be considered with reference (*a.*) to the disease, (*b.*) to the subject of the disease, and (*c.*) to the influence of time or season. I have been able to gather but scanty information on all these points, and it is desirable that more ample data be collected, because, by careful comparison of facts connected with the fatality of leprosy, several features of the natural history of the disease which have practical bearings, may be usefully elicited. It is not improbable that such data are already in existence in different countries of the globe, but their collation and due appreciation has yet to be made. Statistical inquiry of this sort might be very valuable in results.

#### *a. Mortality of Leprosy.*

In most countries, the asylums may be supposed to contain the worst—*i.e.*, the most severe or advanced—cases of the disease, and hence to offer the highest rates of mortality. Yet

such institutions are the only available sources of information, and the remark just made has therefore, to be borne in mind. Again, here only the mean rates of mortality can be conveniently given, and it should be remembered that in the instance of every country mentioned there are local variations of importance; thus, in Norway, I find the range of mortality rates to be much greater in the northern Asylum than in the more southern, and perhaps the explanation of this fact may be found in the greater variability of climate.

1. The general rates of mortality are estimated according to either strength (*i.e.*, total number of inmates), or treated; and commonly, the per-centage is reckoned according to strength. As so estimated, it is found that in Norway the yearly mortality of leprosy varies from 10 to 16 per cent. At the Trinidad Asylum, it has varied from 11 to 16 per cent.; and at Madras, during the year 1873, the rate of mortality as estimated on the total number of cases treated was 16·165 per cent.—a higher number by 1·182 than obtained in the year 1872. I am unable to give the mortality, according to strength, of the Madras Leper Asylum; but it is apparent from the figures now named, that some kind of uniformity widely prevails respecting the rate of mortality of leprosy in general; and this fact is one of considerable interest.

The extremes of annual death-rates at different asylums are, however, tolerably varied; and such broad comparisons as these have, necessarily, but a limited value.

2. *Mortality of each form of the Disease.*—Only in the reports of the Bergen Asylum, are the death-rates of tubercular and anæsthetic leprosy separately stated; and there I find that for some years past, the yearly per-centage on strength of mortality was, for nodular leprosy, 19; for nerve-lepra, 6; the extremes being 17–20 for the one; 4·5–9·3 for the other. So that, upon the whole, tubercular leprosy was three times as fatal to its victims as the anæsthetic; and this fact quite corresponds with what is known of the average duration of these two forms of disease respectively. Here, indeed, is indicated one of the prime natural features of leprosy, which can hardly be too much insisted upon.

With reference to leprosy in the tropics, I do not possess similar precise data to the above, but it is there well known that tubercular leprosy is by far the more fatal form of disease; and confirmation of the fact appears from the statement that of late years, at Trinidad, the deaths were 18 and 9 for tubercular and anæsthetic leprosy, whilst the number of cases belonging to these two types respectively, were nearly equal, there being probably a slight predominance of those of the milder form.

(b.) *Mortality amongst Lepers.*

The rudiments only of this branch of the general subject can, under the present conditions of my inquiry, as yet be elicited. Here, too, data from Norway are commonly most copious and precise.

1. *As regards Sex.*—For all forms of the disease, the mortality usually seems to be greatest amongst males: thus, in Norway, the yearly mortality may be set down as 15 per cent. for men, and 13 per cent. for women. It is obvious, however, that since the ratio of the sexes affected by leprosy appears to continue the same, the rate of mortality must, on the whole, be alike as well; and I notice, along with a wide range, such an occasionally large mortality amongst women-lepers in Norway, as would probably, in a sufficiently long series, bring up the total deaths to the same relative numbers as obtain in men. This point has, however, to be worked out, and I must be content with here drawing attention to the need of further scrutiny.

In the West Indies, there were 17 deaths of men to 10 of women; and having regard to the nearer general equilibrium of the sexes in lepers under lodgement in the Asylum, this proportion would also indicate a somewhat greater fatality amongst males than females.

With regard to experience in India, I may here remark that of 153 lepers dying in Bombay city during a recent term of five years, 125 were males and 28 females; and although these figures cannot be regarded as correctly representing the relative proportion of the sexes affected with leprosy, they still indicate a preponderance of males amongst those dying of the disease, which seems to correspond with observation elsewhere.

Respecting the comparatively mortality of the sexes in the two chief forms of leprosy, I have not sufficient materials to allow of a competent opinion. There are no available data from Norway; and the few from the West Indies are obviously insufficient. Such as they are, however, the figures may be briefly mentioned as follows:—

Amongst 16 deaths in males, 12 were from tubercular leprosy: and among 10 in females, six were from the same nodular form. It would hence appear that male lepers suffered most from the more severe type of disease.

2. *As regards Age.*—The mean age of all lepers, at death, is found in Norway to be about 42 years; in the West Indies, it would seem to be considerably less than this—namely, not quite 32 years, but the data are here very scanty. In Bombay, the mean age of all lepers who died there during a long series of years, both in and out of hospital, was about 37 years.

From these data it would appear that lepers are not so long lived in the tropics as in Northern Europe; but I think it would also be found that the populations, generally, in these localities present a precisely similar feature of greater longevity in the European clime. Here, however, is another point afterwards to settle.

Respecting the two chief forms of disease, evidence confirmative of the greater severity of the nodular form becomes even more precise than before. Thus, the mean age at death of the tuberculous leper is 36·2 years, of the non-tuberculous 50 years, with respect to Norwegian experience; whilst from scantier data procurable in the West Indies the same ages, respectively, were 28 years and 35·5 years. Both series of figures sufficiently correspond in demonstrating the quicker course of nodular leprosy, and on deducting the known mean durations of the malady, we arrive at the important conclusion that, in Norway, tubercular leprosy begins sooner (at 27·6 years), and kills sooner (at 36 years), than does the anæsthetic form (corresponding Nos. 33 years and 50 years).

Respecting the West Indies and India, there is every reason to believe that the same remark applies to them also, and more can hardly be said from want of sufficient data.

With regard to the comparative ages of the two sexes in the two chief forms of leprosy, very little indeed is recorded in the tables to which I now have access. The mean age of 12 male lepers dying of nodular leprosy at Trinidad was 26 years; of six female lepers, 32·3 years: and the mean age of four males dying with anæsthetic leprosy was 33 years; of four females, 40·2 years.

I may introduce the following quotation from my Report on Leprosy in the Bombay Presidency, 1871. Age of lepers at death:—The periods of life at which leprosy proves fatal as

elicited by analysis of 426 deaths entered in the more recent Bombay Mortuary Returns, may be thus arranged :—

*Percentage of Living and Dying amongst Lepers.*

| Age.     | Males.  |        | Females. |        |
|----------|---------|--------|----------|--------|
|          | Living. | Dying. | Living.  | Dying. |
| 10 - - - | ·67     | ·3     | 1·89     | 1·0    |
| 20 - - - | 7·87    | 7·8    | 13·28    | 10·8   |
| 30 - - - | 22·35   | 20·6   | 29·18    | 23·5   |
| 40 - - - | 30·57   | 25·5   | 25·65    | 28·4   |
| 50 - - - | 26·79   | 21·2   | 19·56    | 16·6   |
| 60 - - - | 9·84    | 12·1   | 8·43     | 11·7   |
| 70 - - - | 1·48    | 9·8    | 1·70     | 5·9    |
| 80 - - - | ·03     | 2·6    | ·03      | 2·0    |

It appears that the highest mortality occurs at 21 to 50 years, during which period nearly 70 per cent. of total deaths take place. The difference arising from sex, indicates that females more early succumb to the disease than males; and this inference is in consonance with the fact of their liability to attack, at earlier ages than is observed among men. At 31 to 40 is the highest per-centage of deaths in both sexes, but it is a particularly fatal period for women, and this circumstance may possibly be connected with diminished uterine function. . . . .

3. *Mortality with reference to Race.*—Not much has been elicited with reference to this subject; however, on the whole, it would appear that leprosy is a more quickly fatal disease amongst inhabitants of the tropics—and more especially the West Indies—than in Northern Europe; but in the absence of an accurate knowledge of the general statistics of the peoples concerned, the particular topic of leprosy as a cause of sickness and mortality, cannot be satisfactorily discussed; and such general statistics I do not now possess.

4. *Mortality with reference to Season of the Year.*—It might be anticipated that the influence of season upon the mortality of lepers would be marked, and that more especially in the North; and, to a certain extent, such expectation is realised, but not in the direction which I had myself looked for—namely, that the more rigorous the season, the greater would be the mortality. No very decided rule appears and there are local variations to be considered, but still, taking the four quarters of the year as commonly arranged, I find that in Norway the third quarter (July, August, September), has the most deaths; next, the second quarter; next, the first quarter; and last of all, the fourth quarter (October, November, December), the respective numbers being 90, 88, 81, and 54. A correct appreciation of these results would entail further inquiries, and I must be content with stating my impression, that the two conditions of activity of skin-function and alternations of weather, are the chief factors in causing disturbance or repose of leprosy material located in the integument, and so rendering more or less liable infection of the system, with corresponding risk to the patient.

In the West Indies, deaths occurred in the following order :—First quarter, 18; second quarter, 16; third quarter, 12; fourth quarter, 7 deaths.

In the town of Bombay, during the five years, 1868–73 (excluding 1872), the deaths of 153 lepers are entered in the Municipal Returns, and they occurred in the following order :—First quarter of the year, 39; second quarter, 34; third quarter, 39; fourth quarter, 41 deaths.

B.—CAUSES OF MORTALITY.

The cause of death in lepers, is one of the most interesting and important questions, which concern their malady. For the purposes which I have in view, agencies included in this singular term, may be arranged under two categories—namely, 1. The specific; and 2. The incidental, supervening or intercurrent causes of death. Special attention would naturally be directed to the first-named, as perhaps the most interesting division; but the second group includes a series of hurtful adjuncts of the disease, which oftener than the other lead to death, and which in practice are most of all amenable to medical treatment. In the future, it will be well deserving of study to ascertain, so far as possible and with practical purpose, what are the influences, conditions or occasions, which favour the appearance of one or other of these commonly fatal, intercurrent diseases.

In order to afford a general view of the subject under notice, I here append some tabular statements, condensed from authentic sources and embracing all the information which it was possible to introduce into their abstract form. It was not to be expected that a uniformity of plan should obtain in official Reports published in widely different parts of the globe, for at present there is, unfortunately, so great a want of concordance in nosological arrangements, as largely depreciates the value of many fundamental data, which must be accurately settled before a general advance of scientific medicine can be looked for; and this remark applies especially to the so-called constitutional maladies, of which leprosy is one of the chief.

TABLE OF SICKNESS AND DEATH in three Leper Asylums in NORWAY, during the Years 1870 and 1871.\*

| Disease.                        | Bergen.   |         | Molde.    |         | Trondjheim. |         | Remarks.  |
|---------------------------------|-----------|---------|-----------|---------|-------------|---------|---|
|                                 | Sickness. | Deaths. | Sickness. | Deaths. | Sickness.   | Deaths. |   |
| Angina                          | 2         | —       | —         | —       | 49          | —       | TRONDJHEIM.<br>63° 25' N. lat.<br>Total strength - - - 579<br>Per-centage of sickness - - + 134<br>" " deaths - - - + 15            |
| Albuminuria                     | —         | —       | —         | —       | 8           | 5       |   |
| Abdominal disease               | —         | —       | —         | —       | —           | 1       |   |
| Bronchitis                      | 27        | —       | 43        | 4       | 184         | —       |   |
| Carbuncle                       | —         | —       | —         | —       | —           | 1       |   |
| Conjunctivitis                  | —         | —       | 11        | —       | 64          | —       |   |
| Cardialgia                      | 2         | —       | —         | —       | 56          | —       |   |
| Cholerae                        | —         | —       | —         | —       | 4           | 1       |   |
| Diarrhoea                       | 65        | 4       | 51        | 8       | 236         | 17      |   |
| Dysentery                       | —         | —       | —         | —       | 4           | —       |   |
| Erysipelas                      | —         | —       | 43        | 1       | 55          | —       |   |
| Fever, with or without Eruption | 50        | —       | 52        | —       | 245         | —       |   |
| Felcis catarrhals               | 22        | —       | —         | —       | —           | —       |   |
| Gangrene                        | —         | —       | 2         | 2       | —           | —       |   |
| Gastritis                       | —         | —       | —         | —       | —           | 1       |   |
| Hæmoptysis                      | 1         | —       | —         | —       | —           | —       |   |
| Hydrops ascites                 | —         | 3       | 2         | 1       | —           | 2       |   |
| Icterus                         | 1         | —       | —         | —       | —           | —       |   |
| Keratitis and Iritis            | —         | —       | 10        | —       | 17          | —       |   |
| Laryngitis and Suffocation      | 5         | 5       | 18        | 4       | 23          | 6       |   |
| Mazanus and Hectic              | —         | 43      | —         | 31      | —           | 26      |   |
| Meningitis                      | —         | —       | 2         | 2       | —           | 5       |   |
| Menostasis                      | —         | —       | 7         | —       | —           | —       |   |
| Phthisis                        | —         | 7       | —         | 3       | 6           | 9       |   |
| Pneumonia                       | —         | 2       | 1         | 2       | 18          | 3       |   |
| Pleuritis                       | 3         | 1       | 1         | 1       | 12          | —       |   |
| Peritonitis                     | 3         | 2       | —         | —       | 8           | 2       |   |
| Rheumatism                      | —         | —       | —         | —       | 60          | —       |   |
| Scabies                         | —         | —       | —         | —       | 31          | —       |   |
| Scorbutus                       | —         | —       | —         | —       | —           | —       |   |
| Senectas                        | —         | —       | —         | —       | —           | 6       |   |
| Thrombosis                      | —         | 1       | —         | 1       | 5           | —       |   |
| Ulceration of Intestinal Canal  | —         | 1       | —         | —       | —           | 2       |   |
| Varicellæ                       | —         | —       | 2         | —       | —           | —       |   |
| Volvulus                        | —         | 1       | —         | —       | —           | —       |   |
| Unknown                         | —         | 1       | —         | —       | —           | —       |   |
| Total                           | 213       | 72      | 245       | 60      | 777         | 89      | BERGEN.<br>60° 26' N. lat.<br>Total strength for same period - - 628<br>Per-centage of sickness - - - + 31<br>" " deaths - - - + 10 |

\* The data here included have been collected from the yearly official returns, and the several institutions mentioned have been kept apart, in order that such influence as may be due to climate shall be clearly seen.

## LEPER HOSPITAL, MADRAS: Sick List for 1873.

| Nature of Disease.                                  | Eurasians. |                        | Natives.  |        |
|---|------------|------------------------|-----------|--------|
|   | Sickness.  | Death.                 | Sickness. | Death. |
| Small-pox - - - - -                                 | 2          | 1                      | —         | —      |
| Febricula - - - - -                                 | 11         | —                      | 30        | —      |
| Ague - - - - -                                      | 18         | —                      | 26        | —      |
| Phagedæna - - - - -                                 | 1          | —                      | 1         | —      |
| Chronic Rheumatism - - - - -                        | 11         | —                      | 24        | 1      |
| Scrofula - - - - -                                  | —          | —                      | 1         | —      |
| Diabetes - - - - -                                  | —          | —                      | 1         | —      |
| Anæmia - - - - -                                    | 1          | —                      | 2         | —      |
| Tetanus - - - - -                                   | —          | —                      | 2         | 1      |
| Epilepsy - - - - -                                  | 1          | 1                      | 1         | 1      |
| Hysteria - - - - -                                  | 1          | —                      | 1         | —      |
| Conjunctivitis - - - - -                            | 3          | —                      | 4         | —      |
| Ulcer of Cornea - - - - -                           | 3          | —                      | 5         | —      |
| Otitis (external) - - - - -                         | 3          | —                      | 1         | —      |
| Valv. dis. of Heart - - - - -                       | —          | —                      | 2         | 2      |
| Angina pectoris - - - - -                           | 2          | —                      | —         | —      |
| Chronic Bronchitis - - - - -                        | 23         | —                      | 29        | —      |
| Phthisis - - - - -                                  | 1          | —                      | 4         | 2      |
| Pneumonia - - - - -                                 | —          | —                      | 1         | —      |
| Diarrhœa - - - - -                                  | 13         | 3                      | 27        | 11     |
| Dysentery - - - - -                                 | 7          | —                      | 24        | 8      |
| Constipation - - - - -                              | 95         | —                      | 376       | —      |
| Dyspepsia - - - - -                                 | 14         | —                      | 16        | —      |
| Albuminuria - - - - -                               | 1          | —                      | 13        | 7      |
| Ulcers - - - - -                                    | 27         | —                      | 59        | 2      |
| Pneustia - - - - -                                  | 25         | —                      | 26        | —      |
| General debility - - - - -                          | 3          | 1                      | 16        | 2      |
|   | 270        | 6                      | 691       | 37     |
| Average daily sick - - - - -                        | —          | 22.5                   | —         | 75.14  |
| Average daily strength (approximate only) - - - - - | —          | 26                     | —         | 81     |
| Total treated - - - - -                             | 266        | Total deaths - - - - - | —         | 43     |

Hence it appears that at Trondjheim (the site most northerly in position), bronchitis and diarrhœa are most common as causes of sickness, and the latter of death. From this table may be learnt that form of fever which is peculiar to leprosy, but which is seldom or never of itself fatal; the so-called 'catarrhal fever' of Bergen belongs to the same category, and there should, I think, be associated herewith, the frequent 'erysipelas' as an appanage of leprosy. 'Hectic' is probably the same kind of febrile disturbance of the system, due to infection by a 'materies morbida.' 'Laryngitis' is a local affection directly belonging to the disease, and 'gangrene' is another peculiar complaint. The true frequency of 'phthisis' as a cause of death is, not, perhaps, fully shown in this table, which can only be regarded as a sample, and not as a complete explication, of Norwegian experience. Thus, on turning back to earlier years, I find the following items, not above included, as cause of sickness or death:—Typhoid fever, typhus fever (six fatal cases happening during also an epidemic, at the Bergen asylum, in 1865), cerebro-spinal disease, diphtheria, epilepsy (three fatal cases at Trondjheim, in 1868), chronic hydrocephalus, palsy,

apoplexy, brain-disease (2); other affections adding to the mortality were, endocarditis, gastritis (three or nine cases), dysentery (four cases at Trondjheim, in 1868), ulceration of the stomach and hæmatemesis (could these two or three cases be due to disease of the pneumogastric nerve?), and cancer of the stomach; nephritis is also mentioned more than once, and once of a recurrent character. Necrosis, diffuse phlegmon and pyæmia (three cases) are other entries. It is not, however, necessary to extend this list, because it will be now apparent that in leper-asylums, a large majority of the complaints ordinarily met with in hospitals are to be met with; but there still remains to be made, a due appreciation of these secondary consequences of leprosy, after comparison with such ordinary experience as was just referred to; and I should myself have attempted more in this direction, had circumstances permitted. The Norwegian Leprosy Reports, which have now been published yearly for many years, will prove very useful to any one undertaking a study of the clinical history of leprosy, as the disease is seen in Europe, and I think that the present brief abstract made from them, will prove the accuracy of this statement.

CAUSE OF DEATH, 1868, 1870, 1872.  
*Leper Asylum, Trinidad, West Indies.*

| Sex. | Age. | Form of Leprosy. | Disease.               | Sex. | Age. | Form of Leprosy. | Disease.                |
|------|------|------------------|------------------------|------|------|------------------|-------------------------|
|      | —    | —                | Leprosy : 3 cases.     | M.   | 18   | T. L.            | Chronic Bronchitis.     |
| F.   | 41   | M. L.            | Leprosy in last stage. | M.   | 34   | A. L.            | Phthisis.               |
| F.   | 15   | T. L.            | " "                    | M.   | 26   | A. L.            | Pneumonia.              |
| M.   | 41   | T. L.            | " "                    | F.   | 77   | —                | Lung Disease : 4 cases. |
| M.   | 18   | M. L.            | " "                    | F.   | 43   | A. L.            | Hypertrophy of Heart.   |
| M.   | 23   | T. L.            | Leprosy and Syphilis.  | F.   | 20   | A. L.            | Dropsey.                |
| M.   | 14   | T. L.            | " " Dropsey.           | M.   | 16   | A. L.            | "                       |
| M.   | 26   | T. L.            | " " Phthisis.          | M.   | 41   | A. L.            | Abscess of Kidney.      |
| M.   | 19   | M. L.            | " " Bronchitis.        | F.   | 35   | T. L.            | Abscess in the neck.    |
| M.   | 32   | T. L.            | " " Diarrhœa.          | F.   | 42   | T. L.            | Asarminia.              |
| F.   | 25   | M. L.            | Diarrhœa.              | —    | —    | —                | Gangrene : 2 cases.     |
| F.   | 51   | A. L.            | " "                    | —    | —    | —                | Cancer uteri : 1 case.  |
| M.   | 42   | T. L.            | " "                    | —    | —    | —                | Small-pox : 1 case.     |
| M.   | 20   | M. L.            | " "                    | —    | —    | —                | Tetanus : 1 case.       |
| M.   | 61   | A. L.            | " "                    | —    | —    | —                |                         |
| M.   | 36   | T. L.            | " "                    | —    | —    | —                |                         |
| M.   | 21   | M. L.            | " "                    | —    | —    | —                |                         |
| —    | —    | —                | " : 4 cases.           | —    | —    | —                |                         |
| F.   | 16   | T. L.            | Dysentery.             | —    | —    | —                |                         |

## INTERCURRENT DISEASES, 1869.

|  |    |                               |   |
|--|----|-------------------------------|---|
| Intermittent Fever - - - - -           | 26 | Epilepsy - - - - -            | 2 |
| Malignant Intermittent Fever - - - - - | 2  | Heart-disease - - - - -       | 1 |
| Diarrhœa - - - - -                     | 10 | Strangulated hernia - - - - - | 1 |
| Dropsey - - - - -                      | 3  | Cancer - - - - -              | 1 |
| Bronchitis - - - - -                   | 3  | Yellow Fever - - - - -        | 1 |

## 1.—CAUSES OF MORTALITY : SPECIFIC.

Under the terms of 'Spedalskhed,' 'Marasmus,' 'Hectic,' 'Hectic fever,' there is, in Norway, indicated a condition of the system which of itself appears to terminate in death. Elsewhere, the terms 'leprosy,' alone or in combination, 'general debility,' 'exhaustion of the system,' 'anæmia, &c., are the corresponding expressions which are employed. No particular diagnosis is implied in the state thus indicated, which is, therefore, to be regarded as one negatively defined, rather than marked by positive signs. In outward aspect, the condition is simply one of impaired bodily condition and strength no longer compatible with the continuance of life—of atrophied, perhaps degenerated, structure and exhausted function. The anatomical characters of this state have been already referred to, in the chapter on Morbid Anatomy, but they have still to be fully revealed; and the altered functions of the body seem to wholly depend upon these structural alterations, yet they, too, require our further notice. It seems to me certain, that after a time the general terms 'leprosy,' 'marasmus,' &c., will be either better defined than they now are, or they will be substituted by more correct and significant terms. At present, since the rôle of personal judgment necessarily interferes, there results a want of preciseness which is prejudicial to a thorough acquaintance with the intimate characters of leprosy. Instances have been quoted in the early part of this work of the state of hectic or marasmus which attends the later stages of leprosy, when these are less complicated than usual; and I do not suppose that the expression 'hectic fever' has any particular significance, because it is now well enough known that most subjects afflicted with the advanced degrees of leprosy, are liable to frequent febrile attacks, which hasten their end in a manner probably similar to the ordinary hectic fever of tuberculosis or some other constitutional maladies.

In Norwegian Asylums, 'marasmus' causes a death-rate amongst the inmates of 4-8 per cent. per annum, or rather less than one half the total mortality of the leprosy disease; and amongst these institutions, it seems to be most common as a cause of death at Bergen, and less so at more northern Trondjheim, where intercurrent affections are more numerous.

At Trinidad, in the West Indies, 'leprosy' alone or combined, causes the death of three per cent. per annum of the inmates of the Asylum, and less than one-third of the total mortality of lepers. If 'anæmia' really meant the same thing as 'leprosy' these proportions would more nearly approach those just stated for Norway.

With reference to the Leper Asylum at Madras, I presume that the heading 'general debility' answers to these words 'marasmus' or 'hectic,' &c., and under it is included but a small proportion of casualties—namely, three out of a total of 43 deaths, or only seven per cent. instead of 30–40 per cent.,—but no special stress need be laid upon this seeming discrepancy, because, as I have intimated, must happen, it is probable that the grounds of diagnosis were here differently estimated.

It results from what has now been stated, that a certain proportion—and that a not insignificant one—of the mortality amongst lepers, has been generally put down to a simple wasting of the bodily frame and vital powers. Unfortunately, I am not able to specify which form of leprosy, or what age or which sex, is most of all predisposed to this mode of decease; only I notice that in the West Indies, no fatal cases of anæsthetic leprosy were entered under this heading of 'Leprosy,' as a cause of death.\*

## 2.—CAUSES OF DEATH: NON-SPECIFIC.

Most commonly lepers die of a complaint, which comes on during the course of their disease—when it is probable of an acute, local character—or which supervenes towards its close, when the superadded affection may be of a general nature, more or less [resembling its predecessor. Respecting the long lists of fatal maladies attendant upon leprosy, which are given above, I now propose to treat of the chief items only; and such others as remain here unnoticed, must, I think, be regarded as 'incidental' in the stricter sense of the word. All these affections which are not known to, or do not frequently lead to death, will be mentioned under the heading of 'Complications'; and although the distinction thus implied is clearly an arbitrary one, yet some division of the kind was necessary to enable me to deal with this subject in a regular manner. As all the data I am acquainted with are above referred to, any deficiencies in my observations can easily be supplemented by the reader himself.

In the Mortuary Tables, about 300 fatal cases of leprosy are referred to the supposed or immediate cause of death: and of these cases, 100 have been already accounted for in the preceding sub-section of this chapter. There is one occasion of death which is, in its way, also peculiar; and is only mentioned by the Norwegian physicians. I mean that entered as 'Laryngitis and Suffocation,' which had occasioned 15 casualties; and on inquiry during my late visit to Bergen, I ascertained that this event was sometimes a very sudden one in leprosy; but whether the laryngeal disease causing suffocation is always leprosy, or is sometimes strumous, remained uncertain. The possibility of sudden asphyxia in lepers, is well known to many surgeons in India.†

\* Under the heading of 'Pathology,' will be mentioned what is known of the nature of the structural alterations leading to death in uncomplicated leprosy.

† As an illustration of this subject, I quote as follows from the official return of the Trondjheim Asylum (where the accident seems to be unusually frequent),

for 1866:—"One man died rather suddenly from an access of suffocation, coming on while taking his mid-day meal. A fortnight previously, he had a similar attack, which even then menaced his life. Spedalskshed had for some time back greatly implicated the throat and pharynx, in this case." It occurs to me that a

'Diarrhœa' preceded death in 52 cases; this is in the tropics the ordinary event, and, in Norway, is sufficiently common. I am not acquainted with the proximate cause of this affection. 'Dysentery' (nine cases), is a purely tropical complaint, being unknown in Norway, but whether frequent in an especial manner amongst lepers, I cannot yet say. What is the signification of the Norwegian heading 'Ulceration of Intestinal canal,' is not clear; but amyloid degeneration of the coats of the intestines has been detected.

Next follows the group of lung diseases attendant upon leprosy; of these the most frequent in Norway is 'Phthisis' (19 cases); then 'Pneumonia'; then 'Bronchitis,' which may, as well, be fatal in the tropics. The special relations, as they seem, of tuberculosis to leprosis, which were above referred to in detail, do not find a strong confirmation in these tables, but such generalisations as the latter can never, I may observe, overwhelm the significance of clear individual instances. 'Pleurisy' may be tubercular or renal in character; or merely consecutive. No details of importance appear in the returns of the tropical Asylums, only one would like to know what 'lung disease' was. Total 42 cases.

The next group of constitutional maladies are the 'albuminuria' and the 'dropsies'; if 'peritonitis,' 'pleurisy,' and 'meningitis' be excluded as probably belonging to the strumous series, there remains about 26 fatal cases due to Bright's disease.\* Of these seven occurred in one year at Madras: perhaps the four cases of 'ascites' at Port of Spain, Trinidad, appertain to this group.

So far, as it is evident that diarrhœa, lung disease (probably strumous) albuminuria and dropsy are of all concomitants of leprosis the most common and fatal. I do not think that the data now under consideration, permit of more detailed inference; but they are amply sufficient to indicate some valuable main facts, and also the course of future inquiry.

'Gangrene' or phagadœna, ulcers, &c., sometimes causes death in lepers; all these terms are too vague to permit of further remark.

I notice 'valvular disease of the heart' as an entry for Madras and Trinidad; did this appertain to kidney-disease? It could hardly be rheumatic, because tropical rheumatism is said to be seldom acute. Rheumatism in Norway, was simply climatic.

More, perhaps, to be noted is the occurrence of two fatal cases of 'Epilepsy' amongst lepers at Madras: one is curious to know if here was mere coincidence or not, and would hope that autopsy may be practicable in future instances of the kind.

That 'Tetanus' should cause death, is hardly to be wondered at in the tropics; and without further information, it would be futile to speculate upon its connexion with leprosy-disease.

'Senectas' or old age, is not strictly a cause of death in leprosy: one would be glad to learn the precise state of all the parts originally the seat of leprosy, in some of these cases. Seven instances.

question would arise in similar instances, of the advisability of performing laryngotomy, as a precautionary measure.

At the same Asylum is the rather frequent heading of 'Angina;' and this affection of the throat seems to be also a concomitant of leprosy deposit in the part, for I find an entry to the effect that fatal access of suffocation had supervened upon such 'angina.' However there is probably some room for difference of opinion here; and the greater frequency of throat

affections in the north, may be due to climatic influences. Angina, I may add, is sometimes distinguished in these returns as 'A. facium,' and 'A. porotidea.'

\* Danielsen and Boeck in their early experience, specially noticed the occurrence of 'dropsies' in leprosy, and they thus referred to the subject. "The hydropic affections have been always connected with pathological changes in the kidneys, and have commonly by their effects hastened a decease already imminent."

Respecting other items in the above tables, additional remarks do not seem to be required; for the fewer or exceptional items have apparently no especially reference to the leprous disease. I must, however, observe that *every* thoroughly sifted instance of fatal leprosy, would be most welcome in aid of an elucidation of even the anatomical characters of the disease, such as is yet wanting.

In the absence of fuller data, those now submitted must, I think, be accepted as evidence of ordinary experience in different parts of the globe; but much more information should be forthcoming in India itself.

#### 8.—COMPLICATIONS.

Under this head I intend to refer to those intercurrent affections, which being neither characteristic of leprosy, nor of themselves fatal, do yet produce a considerable proportion of the sickness amongst lepers. By the first proviso, I here exclude leprous fever; and by the second, those diseases which have just been considered, as causes of mortality. It is sufficiently obvious that this division of the maladies concurrent with leprosy is convenient rather than precise, for there are many affections included in the class last-named, which give rise to much sickness as well as some deaths, and which have already passed under review. I therefore proceed to mention the most frequent of other complications of leprosy, and the enumeration could be much more interesting were it known in what comparative proportions the same maladies occurred amongst individuals of the community who are not lepers.

First, respecting the other constitutional maladies incident to man, I remark that 'syphilis' is not in either India or Norway, a frequent attendant on leprosy. When the two diseases co-exist, the course of the one does not seem to be influenced by the presence of the other. Perhaps more definite information is needed on this particular subject; but it is in Norway held by the best observers that these maladies are wholly and essentially distinct from each other.\*

I have already alluded to 'phthisis' and 'lupus,' as possible complications of leprosy; it is noteworthy that 'strumous' gland affections are not very frequent, in the countries above-named, as attendants upon this disease—in fact, they even seldom co-exist. There is not, however, any reason to suppose that an antagonism here prevails; and true leprous matter has been found in an enlarged mesenteric gland taken from a subject affected with tuberculosis. Both leprosy and scrofula have a tendency to occupy the lymphatic glands of the body. The ordinary 'eruptive fevers' may occur in lepers without undergoing apparent modification; thus small-pox, and varicella;†

\* The syphilisation of lepers has been practised as a therapeutic measure, in Norway, with success as regards the infliction of syphilis, but not as regards opposition to the leprous complaint, which remained unchanged. Such experience would seem to be final, but observers in other countries have been disposed to lay some stress upon the connexion of these two maladies; thus in an interesting paper by Dr. Hoffmann, of Honolulu (for opportunity of perusing which, I am indebted to Dr. Tilbury Fox), it is stated, "with but a few exceptions, all the lepers (adults) who have come under my care, have acknowledged to have had syphilis, or at least showed the result of it, thus impressing me strongly with the idea that syphilis may bring into life, the disease which otherwise would have been dormant: or is it not possible that syphilis, passing through one or more generations, becomes another distinct disease, such as leprosy?"

† In the 'Traité de la Spedalskhed' (p. 323), it is recorded that during an epidemic of small-pox at

Bergen, many lepers in Hospital, and especially those affected with the 'nodular' form, were attacked with small-pox; and in those cases of prominent leprous disease, an unusually wide extent of suppuration followed, which ended in the total destruction (*id. so far as appeared*, H. V. C.) of the leprous deposits. Contrary, however, to plausible expectation that the new 'dyscrasia' might eradicate or displace the older, after an interval of six months fresh 'nodules' recommenced to appear in spots on the surface not previously affected. It seems to me that this natural experiment, as it may be regarded, is full of instruction, with reference to the utility of certain external remedies, which have been much recommended in leprosy; for it is here shown that an extensive obliteration of 'tubercles,' does not necessarily lead to anything more than a temporary disappearance of disease. Comparatively few 'anaesthetic' lepers were attacked on the occasion now referred to; and in them the course of the small-pox presented no peculiarity.

scarlet fever\* and measles, are amongst the hospital entries in various regions. I have said that typhus, typhoid, and yellow fever happen amongst lepers; scurvy is not common, at the present day. Anæmia, diabetes, jaundice, are other entries; also hysteria, and angina pectoris. I do not know that any use can yet be made of these facts.

Amongst the common entries are, in Norway, 'Erysipelas'; and this complication appears to be connected with the peculiar 'fever' of the affection; it has, however, other relations. 'Bronchitis' is common amongst lepers, even in India; and amongst the most frequent of all complications are the 'Dyspeptic.' A peculiar force seems to attach to this group, because of the prominence which cardialgia, pyrosis, thirst, &c. have attained as premonitory signs of the complaint, in Norway; similarly, it is to be remarked that, in India, the same distended state and functional disturbance of the stomach is very common; and in both instances, these untoward conditions seem to be due to unsuitable food. I do not know, however, that they have an especial connexion with the leprous complaint; for they are universally amongst the commonest of ailments; and as it is now shown that the central nervous system is not particularly affected in anæsthetic leprosy (which is said to be most subject to severe dyspeptic complications),† there are seemingly no longer tenable grounds for insisting upon their importance.

Lastly, ulcers and ordinary skin-diseases are, as was above shown, common in lepers. It has often been imagined that these miserable subjects are particularly liable to affections of the skin; but I am not aware that the notion has received adequate confirmation, based upon suitable data.‡

\* During the epidemic of scarlet fever which for more than a year visited Bergen and its neighbourhood, there appeared in June 1867, a few cases of the disease at the Hospital. As in one of these there supervened the so-called gravid icterus, with a speedy determination of the life of the patient; Dr. Danielsen supposed it would be interesting to append the particulars of this instance. The patient was a young woman affected with 'smooth' leprosy, who had been under treatment for nearly two years and was regarded as cured, when she was attacked with scarlatina; she died with symptoms of pyrexia, jaundice, delirium, and convulsions. The liver weighed 1,742 grammes, and had a soft consistence, almost like that of the spleen; the latter organ was almost double its natural size. Danielsen comments on the pathology of this unusual complication, and refers to the pathological effects of poisoning by phosphorus; remarking "that the contagion of scarlet fever may here have led to the same consequences as phosphorus, namely, an extraordinary and rapid formation of fat in the liver, spleen, kidneys, and brain, attended with considerable ecchymosis of the lungs and kidneys."

† The older Norwegian authors strongly insist upon this point (Traité, &c., p. 326). They also associated with their peculiar views of the state of the blood (*i.e.* its highly fibrinous character), the frequent occurrence of acute inflammations in leprosy, remarking at the same time the influence of these last upon the course of disease. Thus, during pneumonia, pleurisy, peritonitis, &c. the leprous tubercles cease to grow or become absorbed; but shortly afterwards they re-appear; and even anæsthetic leprosy is thus liable to check. In the absence of other information regarding this supposed

antagonism of diseases, I am compelled to reserve discussion of this interesting subject, and here will only remark that there is probably nothing strictly peculiar in the comportment of skin-leprosy, while under the influences just mentioned; whilst the internal changes that occur are as yet wholly unknown.

‡ Thus, Danielsen and Boeck (*loc. cit.*, p. 322) regarded it as 'very conceivable' that the skin of the leper might become a favourite nidus for various skin-diseases; and they notice that the two or three different cutaneous affections may here co-exist in one subject. It would be, at least, equally correct to say that, in most countries, lepers belong to classes of people, who do not observe a strict hygiene; and hence that skin-diseases amongst them are not only frequent enough, but may become greatly aggravated, on account of the increased neglect and exposure to which lepers are everywhere liable. Under such circumstances, doubtless, arose the time-honoured confusion of leprous and other skin-affections; and hence, too, the innumerable pretended criteria of each group of maladies. The older Norwegian observers had recorded their opinion that such incidental skin-complications, as 'eczema' and 'impetigo,' are much developed in the body, they assume a positive relation to leprosy, and exert a 'not feeble' influence upon its progress; thus, when the one subsides, the other begins to spread afresh. The fact here alluded to is possible enough, but it only indicates, as I think, that there are certain local conditions of the skin (and those it is assumable from other data, chiefly regarding the state of the circulation, which are more favourable than others to the spread of leprosy, and especially of the 'tubercular' form of this disease.

The itch, in Norway, has had a notorious prominence awarded it, but has failed longer to maintain attention.\* These remarks more immediately concern the cutaneous leprosy, whether nodular or macular; but it is well worthy of further inquiry, how anæsthetic surfaces comport themselves with reference to skin-diseases, when compared with areas not deprived of nervous influence.

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\* Why in the Madras Asylum, 'psoriasis' should claim such special notice as is given to it, amongst skin-affections, I am curious to know. Can it be that the

'leprous eruption' proper has here been relegated to the rank of ordinary skin-complaints—still however, requiring particular mention?

## SECTION II.

CHAPTER II.—GENERAL CHARACTER OF LEPROSY AS  
REGARDS THE SUBJECT.

|         |                |
|---------|----------------|
| 1. SEX. | 3. OCCUPATION. |
| 2. AGE. | 4. RACE.       |

These important topics can now be only briefly discussed; and I propose still using the Bombay researches as a text, the data being now taken from a report lately presented to Government, in which other details of interest will be found, besides those here introduced.

## 1.—SEX OF LEPEERS.

By a special census made in 1867, it was ascertained that in certain districts of the Bombay Presidency there were 8,220 leprosy individuals, whose residence, sex, name, age, &c. were duly registered in a formal schedule. Of these 8,220 lepers, 6,692 were males and 1,528 females, the ratio being 4·38 to 1.

So far as known, the normal proportion of the sexes in some Indian populations is, when compared with European standards, peculiar from the excess of males: the exact ratio in Western India has yet to be determined, but it probably differs little from that found to obtain in Central India and the North-west; thus in a Deccan district there were 100 males to 92 females, in a Concan talooka (Rutnagherry) 100 to 88; and in Canara 100 to 70—possibly an exception—it is not unlikely that a natural variation exists, but the proportions are never equal, as in a few European countries, much less is the female sex in the ascendant—as in most, 100 males to 104·6 females being there the prevalent ratio. The reversed proportions in this country have been attributed partly to climate (males preponderating in the tropics), and to the commonly greater age of the husband, which is supposed to influence the sex of children. Since amongst lepers males are as 100 to 23 females, the special liability of men to become affected is sufficiently apparent.\*

\* Referring for illustration of the text to other provinces of India, I find upon examination of the latest available census returns, that a similar preponderance amongst lepers of men over women is everywhere to be noticed. This fact will be sufficiently obvious from the following table.

| Province.        | Normal. |      | Leprous. |      |
|------------------|---------|------|----------|------|
|                  | M.      | F.   | M.       | F.   |
| Bengal - -       | 100     | 99·6 | 100      | 15·  |
| N.W. Provinces - | 100     | 87·  | 100      | 23·8 |
| Punjab - -       | 100     | 83·3 | 100      | 25·3 |
| Central Province | 100     | 96·4 | 100      | 43·2 |
| Mean - -         | 100     | 91·6 | 130      | 27·  |

Whatever be the explanation of this remarkable preponderance of male lepers in India, the fact of its general prevalence seems to be undoubted.

If attention be now directed to Norway, it will be found that such preponderance does not exist. Thus, in a total of 5,071 lepers, there were 2,855 men, and 2,216 women; or a proportion of 100 of the former to 84·2. The normal population of the country possesses a slight preponderance of females; but yet male lepers are rather the more numerous.

In Jamaica, a few years ago the normal population showed a slight excess of females, viz., 106 females to 100 males; whilst the leprosy population was also nearly equal—namely, 100 males to 99 females. Hence, it is evident that experience in India is somewhat peculiar, and in the absence of other data bearing upon this subject, I must defer its discussion to a future opportunity.

The proportion of the sexes varies at different ages; only at childhood does it approach the normal ratio, so far as this is known; between 31 to 60 years, male lepers greatly predominate, and in extreme old age they are more numerous than the mean. This large predominance of affected men at adult ages is the chief peculiarity in leprosy, and there is no counterpart to it in the normal population: the disease appears to be equally common amongst boys and girls; more than four times as common in the whole of mid-life amongst men, and even more frequent amongst old men, notwithstanding a slight increase in the proportion of women affected: the Table below illustrates these statements:—

*Proportion of the Sexes at different Ages.*

| Age.     | Males. | Females. | M. F.   |
|----------|--------|----------|---|
| 10       | 100    | 64·4     | } 100:77·2 Lepers—to 13 years.<br>100:76 Normal pop., do.     |
| 20       | "      | 38·5     |   |
| 30       | "      | 29·8     |   |
| 40       | "      | 19·1     | } 100:22·1 Lepers—13—60 years.<br>100:98 Normal pop., do.     |
| 50       | "      | 16·6     |   |
| 60       | "      | 19·5     |   |
| 70       | "      | 25·0     | } 100:23·3 Lepers—above 60 years.<br>100:150 Normal pop., do. |
| 80       | "      | 21·7     |   |
| 90       | "      | 0·       |   |
| 100      | "      | 0·       |   |
| Mean - - | 100    | 23·4     |   |

It need only be added that the disease thus appears to commence early oftener in women than in men, an inference hereafter to be confirmed.

Hereditary or family predisposition prevails to a considerable extent in both sexes, and is rather more marked among women than in men; thus, excluding conjugal and legal, 1 leper in 5·8 of men acknowledge a family taint, and 1 leper woman in 4·6 makes the same admission. This fact is interesting, since leprosy shows such a decided tendency to affect one sex rather than the other, and it will be considered in more detail under the heading, 'Causes' of leprosy.

## 2.—AGE.

The ages of 8,220 lepers of both sexes are entered in the Bombay Returns, and are shown in the following Table:—

*Ages of Lepers.*

| Age.      | Sex.  |         |        | Per-centage. |         |        |
|-----------|-------|---------|--------|--------------|---------|--------|
|           | Male. | Female. | Total. | Male.        | Female. | Total. |
| 10        | 45    | 29      | 74     | 0·67         | 1·89    | 0·9    |
| 20        | 527   | 203     | 730    | 7·87         | 13·28   | 8·88   |
| 30        | 1,496 | 446     | 1,942  | 22·35        | 29·18   | 23·62  |
| 40        | 2,046 | 392     | 2,438  | 30·57        | 25·65   | 29·65  |
| 50        | 1,793 | 299     | 2,092  | 26·79        | 19·56   | 25·44  |
| 60        | 659   | 129     | 788    | 9·84         | 8·48    | 9·58   |
| 70        | 100   | 25      | 125    | 1·48         | 1·70    | 1·58   |
| 80        | 23    | 5       | 28     | 0·03         | 0·03    | 0·52   |
| 90        | 2     | 0       | 2      | 0·           | 0·      | 0·03   |
| 100       | 1     | 0       | 1      | 0·           | 0·      | 0·     |
| Total - - | 6,692 | 1,528   | 8,220  | —            | —       | —      |

The largest number is found at 31 to 40 years; the next highest at 41 to 50, then at 21 to 30 years; these and all the remaining numbers at various decennial periods being determined by

the figures in the 'male' column, owing to the great preponderance of that sex in leprosy. Not 1 per cent. of all lepers are found at childhood, and not 2 per cent. after 60 years of age: at 11 to 20, and 51 to 60 years, the per-centage is about 9 only, so that the great majority of lepers are between 21 and 50 years of age: and this statement applies to both sexes. The following differences in the sexes appear:—female leper children are proportionately three times as numerous as male children; at 11 to 20 they are not very far short of double as many, and at 21 to 30 the per-centage of women is at its maximum, that of men being found in the next decennial period (31 to 40 years); after 30 years, amongst women, the per-centage diminishes and then falls rapidly till at 61 to 70 it is nearly the same as amongst men. In both sexes a sudden diminution in numbers occurs after 50 years, it is especially marked in men, and well in women at 51 to 60.

It is apparent that the age of female lepers tends, among early adults, to anticipate that of males, and that a greater rise in numbers takes place amongst them at the period of puberty; it may hence be inferred that the disease tends to appear sooner in women than in men.

The want of a general census of the population prevents further details, but from a few inquiries it seems that about 36 per cent. of males, and 30 per cent. of females, are found under 13 years of age; the per-centage of lepers of the same age being only 2·3 and 5 respectively: at 13 to 60 years, 57 and 58 per cent. of the population are found, while 94 and 92 per cent. of lepers are between these ages; subsequently the proportions of the latter again diminish.

Other evidence on this subject is contained in the following Table, which exhibits the results of inquiry into the history of 226 lepers, independently observed in Bombay and Sattara, of whom 186 were males and 58 females\* :—

*Age at which Leprosy appears.*

| Age at Commencement. | Males per Cent. | Females per Cent. |
|----------------------|-----------------|-------------------|
| To 10 years.         | 4·7             | 20·0              |
| 20                   | 26·7            | 29·3              |
| 30                   | 33·9            | 27·2              |
| 40                   | 20·8            | 17·2              |
| 50                   | 9·5             | 3·4               |
| 60                   | 4·1             | 1·7               |

Under 10 years means at infancy in nearly half the instances, especially amongst females; there are numerous examples of leprosy appearing about the time of puberty, particularly in females whose marriage commonly takes place at this period; about 30 years is a common age for

\* Danielsen and Boeck furnish a table which may be, in some respects, compared with that below, and is thus summarised :—

Per-centage of lepers whose age at commencement of this disease is known: the form of leprosy is also indicated *A.L.*, meaning the anaesthetic; and *T.L.*, the tubercular form.

| Age.         | T. L. | A. L. |
|--------------|-------|-------|
| To 10 years. | 14·   | 16·   |
| 20           | 33·   | 42·2  |
| 30           | 25·   | 24·7  |
| 40           | 17·   | 11·8  |
| 50           | 8·    | —     |

Hence, it appears that in Norway, leprosy in general commences at an earlier age than in Bombay; and the observation is a valuable one. I have already shown that the malady has a shorter course in the northern zone than in the tropical one.

The same authors remark that they have seen infants at early age presenting 'tubercles,' and whose parents declared they were born with livid spots, soon changing into tubercles. "We have also heard from other parents, that their children had 'bullæ' here and there on their limbs during the first months after birth; and we have seen children at their eighth year attacked with the anaesthetic form."

the disease to begin, in both sexes, and soon after, while the frame retains its full vigour, it not unusually appears. Subsequently, *i.e.*, at 50 years and onwards, leprosy commences more rarely than even at first, and this is most marked in women. The chief distinction between the sexes lies in the earlier commencement of the disease amongst females, particularly in infancy and soon after puberty, and it is one worthy of notice.

The practical inference to be made from the above table is this, *viz.*, that the germs of leprosy may be dormant till near the middle of life; and it is also apparent that an individual bearing within him the leprous taint may grow up and beget children and die, before the evidence of this taint becomes manifest in his person: and it can hardly be denied that this experience might be repeated in the instance of his children, all or any; such being, it might be surmised, the explanation of many obscure facts in the history of leprosy, as well as of some other constitutional diseases known to be propagated from parent to child.

The first signs of leprosy being obscure, and, as observation shows, liable to be overlooked; also memory being a fallacious guide in the reckoning of long periods, it may be supposed that the earlier dates entered in the above table are liable to be somewhat erroneous, yet nothing appears which is opposed to other experience, and as an approximation to the truth the conclusions named may be accepted. There is nothing which militates against the idea of a child being born diseased; the event is probably extremely rare, but so it is with cancer and scrofulous disease, not with syphilis. Facts are, however, still wanting for the full discussion of this subject.

It is possible to elicit the numbers of *married* and *single* women entered in the Returns, and a short reference may here be made to a few data taken from the Returns of the Kaira, Tanna, and Ahmednuggur districts:—

*Ages of Married and Single Women.*

| Age in Years.   | 1 to 10. | 11 to 20. | 21 to 30. | 31, &c. | Total. | Per cent. |
|-----------------|----------|-----------|-----------|---------|--------|-----------|
| Married - - - - | 0        | 18        | 65        | 291     | 374    | 76        |
| Single - - - -  | 6        | 31        | 26        | 54      | 117    | 24        |
| Total - - - -   | 6        | 49        | 91        | 345     | 491    | —         |

The majority of adult leper women are married; those under 20 years of age are oftenest single.

As practically every healthy woman in India is married, and since leprosy is regarded as a bar, it is obvious that the early appearance of the disease interdicts matrimony; and the above table shows its tendency this way, since only about one-third of the women under 20 years of age were married, whence it may be inferred that in all these instances the disease had appeared before puberty, a period identical with matrimony, in ordinary custom. The advent of leprosy, it may be observed, annuls betrothal (which is common at six to eight years) but not marriage.

This disease does not necessarily or invariably interfere with the procreative faculty of either sex: there being many leprous families of several members each, including one or both parents, entered in the Returns: and that many other lepers, male and female, are childless, may be owing to their exclusion from society.

### 3.—OCCUPATION OF LEPERS.

A considerable amount of information on this point has been collected in India, and is referred to in my Report; but as other data suitable for comparison with these, and regarding

the normal population, is yet wanting, no practical use can be made of the statistics named. The few remarks which I now offer, have reference to both diet and occupation.

In my earliest communication on the subject of leprosy (1862), the following quotation from the Bombay Mortuary Returns of 1860, was included:—"The frequency of the disease (*i.e.* leprosy) " in the class concerned with the catching and selling of fish is very remarkable, especially " as this class contributes in but a trifling proportion to the general mortality. This serves " strongly to confirm the opinion long entertained, that an inordinate use of fish tends to produce " the disease; for the other classes which suffer the most are also those which use fish very " largely, not always in the freshest condition; and it is interesting in connection with the fact " of the prevalence of a very similar disease, notwithstanding the great difference of climate, in " those countries of Europe where the poorer population feed the most largely upon fish, *viz.*, " Norway and the Shetland Isles, the Faroe Isles and Iceland" (Remarks by Dr. Haines). Subsequent inquiry in India, has not served to convince me, that fishermen become lepers in a larger proportion than persons of other occupation; and although the idea that they are so, would seem to derive confirmation from such foreign experience as that referred to in the above quotation, yet, during my late visit to Norway, I did not find any stress whatever laid upon this point, with regard to the etiology of leprosy. In fact, while virtually all the inhabitants of the 'west coast' of Norway are both fishermen and farmers, according to the season of the year suited to toil; and while all classes partake largely of fish as a constant article of diet, yet I find upon examination of the admirable official statistics which were published by the Norwegian Government last year, that the three localities on the infested coast, have but a small proportion of their inhabitants attacked with leprosy. Thus, proceeding northward, the South Bergenhus district has 3·07 per 1,000; North Bergenhus, 6·80 per 1,000; and Romsdal district, with Nordmore, but 3·59 lepers per 1,000 of population. From these data, it is clear that some other especial condition is to be inferred, as an active or even passive cause of the prevalence of leprosy in these parts; and so many other facts with which I have become acquainted, tend to show the necessity of some more intimate agency than this of occupation, or even of diet, that I am unwilling to enter upon a discussion which would seem to me likely to be unprofitable.\*

\* The resident physician of Asylum No. 1 at Bergen—Dr. G. A. Hansen—assured me that leprosy is even rare amongst the inhabitants of the outermost range of islands, situated along the west coast of Norway; and that the disease begins to be common in the nearer groups or landward side of the larger islands, being most frequent of all upon the sea-borders of the mainland and of the numerous deep bays (*fjords*) projecting into it. Now the seaward residents are so much pure fishermen, that their very physique may be recognised, in the comparatively weak lower limbs, and stalwart arms so much used in rowing in boats. According to this statement it appears that fishermen, *per se*, are not peculiarly liable to leprosy.

Mr. F. Day, Inspector of Fisheries in India, observes that "leprosy is a well-marked disease which is by no means infrequent in the Punjab, N. W. provinces, and other districts of India, far inland, and amongst people who resolutely refuse ever to eat salt fish, however prepared; and the only way in which they consume fish is in the form of 'fry' caught during

" the rainy months, and generally in a bad condition " when cooked for food. But if we go a little further " to the East, we find the Burmese race, who most assuredly are a fish-consuming one, and prefer their " odoriferous 'nga-pee' to fresh fish: yet in my travels " through Burmah, I never saw a single instance of " leprosy amongst the indigenous people, nor a case of " those congenital malformations of the fingers and " toes, so common in India amongst natives born with " a leprous taint. In fact, it has been frequently " marked that this disease does not exist amongst the " Burmese; and the same observation applies to the " fish and animal food eating Andamanese, whilst, on " the other hand, it is as common amongst the inland " classes who do not eat fish, as amongst those who do " so. As regards Elephantiasis Arabum, there does " not appear to be any stronger reason for attributing " its origin to a fish diet, than there is in regard to " El. Græcorum." (Report on the Fisheries of India and Burmah, 1875.)

Adverting more particularly to the 'occupations' of lepers, I should remark that during the minute analysis of the late Leper Returns for Western India, I found no one class of artificer or labourer, whose numbers were at all considerable, to be exempt from disease; agriculturists were, of all others, by far the oftenest lepers, but they perhaps equally in numerical excess of other classes; whether, however, this last statement is true, has yet to be determined.

#### 4.—RACE.

The subject of race, together with that of Hindu castes, closely engaged my attention during analysis of the official leper-statistics of Western India; and I came to the conclusions, thus expressed in my Report to the Government of Bombay; when referring to a long list of the castes and races of known lepers, it is said—

"The above enumeration is not devoid of interest: it illustrates the cardinal fact that leprosy is not limited to any one caste or race. If Brahmans and the higher castes have but few lepers amongst them, yet in the mass of the population as represented by agriculturists, &c., are many affected; and more, probably, in proportion, among the low-castes and the non-Arian tribes. Those of the Mahomedan creed (mostly foreigners by descent) are also not seldom lepers.

"Until, however, the normal relations of the population are known by a complete census correct inference as to the comparative prevalence of leprosy in Western India is impracticable. A crude estimate is the following: if 1 in 1,000 of all peoples may be a leper, then amongst Hindus and non-Arians 1 in 600 would be found; 1 in 1,000 Jains, and 1 in 1,500 Lingaets; 1 leper in every 1,000 of Mussulmans; 1 in 2,000 Parsees; 1 in 600 Jews, and 1 in 1,000 Christian converts. In more detail, Kunbis in Deccan may have 1 in 600, fewer perhaps in Gujarat; Kolis 1 in 400, with the same variation; Mahars would seem to have 1 in 500; the Mali appears to be freer from leprosy than the Kunbi; the Nhawi or barber, and the Simpi or tailor, in Northern Deccan, seemed unusually predisposed; and so the Teli or oil-presser.

"In conclusion, with respect to races of people, it seems that while the ascertained degree of family taint does not greatly vary, yet amongst the aboriginal tribes more women than usual mentioned this influence; a fact which would indicate intensity of hereditary predisposition."\*

\* Some very curious information of a general kind, is extant regarding the influence of 'race' in leprosy. Thus, the aborigines of a country (*e.g.* Br. Guiana) may be comparatively exempt; or the more affected (*e.g.* the Cape of Good Hope, and, perhaps, India). Very many references to this topic will be found in the late Report of the London College of Physicians; and Dr.

Tilbury Fox has collected other valuable data which I have had access to, but it has been impossible for me to reduce this to a small compass. With reference to the spread of leprosy in a new country—an event well-known to occur—this subject of 'race' is, in my estimation, one of the most important.

## SECTION II.

## CHAPTER III.—DIAGNOSIS OF LEPROSY: GENERAL REMARKS.

IN the middle ages, almost all the asserted diagnostic signs of leprosy were either such as belonged to unmistakable disease—*e.g.* the appearance of nodules, falling off of hair, numbness of the limbs, &c.—or they were valueless, or even erroneous in their special indications; and this last circumstance is easily explicable, because the leprosy itself was then hardly well defined. Hence, not much aid to early diagnosis is to be derived from the older authors. At the present day the signs which precede or first unequivocally display the leprosy are not much better known; yet that for other reasons, and chiefly because observation has shown that whole groups of skin-affections may commence in the same way. Whether the result of this generalisation will be a successful attempt to resolve such groups into more refined local species, or whether attention should now not rather be turned to attendant and surrounding conditions, are questions which observers will answer for themselves; and, while having regard to the truly specific characters (as I regard them) of leprosy, I still think that aid to early discrimination of this disease may be properly sought for from all sources of information.\*

The detection of the malady is concerned with both premonitory and incipient signs. Fully established disease needs no special notice in this place.

*a.* With regard to the *Prodromata* of leprosy, at the best only a limited diagnostic value can be accorded to them. Such as concern the nervous centres, whether brain or spinal cord, appear to rest upon a basis as yet unsubstantiated; and those which refer to the digestive organs are of precisely such a character as the dyspeptic symptoms, which are common all the world over. Yet, as some observers have largely insisted upon these vague indications, it is to be remarked in this place that mental apathy, rheumatoid pains, and acute dyspepsia occurring in natives of leprosy districts, or in foreigners visiting such countries, may give rise to a suspicion of approaching disease of some form; and at the same time should large vesicles appear upon the limbs, these would point to the form of 'nerve-lepra' or l. anæsthetica. Chills or shivering fits, followed or not by febrile disturbance, have been noticed at the very beginning of an attack of leprosy, but then the diagnosis was not made to depend upon such symptoms, and the latter were only events recalled to mind by the patient. As, however, a similar order of phenomena is observed by the physician himself at a later stage of the disease their significance is probably supreme; and on the adoption of the infection-theory of leprosy,

\* The following remarks include the entire statement of the early Norwegian observers, upon this subject:—"We trust that our description of leprosy has shown this disease to be a special complaint, which, when fully developed, cannot be confounded with any other one. The patches peculiar to the tubercular form have, in their early stage, been regarded as a pityriasis; but this confusion will very soon disappear. On the other hand, we have instances of the tubercular form, when only patches

" are present, and later as well, when tubercles are developed, being considered to be a syphilitic affection, and treated as such. This mistake is a serious one, for besides the loss of valuable time, the anti-syphilitic treatment will give rise to hurtful consequences to the patient, rendering him liable to a very early death. Some tolerable acquaintance with the two diseases, would prevent such a confusion." (Traité de la Sped. p. 344.)

it may be said that such signs are both true and invariable marks of the implanted malady, whether or not they be noticed by the patient or detected by the physician. Here, at all events, is a tangible conception, which by future observation must be negatived or affirmed. Finally, since the so-called 'prodromata' of leprosy are, in a practical sense, never the sphere of skilled scrutiny; but, on the contrary, are the more or less accurate memoranda of patients who bear about the person some or other visible mark of disease. The further consideration of this branch of the subject cannot be of much value, and for such details as are already known, I must refer to the several heads of leprosy types above described.

*b. Marks of incipient disease.*—My earlier comments on the diagnosis of leprosy, tubercles, and numbness had reference mostly to uncomplicated examples of these several phases; and I here propose to consider in more detail the differential diagnosis of leprosy, with regard to the more common sources of fallacy. Summarily, it might be said that difficulty may arise either from (a.) nervous or rheumatic affections, which might disguise nerve-leprosy, or from (b.) skin-disease, of syphilitic or scrofulous nature, lupus, multiple fibroma, molluscum, sarcoma, &c., which might more or less closely resemble nodular or macular leprosy.

It is from no desire to hide the unquestionable difficulties in diagnosis, which are liable to occur in practice, that I have but briefly treated this important subject of the correct discrimination of leprosy. Details in abundance might have been added, but as perfectly parallel cases are seldom seen, the fittest preparation for all emergencies is a knowledge of the clinical or natural history, the anatomy and the general features of the affection under notice, and such an acquaintance with leprosy is, for the most part, implied in the succeeding remarks.

#### 1.—LEPROUS ERUPTION.

In no form does this typical skin-affection present the multiple characters of the syphilitic dermatoma. At first the spots are transient, and their specific nature may be regarded as obscure;\* but even at this time I have found, in both India and Norway, indications of those characteristics which are apparent enough in the spots when these acquire their final permanence; there are seen patches of annular or circinate form and serpiginous tendency, with raised florid margins free from scales, and a depressed (atrophied) centre, in which sensation is wanting. The dynamic characters of such patches are, perhaps, their distinguishing feature, and search should be made for other marks of peripheral nerve-disease. Having already fully described the leper-spot, the significance of which I hold to be indubitable, in both attendants and consequences, it will not be necessary for me to again discuss this subject.†

\* On one occasion when passing through the wards of the Lungegaards hospital at Bergen, in company with Dr. Hansen, I saw there a girl who now had 'favus' of the scalp; and who some time since, was here with an eruption of raised and red patches of some size, attended with febrile disturbance which lasted for a week, but leaving no visible mark behind. Hansen remarked that this was probably an instance of the transitory eruptive phase of leprosy, but it could not be positively asserted that an established form of disease would follow, because diagnosis is, until then, obscure or even impossible to be made.

† Respecting the annular and serpiginous character of *lepra leprosa*, this is one of its features which, in India, has led to popular apprehensions respecting 'ringworm'; in other countries, to confusion with psoriasis, &c., and in the West Indies, to states of feeling thus alluded to

by Dr. Bowerbank—"I may here observe that any "yellow or light brown patch of discolouration of the "skin, from that of ephelis to leprosy, including the "copper-coloured rashes of secondary syphilis—*Ery-* " *thema marginatum*, *Tinea circinata*, and *Chloasma*—are "looked upon with dread and terror." Milroy's Report, &c., p. 8, foot-note.

I may here refer to earlier statements of a peculiar livid colour of the face, or a similar tint in the soles of the feet (attended, it may be, with deranged sensation), which have also been regarded as diagnostic of incipient leprosy. Probably such opinion is also peculiar to leper-infested countries; and mere differences in hue are necessarily of vague application, in regard to the coloured races of mankind—as the creole, or black; or the various Hindoo castes.

## 2.—LEPROUS TUBERCLES.

These are most commonly, but not invariably, preceded by erythematous patches, which are probably identical in nature—as they seem to be in structure—with those of the simple eruption. They do not, however, usually acquire the circular form or serpiginous character of the latter; and are not accompanied by special implication of the subjacent nerves. Such patches are numerous, they frequently supervene upon a febrile state, their form is very diverse; they are at first fugitive in duration, and they terminate in ‘nodules.’ The latter may, however, be formed without them. An ordinary appearance of such patches, is perfectly comparable with *erythema nodosum*, as I have myself seen. The state of the cutaneous circulation seems to regulate the colour and prominence of these spots; and although they apparently subside with the local hyperæmia, yet it is probable that a solid formation is always present, which afterwards grows to a visible ‘nodule.’

Older spots of the kind under notice as common predecessors of the ‘tubercles,’ may assume some of the appearances of *lepra leprosa*, such as rounded form and faded centre; but at an early stage and in themselves, such patches have not clear characteristics; only an inquiry into the clinical history of the patient, and his liability to infection; the position, long duration, and deep tint of the spots; the possible presence of anæsthesia in the hands or feet, or other sign of nerve-disease, are aids and signs to be asked and looked for. Should syphilis or tuberculosis co-exist, their clinical history and proper signs must be discriminated, from those belonging to leprosy; and if this cannot be done, at one time, it will soon become possible in superposition of other marks peculiar to these several forms of malady.\*

Adverting, now, to the completer nodular stage of leprosy, the diagnosis will commonly turn upon its discrimination from the somewhat similar characters belonging to lupus and syphilis; and, first, as regards syphilis. Having already alluded to the subject, I will here subjoin the characteristics and marks named by Bergmann, as the result of clinical study at Dorpat:—

1. The transition of patches into nodules is peculiar to leprosy; their ordinary co-existence in the same subject being a phenomenon unknown in syphilis, where the skin changes take place after a certain order of evolution. 2. Leprous nodules are the most persistent in character of all the tubercular skin-diseases; they grow, endure, and fade more slowly than do the syphilitic. 3. Ulceration is not by any means so common a result in leprosy as in syphilis, where it is the rule; while on the other hand, incidental circumstances of an unfavourable character seem commonly to determine its occurrence in leprosy. 4. The symmetrical disposition of the nodular leprosy eruption is unmistakable, and more pronounced than in syphilis; but the ‘tubercles’ are

\* The following are some observations by Dr. E. Bergmann, of Dorpat (*loc. cit.*, p. 35):—“At their first incidence, I do not hold it to be possible to distinguish between leprosy and syphilitic patches. The eruptive fever, the coming and going, the bright red spots afterwards changing to dull red or brownish grey tint—these are common characters. The leper-spots are not elevated, although perhaps firm to the touch: the syphilitic maculæ commonly resemble level prominences or papillary swellings. The permanent leper-spot has acquired at the end of a year, a far deeper brown or yellow tint than a syphilitic patch of the same age, would present . . . . The leprosy spots come mostly on the face . . . . the syphilitic efflorescence is most abundant upon the trunk: the

“former never attacks the hairy scalp, or the palms and soles; while the latter may do so . . . . Characteristic nodules follow leper-spots, and appearances like the syphilitic erythems of the mucous membranes and genitals, are here wanting.” Syphilitic eruptions, I would add, are not only ‘dry,’ but vesicular, pustular, or scaly: only by an effort of fancy could *pemphigus solitarius* be compared with *rupia*: syphilitic psoriasis does not specially affect the elbows and knees. Although the progress of inquiry may bring out the affinity rather than the distinction of lepro-dermata and syphilo-dermata; yet, practically, their important difference is a point to be in every way made as plain as possible.

never arranged in arch, uniform, or horse-shoe shape, as often happens in the latter; and in leprosy the face is much the most affected part, while the scalp altogether escapes. 5. The conjunction of papillary efflorescence upon the mucous membranes, with nodules in the skin, is peculiar to leprosy. Added to these various considerations, there is for guidance the clinical history of the cases, and the several negative and positive features of each affection, which need not be here repeated.

In a union of leprosy and syphilis, which is by no means uncommon, a difficulty in apportioning the signs may doubtless arise; and then discrimination is best to be effected by a consideration of all the features of the case.

Respecting the diagnosis of leprosy and lupus, the following points are named by Bergmann:—  
1. The lupus-nodule is the smallest in size of all tubercular affections of the skin; and even where most developed it is soft and doughy to the feel. 2. Whilst the leprosy nodule is very chronic in duration and seldom ulcerates, the lupus-tubercle soon disintegrates and wears away. 3. Leprosy either affects certain parts only—nose, lip, cheek,—or it assumes a certain form—the serpiginous; and it is far more limited in extent than the leprosy formation.

I have seen the conjunction of lupus and leprosy in one subject; the patient being an adult female, who was under treatment in the Rigshospital at Christiania; and the distinction of the two maladies was evident.

It is not proposed to pursue this subject, since the discrimination of leprosy in its several phases, as attempted for the benefit of those totally ignorant of the disease—a state which this word is intended to aid in preventing—would lead to minute and lengthy comparisons, which are here impossible; and I repeat that the best of all guides to the detection of ordinary leprosy is a knowledge of its signs, and a correct idea of its nature and material manifestation in the body. In the darker-skinned races of men, the discrimination of leprosy may be more difficult than in the paler, and elephantoid swellings are commoner in the tropics; but so marked are the characters of the severer malady, that difficulty in diagnosis seldom arises.

While the syphilitic tubercle is distinguished by a proneness to ulceration, that belonging to the scrofulo-dermata may be said to be, in contrast with the leprosy, marked by its soft consistence and liability to pass into suppuration. Each form, in fact, of the tolerably natural group of 'granulation-tumours,' has its own characteristic features, which will be apparent, if not at a single glance, yet always after watching awhile.\*

### 3.—NERVE-LEPRA.

It has already been shown that a close similarity exists between the results of leprosy and mechanical nerve-lesion: thus, the wasted, bent, and paralysed fingers of the leper-hand are closely imitated by the consequences of injury to the ulnar and median nerves. But no difficulty of discrimination need hence arise. Forms of palsy affecting the hands—as writer's palsy and that following poisoning by lead—are, on the other hand, wholly diverse from leprosy: so, too, are the vagaries of hysteric paralysis.† With signs of numbness and perhaps feebleness of the fingers, these will, in leprosy, be associated tumefaction or tenderness of the ulnar nerve

\* A peculiar nodular or tubercular eruption, seemingly like that of leprosy, has been observed in children of a scrofulous diathesis. Uffelmann, *Ark. f. Klin. Med.* X. s. 454.

† As an illustration additional to several others of the kind which have been previously published, I may here refer to the instance of a professional man, who after

living a couple of years in the Bermudas and subsequently residing for three years in Canada, noticed an eruption on the ankles which gradually spread upwards. During the spring season of the same year an affection of the hand comparable, it is said, to 'writer's palsy' made its appearance. The patient was accustomed to write a good deal. At the same time, numbness and

at the inner side of the olecranon; or of the median, in the bicipital depression or at the front of the wrist. The ham and inner ankle are corresponding localities in the lower extremities, where I have noticed nerve-disease of this kind.

Deformity of the hand resulting from rheumatic affections of the finger-joints, is not to be compared with the leprous.\* Profuse perspiration of the hands, &c., has been known to precede loss of feeling, and suppressed secretion.

Respecting anaesthesia in the arms and legs, or on the face and trunk, there is nothing peculiar in the numbed patches themselves, which would serve to stamp them as leprous. The loss of feeling is sometimes curiously defined: it may not follow the course of a given nerve-area: it is slow to change. Here, however, as in other cases, the attendant circumstances are most useful as guides to discrimination: in leprosy, patches on the skin almost invariably co-exist with the anaesthesia, or nodules on the face, &c., there has been a possibility of infection, is some family taint, and inquiry should be made for prodromal symptoms (so-called), and the occurrence of bullae. Commonly, the numbness is accidentally detected.

With reference to the severe pains in the limbs, following the course of the main nerve-trunks, which has been so much insisted upon, and the deep-seated or latent pain (elicited by pressure) which has also been regarded as peculiar, observers will probably have no difficulty in discriminating them from pains of a rheumatic or ordinary neuralgic character, and their several features are sufficiently obvious.

The hyperaesthesia which has been regarded as an invariable predecessor of numbness, is doubtless neuralgic in character, and it is commonly attended with hyperaemia of the surface. Anaesthetic leprosy coming on in the face is, however, marked by skin-discolouration rather than by mere neuralgic symptoms, and the persistence of its signs, would also serve to distinguish it from ordinary neuralgia. That such distinction was needed, does not seem to have occurred to the eminent Norwegian observers themselves; although I found that in Norway, 'face-ache' was common and unusually severe amongst women.

tingling began in the right foot and leg, but this disappeared in two or three weeks: a year or two afterwards, well-marked hyperaesthesia appeared in both hands and both feet, but particularly in the forehead. Next year, an eruption appeared on the forehead, and was accompanied by stiffness and anaesthesia of the little fingers and little toes, and a very serious oppression of breathing of a continuous asthmatic character. There was a general tremulousness of the entire system, under the excitement of public duty. In the following two years, cerebral symptoms of a grave character occurred—as loss of continuity of thought, inability to sleep, &c. The anaesthesia had now extended over both hands and feet, but specially the right members. Progressive muscular atrophy then set in, and the wasting spread into the fore-arms. The phalangeal articulations are (*i.e.* by comparison, appear to be? H.V.C.) enlarged, and slightly but permanently flexed. There is great reflex activity in the ulnar nerves, and a millet-seed enlargement in their course by the olecranon. There is general debility of the system, and a special excitability of the brain, which has, at times, prevented sleep for 70 hours consecutively. The appetite was good and the intellectual powers seemed to be unimpaired, but the patient became incapacitated

from the discharge of public duty . . . . There was nothing tubercular in the condition of the orbicular patches, no discharge from the nose, nor any affection of the throat or larynx . . . . habits strictly moral . . . . Such were the symptoms, as narrated by a medical man, of a case which was diagnosed in Europe to be one of 'Lepra Græcorum'; and the instance is noteworthy because of the concurrence with nerve-leprosy, of signs which seems to point to implication of the nerve-centres. At present, I allude to this case as illustrating a confusion in diagnosis, which need not to have ever existed, and which may in future be avoided.

\* Having before alluded to the semblance (which is really considerable) of early leprous nodules to the spots of *erythema nodosum*, I may here introduce a remark in supplement of the statement in the text. Dr. Hansen mentioned to me on an occasion when we were looking at a rheumatic patient, that he had seen an instance of this kind in which there existed, besides deformity of the hand, some decided loss of feeling; but diagnosis was rendered easy by the fact that this numbness did not extend above the wrist, whilst in leprosy, such limitation of anaesthesia is not known.

## SECTION III.

PATHOLOGY OF LEPROSY: OR THE DISTRIBUTION,  
NATURE, AND PROPAGATION OF THE DISEASE.

## CHAPTER I.—THE DISTRIBUTION OF LEPROSY.—

*a.* IN TIME; AND *b.* IN SPACE.

*a.* RESPECTING the past prevalence of the great leprous scourge and its general history, the present occasion is not one necessitating a full discussion of such interesting topics, and since these have been so fully treated of in several very accessible quarters, I shall be contented with my previous reference to the ascertained unity of the disease at different ages of the world, and with again expressing my opinion that this malady has not undergone any considerable, or at least any essential, change of character or intensity, since it was first distinguished as one of the greatest plagues of man. Evidence bearing upon this point is, for the most part, only inferential; but there seems to me no reason to suppose that leprosy is of late less hideous and fatal than formerly, and it is impossible to conceive of objects more pitiable and distressing than are many of the lepers now well-cared for in the asylums in Norway, or, in India, banished to rude hovels, or altogether expelled from home and otherwise left to perish. At the present day, medical men of all civilised countries speak of the disease and its victims, as a subject of dread and objects of deep commiseration. It must suffice, therefore, to remark that in general and for practical considerations, this malady has not shown a tendency to disappear from the face of the earth; and it is perhaps a question whether it is not at the present era quite as prevalent, in proportion to population, as at any earlier period of the world's history.\*

*b.* A very brief inquiry into the ancient and modern topography of the malady in question (which, short as it might be, cannot conveniently be attempted here), would suffice to show, first,

\* I have here in mind the fact that if leprosy has lost ground in Europe, it has gained in South America and in many large and scattered islands. What its real progress is in those European countries, where it still lingers, is not known to me with the notable exception of Nor-

way; but in both East and West there are many localities, not newly affected, where the disease is said to be even now advancing, and within the most recent times fresh spots have become infested.

that leprosy is not, and has not been, restricted to any particular quarter of the globe: that is to say, not restricted to certain kinds of soil, of whatever geological origin and relations, or of whatever acquired properties. Nor, I may add, is any continent of the earth exempt from this plague; and many isolated groups of islands suffer very largely.\*

Next, it would appear that no special condition of atmosphere, as ordinarily represented by climatic distinctions, has yet been shown to be altogether exempt: certainly, extremes of heat do not imply absence of leprosy, nor does a very low degree of cold. In other words, wide ranges of temperature, weight and moisture of the air, do not seem to greatly influence the disease.

Thirdly, that the geographical dissemination of leprosy does not seem to be essentially connected with the distribution of water on the globe, as represented by seas or large rivers, &c.† Here is a topic which merits close consideration, from the firm hold upon public opinion in Europe, of the idea that the disease is peculiarly limited to sea-coast districts. At the present day, indeed, such districts are the chief or only ones yet affected, in the European continent; but, on the other hand, historical records show this not to have been necessarily the case in former years, and if attention be directed to wider spheres of observation, it will soon be seen that in the interior of large tracts of land, leprosy is, and has long been, by no means absent, and a very few instances of this kind (which India alone furnishes), is sufficient to dispel the notion of limited prevalence now alluded to.

Lastly, if it be said that a combination of circumstances is, if not needful, still highly favourable to the maintenance or spread of this disease, I must remark that, as yet, no such conjunction of general conditions whether of soil, climate, or water-area, has occurred to me as being so favourable; nor am I aware that others have, after taking a wide review of the

\* The instance of the Australian continent is no exception, but it is difficult to arrive at all the facts of this case. Thus in the Report of the R. Coll. Phys. of London, 1867, p. 81, it is said that there are about 13 known lepers in Victoria, and these all amongst the Chinese immigrants; but in the Australian Medical Journal for March 1874, it is stated that the number of lepers in the colony of Victoria in 1866 was 31, while in 1874, it was reduced by deaths to 15. In New South Wales also leprosy exists, and that occasionally amongst Europeans; evidence to this effect may be seen in the New South Wales Gazette, Sydney, for October 1872, p. 10, and Dr. Cox's paper is well worth referring to by those interested in this subject.

† The instance of Honolulu, in the Sandwich Islands, is a remarkable one of new ground gained by this malady. Thus Mr. McKibbin of the Queen's Hospital, writes:—"On my arrival at these islands in 1856, I do not believe there were above 50 lepers in the whole island group, whilst there are at present (January, 1873) about 800 in the leper settlement in the island of Molokoi." The population is estimated at 50,000 people.

† No reference is here made to strictly local conditions, as to the distribution of water supply; but with regard to this point, I would quote the following remark

by Hansen (*see* Appendix A, p. xxii):—"So far as I know the sole condition which can with any tolerable certainty be regarded as universally prevalent in all these several localities (both at home and abroad)—(*etc.*) where leprosy is known to prevail—is the vicinity of water, either salt or fresh. This fact points to connexion between such vicinity and the prevalence of disease, but to nothing more." This subject will be mentioned again shortly, meanwhile I will avert to an illustration taken from an Indian experience, which seems to support this idea of the need of the presence of a certain amount of moisture (for such is the essence of the matter), for the maintenance of the leprosy disease. This latter is comparatively rare in the province of Sind (Bombay Presidency), especially about the more arid central districts, and there is here to the eastward, a range of country known as Thurr and Parkur, where, on repeated inquiry, I was assured that no lepers are to be found—this I note in my Report (p. 71) is "a circumstance singular and inexplicable, and deserving further investigation." The districts named have an especially scanty rainfall, and are only just outside the tropics; the soil is sandy, and the elevation slight: the ocean is at a distance. Virchow is of opinion that leprosy is limited to the borders of seas and large rivers; but it certainly prevails outside such narrow restrictions.

facts of the case, rendered valid such a conclusion as that suggested. In short, it does not appear that the endemic prevalence of leprosy is to be explained upon these more general conditions.\*

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\*I am now unable to enlarge upon this subject, but will remark that having lately examined the conditions of climate in the Bombay Presidency, as represented by the several sub-climates of certain typical districts, I arrived at the conclusion that the prevalence of leprosy was not connected with such conditions. I also found that the endemic variations of the disease were not seemingly referable to composition or elevation of soil: nor, on further inquiry, did I find any effective peculiarities of diet or habits of people, so that on the whole, no other inference was tenable than that the varying prevalence of leprosy in this large province is due to racial influences.

A similar, or even more striking, endemic limitation of leprosy I find to occur everywhere in India, so far as I have inquired; and I hope to ascertain if the same explanation is of common application. One learns that in England itself, leprosy was always more frequent on the east and south, than elsewhere; and one can hardly help suspecting that here, too, the explanation is to be found in the range of invasion by Scandinavian settlers; for the Vikings of Norway, &c., had certainly the disease amongst them in the era referred to; but I have had no time to pursue this particular topic.

## SECTION III.

CHAPTER II.—THE NATURE AND SEAT OF LEPROSIS  
THE LEPROUS DISEASE (*a.*) ITS ANALOGUES (*b.*)

(*a.*) OUR views regarding this subject will naturally be determined by the interpretation which is put upon facts conveyed by the clinical history, the general features, and the structural changes appertaining to the malady under consideration.

At different times, different inferences have been made from such series of facts; and if in anything the present generation has to make an advance upon previous knowledge, this advance will consist in either addition to the data, or their more correct explanation.

As regards the last-named point, I remark that since the interpretation of phenomena is a process hitherto in Medicine regulated by no fundamental principle—being rather determined by current pathological doctrines, themselves of variable quality—it is hardly within the bounds of likelihood that an universal and permanent conclusion will as yet be arrived at, notwithstanding that certain chief data remain of general acceptance. Besides, the deductive system of reasoning—the sole one yet available in Medicine—though convenient and even useful is more liable to fallacy than the stricter method of induction, and its conclusions can be hardly other than provisional.

As regards increase of the only stable elements of opinion—namely, correct observations, both physical and dynamic—I shall now have to direct attention to late acquisitions of special importance.

As a further preliminary remark, I note that respecting the leprous malady, which is perhaps the oldest and most severe and wide-spread of chronic maladies incident to man, medical opinion has not ceased to change with progress of knowledge and ingenuity of theory. And referring only to the present epoch, it will be found, as was above shown, that the views of some competent observers have undergone important changes, which, upon an impartial estimate as is possible, seem to be both well-founded and of useful practical tendency.

I propose, therefore, to briefly allude to those views of the nature of leprosy, which others and myself have recently proposed; and they may be summarily arranged as follows:—1. The humoralistic view, or that of a primary dyscrasia. 2. The solidistic view, or that of developmental tissue-defect. 3. The parasitic view, or that of systemic infection and secondary dyscrasia. This order indicates the chronology of opinions; and I may add that Daniëlssen and Boeck have maintained the first, myself suggested the second, and the third has arisen from the later investigation of Dr. G. A. Hansen of Bergen. These conceptions will now be discussed in the same order as that just named.

1. Almost all authors regard leprosy as a general or constitutional malady, and this conception has been very precisely elaborated by Danielssen and Boeck, in their well-known treatise on *Spedalskhd.* Although I am aware that the views in question are not now insisted upon, in Norway, yet since they are still commonly reproduced in England, it will be necessary to shortly discuss this subject. It is considered that the commencement, the progress, the complications, and anatomical lesions peculiar to leprosy, would of themselves sufficiently point to the existence of a real dyscrasia; but that chemical analysis of the blood of lepers, has afforded a positive proof of the connection of such dyscrasia with the presence of the leprosy disease. How the dyscrasia arises is not known, nor can it be said why one form of leprosy follows rather than another. The essence of the morbid alterations of the blood consists in an excess of albumen and of fibrine,\* and the same changes are always found. They precede and cause the prodromal symptoms; after the production of patches or nodules in the skin (which consist of the same chemical principles), the patient feels better, and if the blood be "actually examined, it will be found to be nearly normal." But a re-accumulation of the peccant materials takes place, which is followed by a new access of fever and eruption, and again with relief; or if the growth of the deposit continues or a copious suppuration sets in, the blood (the system) may be also thus relieved. In fact, the whole course of the disease may be easily understood, upon this ingeniously elaborated hypothesis. And so with the morbid products themselves—at first they are fibrinous rather than albuminous, and so long the tubercles and patches remain firm and small; but when albumen comes to predominate, the nodules increase in size, soften, acquire a deeper brown colour, or finally a yellowish one, and the neighbouring tissue is as well destroyed. In the anæsthetic form of leprosy, there is, with a less amount of deposited morbid material, a considerable amount of albuminous effusion in the 'pemphigus'; there is effusion of a highly albuminous fluid in the nerve-centres, and even the sclerosis of the nerve-organs seems to be due to excessive secretion of albumen. Once the specific dyscrasia is formed, there naturally

\* Eight separate analyses of blood taken from tubercular subjects, and five from anæsthetic, are given in detail: from these it would appear that the fibrine rises from 2·2 per mille to 3, 4 or once to 6·027 (the patient was an adult man, affected with anæsthetic leprosy at a rather early stage, and he was in fair health): the quantity of albumen varied from 52 to 139 parts per mille, and the globuline varied even more. As I do not gather from a perusal of the cases and analyses, any clear insight into the supposed connexion of phenomena—and the data may be too few for this—I must be content with observing that the method of analyses adopted was perhaps incapable of giving sufficiently precise results that no comparison is made with other diseases of the kind—and that subsequent investigations hardly agree with the above. As these analyses were seemingly made at no particular epochs in the disease, it is impossible to verify from them the assertions made in the text, and in general, there is a vagueness which would lead one to reduce the latter to hypothetical considerations, rather than to regard them as substantiated statements.

Although I place no great confidence in any scanty numerical series of chemical analyses, concerned with so complex a body as the blood, the following may be

mentioned here, as additional to other data: they are recorded by Hillairet of St. Louis, in *Ann. de Dermat. et Syphilog.* Paris, tome V. No. 3:—

|           |   |   |                     |                     |                   |
|-----------|---|---|---------------------|---------------------|-------------------|
| Water     | - | - | 784·10 <sup>1</sup> | 780·40 <sup>2</sup> | 818· <sup>3</sup> |
| Albumen   | - | - | 70·                 | 70·                 | 85·80             |
| Fibrine   | - | - | 3·90                | 3·10                | 6·10              |
| Globuline | - | - | 142·                | 139·                | 89·50             |

1. Patient a European affected for five years with nodular leprosy; no fever. 2. The same patient, at the time 'fever' was beginning, but yet the amount of fibrine was not increased. 3. Patient a middle-aged man 10 years sick, also with nodular leprosy: the blood was taken during the febrile state and while there was an eruption of tubercles. It appears that the excess of fibrine was due to the fever; but yet the total solids were less than in the other case. The recorder observes:—"If the solid matters of the blood (albumen and the albuminates) are often found in excess in leprosy, it is needful to remark that this occurs only under particular circumstances; that is to say, at the time of nodular outbreaks, accompanied by a febrile state and caused by changes in the seasons or, in the same season, by influences as yet but indifferently known."

follow congestions and effusions; and since "we know that the posterior surface of the spinal cord, as well as its grey substance, is richer than other parts in blood-vessels; also that the Gasserian ganglion and the facial nerve have near to them large various sinuses (whence exudation of serum might occur), we can naturally understand the seat and degree of the morbid changes which are known to occur."

Thus it will be seen that the authors endeavour to satisfactorily explain one phenomenon by another; the dyscratic condition of the blood being the *primum mobile*, there follows according to what is known of other similar maladies, a certain state of the system; and, lastly, the effusion of a certain morbid product, and temporary cessation of the constitutional symptoms.

It is not quite easy to seize on all the particulars as narrated in different parts of the great Norwegian work, but I have endeavoured to condense a large portion of them. The authors do not expressly refer to any other malady to which in their view leprosy, would thus be found to correspond, but it is evident that the general result of their inquiries is the application to this disease of the humeral pathology, as at one time taught in Europe.

2. I now come to my own view as put forth in a communication addressed to the Medico-Chirurgical Society of London, in February 1873; and printed in volume LVI. of the Medico-Chirurgical Transactions. I will here remark that at the time this paper was written, I was not acquainted with the later Norwegian researches, and therefore had not the advantage of such additional information as they had elicited. I wrote:—

"The proximate cause of leprosy appears to consist in a faulty condition of certain tissues of the integument—a defect, perhaps, of development, certainly a quality transmissible to offspring.

"The existence of a primary dyscrasia or blood change, seems hypothetical and even needless.

"The nearest approach to evidence of such dyscrasia which I have witnessed in India is the stunted growth with arrested development of some young lepers, the victims of the tubercular or mixed tubercular and anaesthetic forms of the disease; but as these individuals were born and reared in dire poverty, and had been subjected since the outbreak of their complaint to additional privation and exposure, there already was apparent sufficient explanation of their miserable condition. In such cases, I may add, it is usual to see ulceration both of the digits and of the 'tubercles' in various parts, especially in the mouth and larynx; internal ulceration and subsidence of the nose may also co-exist, which I have thought traceable to disease of the nasal branch of the first division of the fifth cranial nerve, and direct and more striking illustrations of similar correlations are recorded in my dissections.

"Occasionally the urine is albuminous, with other signs of degeneration of the kidneys, but since I have not found in the renal organs a leprosy deposit, these instances strictly have the force of coincidence only, and are not evidence of a dyscrasia peculiar to the disease under notice."

The grounds upon which this view was founded, are thus alluded to in the same article, when the subject of the seat of leprosy is discussed:—

"*Seat of Leprosy.*—The defect constituting this disease involves the constitution, inasmuch as it is transmissible in a latent form to offspring; but with respect to its outward manifestation it is restricted to certain tissues of the integument or cutaneous system.

"Evidence to this effect is both negative and positive, and may thus be summarised:—First, in sixteen unselected autopsies no uniform morbid change was observed in any of the great cavities

or their contents; the blood itself, so far as examined, varied in appearance, and the incidental character of the cause of death was sufficiently apparent. I have lately reconsidered the point, and am still of opinion that there is at present no positive evidence that leprosy, even in its worst form, involves the deeper-seated structures of the body.

“ Again, it is not every tissue of the integument which is directly implicated, but, as before stated, first the nerves, next the cutis; and the nerve-affection I hold to be pre-eminently the more characteristic. Thus, both ‘ tubercles ’ and ‘ eruption ’ are invariably associated with nerve lesion, while this latter may, for a time at least, exist alone. By repeated dissections I have ascertained that so many of the cutaneous nerves are actually diseased as to render the assertion credible that none are not liable to become affected.

“ Very noteworthy, too, is the fact that these nerves—such as the branches of the fifth pair on the face, of the cervical plexus to the ear, &c., of the brachial plexus and intercostal to the upper extremity, of the dorsal nerves, and of the lumbar and sacral plexuses to the lower extremities—are all diseased beyond that spot in the deep fascia of the muscles at which they become strictly cutaneous, or, in other words, only in that part of their course in more immediate relation with the skin, and they are seldom altered except by subsequent wasting in the deep-seated part of their course. I never detected any constriction at the perforation in the fascia which could mechanically account for this marked limitation of disease, so significant in its meaning.

“ But sooner or later the deeper-seated main nerve-trunks of compound function become more or less diseased, and at first sight this might seem an objection to the view propounded. Let it, however, be noted that the nerves, *e.g.*, the ulnar at the elbow and wrist, the median at the wrist, the popliteal in the ham, the posterior tibial at the ankle—are earliest and most, if not alone, affected where in their course they approach nearest to the skin, and where, one might hence almost infer, some irritative influence reached them. It is true that the spots I have mentioned being near to joints, the nerves are there exposed to repeated traction during movements of the limbs, and that such traction, entailing pressure, may be sufficiently irritative to induce leprosy deposit; but in many cases it will be found that there is a direct continuity between the affected main trunk and its altered cutaneous branches, which indicates extension of disease from the latter to the former. It should be specially noted that not every part of the larger trunks in these instances is impaired, since motor paralysis is rarely present to any extent, even in the worst cases of leprosy; and the inference is therefore plain, namely, that it is the sensory element of these compound nerves which alone is implicated.

“ I would here remark that, in my estimation, ‘ trophic ’ or nutritive nerve-tubules are commonly associated with those termed ‘ sensory; ’ and I will add equally explicitly my opinion that the process of nutrition may be directly affected by nerve-influence.

“ It may be urged that in the so-called ‘ tubercular ’ leprosy the nerve affection is of very subordinate importance. Certainly it would seem as if the force of the disease, then I believe at its greatest, were in this case expended on the skin; yet without pressing mere argument I must observe that even in tubercular leprosy (which is comparatively rare in Western India and adjoining countries), the ordinary nerve-disease is well marked, as is proved by the dissection recorded in my first paper, as well as by those of the fatal cases of mixed tubercular and anæsthetic forms of the disease.

“ I have, too, been impressed by the fact that the seat of the tubercles on the face is just where the cutaneous branches of the fifth pair emerge and pass onwards; notable is this with reference to the first division, or supra-orbital nerve.

"Again, I have so repeatedly found association of tubercular enlargement of the ear and disease of the great auricular branch of the cervical plexus, that I should be disposed to make this instance a stand-point for discussion; the question being whether the phenomena are contemporary or consecutive. Without prejudging, I think there are good grounds for believing in the priority and even causative precedence of the nerve-affection; nor is there any error in assuming that impaired nerve-influence might dispose to leper deposit in the skin.

"As respects the characteristic eruption known as 'Baras,' there are reasons equally or even more forcible for connecting it with the co-existing nerve-disease, but their repetition in this place is not needed.

"Thus the characteristic nerve-lesion of leprosy appears amply competent to explain all the more serious symptoms of the disease—the loss of feeling, shrinking, drying and coldness of the skin; the wasting and final disappearance of the digits, or even next segments, of the extremities. There is, indeed, such a close correspondence between the areas thus changed, and those of the nerve appertaining, that, having regard to the apparent sequence of symptoms, but one inference seems possible, to the exclusion of the idea that the ordinary tissues and the nerves are affected by a common change.

"Finally, it should always be remembered that the effects of locally suspended nerve-influence greatly depend upon attendant circumstances. In India lepers belong for the most part to people of primitive habits and limited means: they are therefore commonly without the appliances adapted to mitigate their complaint; and what is worse, scores of them are yearly expelled their homes, or sent forth as wandering mendicants, being subject to such want and exposure as would be detrimental to even healthy people; and hence most of their sufferings. On the other hand, I have known instances where with comforts and due care the worst degrees of the disease have been so mitigated that life was prolonged for years and but little physical pain experienced."

It will thus be seen, that my views were founded partly upon negative grounds which no longer have the same force as formerly, and partly upon the extraordinary changes which take place in peripheral nervous system in leprosy. Hence, in the absence of other adequate explanation of the phenomena of this disease, I am disposed to attribute much influence to the local nervous affection; and I still hold that there is no primary cachexia in leprosy, and also that the changes of the peripheral nervous system are the essential cause of a large part of the phenomena, which has been erroneously referred to an imaginary cachexia: nor am I aware that in any other theory of the disease, these special lesions and special sequences are sufficiently taken into account.\*

\* Without again referring to the almost countless number of illustrations, which might be brought forward in support of the views above stated, I should here observe that Danielsen and Boeck have not by any means ignored this subject: but since they based their explanations upon changes in the *central nervous system*—especially of the spinal cord and conjoined ganglia, *e.g.* the Gasserian of the fifth, which I cannot, from my own experience, regard as belonging to leprosy at all, it does not seem necessary to enter further upon their views; and so it remains that my own hypothesis was the first of the kind put forth. Danielsen has, however, subsequently pointed out the connexion of local nerve disease and skin-changes, in a manner favouring the opinion of the text; and I may here note an additional illustration taken from

a leprosy case recorded by Bergmann (*loc. cit.*, p. 18); speaking of the severe pains suffered by his patient, he observes, "after one attack, in which the pain extended along the course of the intercostal nerves, fresh spots of eruption appeared upon the chest, and they occupied perfectly symmetrical positions." I had accumulated many additional fundamental facts bearing upon all the points above mentioned, but can here only refer to their source in Fischer of Breslau, in the *Berliner klinisch Wochenschrift*, 1871, No. 13, S. 1 & 5. Bouchut, in the *Gaz. des Hôpitaux*, 1873. Duchenne, *De l'Électrisation localisée*, 3rd ed., 1872. Mitchell, Morehouse, and Keen, on *Gun-shot Wounds and other Injuries of Nerves*, Philadelphia, 1864. In the following chapter on the etiology of leprosy, this subject will be again referred to.

Finally, I observe that so often has incipient leprosy appeared before me in both men and women, whose health and general condition were otherwise quite good, that I was disposed to ignore the presence of a blood-dyscrasia, and to look for extraneous cause or a local tissue-defect in explanation of the origin of the malady. Whether both these influences may co-exist; or in other words, whether the so-called 'predisposition' to leprosy is a tissue-defect, is a question to be considered.

3. The most recent view of the nature of leprosy, which I have to mention, is that put forth in the writings of Hansen of Bergen, and already referred to in the text by Dr. Danielsen in the course of his remarks (see page 128). In Appendix A. will be found all the other information which has, as yet, been put forth by the author of this ingenious, and probably accurate theory. The chief distinctive features of the view in question are the following:—The leprosy disease is essentially an implanted one and derived from without; its structural elements are at first located in the skin or adjoining surfaces, and afterwards reach the blood or 'system'—whence arises the series of 'constitutional' symptoms so called. Here, in fact, is a specific malady which, though of chronic character, is yet of 'parasitic' nature; and it is almost a necessary corollary that it should be, as well, of infectious property. The grounds upon which this theory of the chronic infectious nature of leprosy is based, are these:—A peculiar class of structural elements is found in all parts, which are the seat of true active leprosy change, the bodies in question have the form of rounded masses or collections, which closely resemble the so-called Bacteria—or Micrococcus—colonies, now so well known in Medicine;\* and they exist not only in the skin (in

\* The resemblance in question is, as regards structure and general characters, of itself very noteworthy; but when associated with some other facts, it becomes still more significant. Such are the observations thus referred to:—Bergen, Sept. 9, 1873. A prominent, firm, bright-tinted nodule, the size of a horse-bean, was snipped off the chin of a young male leper, with scissors previously cleansed and heated, was received upon glass also thoroughly clean, and fragments taken from the deep surface were then examined with a power of 600 diameters, and more. When no addition of fluid was made there were seen very distinctly the usual large, round, granular cells, which look like very large, white, blood-corpuscles, and have a clear, solid body within (like a 'vacuole'), and besides frequently a small, rounded, granular nucleus; minute bright granules are interspersed, and amongst these may sometimes be seen small motile rods like those of Bacterium, or rather Bacillus, which move about while within the cell, but when outside and freely floating, are still more active. If a little distilled water be added (the immersion lens still being used), the cells are seen to swell, nuclei and contents become clearer, and the moving filaments more distinct. These rods are not very numerous; commonly they are seen freely floating about, but occasionally within the cells and imbedded in the protoplasm. There are free granules, which exhibit 'molecular movements,' but the motion of the rods is peculiar, and as if made from one end only. The whole cells may exhibit ameboid movements; the smaller cells are like white blood-corpuscles; the larger ones had generally a globular form, appeared quite translucent and not as if undergoing degeneration. No cell-wall was to be seen; there was sometimes a double nucleus, and some-

times a 'vacuole' only; granules were most abundant in the larger cells. I have said that the number of the rods at one time in view was not considerable (perhaps from 6 to 12), and but few were seen within the cells. I own that they might have escaped my notice had it not especially been directed to their presence; and even then, their significance did not appear to be great. Still it is not likely that they could have been introduced from without, under the conditions of the experiment, and it may be that their significance is great. It is possible that they enter the cells and there proliferate, finally producing the brown-tinted bodies are apparently characteristic of leprosy formations after a certain stage of growth and, perhaps, incipient softening and decay. It is true that such or similar Bacterioid particles are found plentifully in the discharge from ulcerating tubercles, but their origin from without is then sufficiently obvious, and it is hardly likely that such was the case in the instance of the experiment under notice. The next day, parts of the same excised nodule which had been placed in a moist chamber, and others which were preserved in osmic acid solution were examined; found a few vacillary particles in the cells hardened in the acid, but they were now quiescent, whilst others, free and floating, still presented active movements. This last circumstance rendered suspicious the animal nature of these organisms (so I note). In the other specimen no change had yet occurred, but Hansen has found the particles develop into beaded rows of moving filaments, and has seen appearances similar to those described by Klebs (Arch. f. Exper. Pathol. u. Pharm. 1873). *Extracts from my note-book.* I have had no opportunity of repeating this observation thus carried out by Dr. Hansen in the presence of

tubercle or eruption), but in the nerves, in clusters of the lymphatic glands, both superficial and deep;\* and even in the spleen, the liver, the testes, &c., and the corresponding deep-seated lymphatic glands.

So far does anatomical investigation reveal good grounds for the opinion mooted, and the same seems to be supported by the clinical history of the leprous disease, or 'leprosis,' as it may be termed. Thus, every change, whether of advance or repression, of the complaint, appears to be attended with movement of these leprous formations or deposits, so far as they can be outwardly seen, and possibly of those also which are deep-seated. A rapid subsidence of 'tubercles' or eruption, is an event which indicates absorption of their substance, and commonly associated with contamination of the system, as evidenced in febrile disturbance; at the same time the lymphatic glands in the groin and axilla, or neck, undergo corresponding changes, becoming enlarged and tender, as if from the accession of fresh morbid matters, which act as an irritant upon them. After a while, these symptoms cease, and it is supposed that the peccant material has become destroyed in the circulation, or excreted, or re-deposited in other parts of the body as a fresh eruption or crop of tubercles. In some way, the blood became more or less freed from it, and the malady is at rest until renewed growth and development of the germs inclosed in the integument, or the deep-seated organs, again give rise to a surcharge and fresh poisoning of the system, to be followed by like exacerbation of symptoms, and commonly with deeper implication of the frame.

Having already pointed out the original sources of information respecting Hansen's views, it is not necessary for me here to enter into further details;† but I must add that this theory is not

Dr. Danielsen and myself, and, therefore, simply record these memoranda for future use by others more favourably situated. To the original observer belongs all the credit attaching to the investigation; whatever its final outcome, the simple fact is above described.

It may here be remarked that the same large, brown, irregular shaped bodies as those so fully described and figured by Hansen (see Appendix A.), were seen by me in Bombay, but under the use of the low optical powers which I then possessed, their entire characters were not detected. Virchow has seen the same, and regards them as but large granule-cells of ordinary character. The significance of Bacteria, even under the circumstances above narrated, being also matter open to doubt, there exist, as yet, but the germs of a theory concerning leprosy which seems far more promising in results than others yet broached.

\* The frequent occurrence in leprosy of groups of enlarged and indolent lymphatic glands, especially in the groin, has long been remarked; but, in general, such enlargements have been referred to the consequences of ordinary inflammation or to struma, syphilis, &c., and not to special leprous disease. I had, however, in Bombay noticed the occurrence in such glands of structural elements, which were undoubtedly the same as those described by Hansen. See Plate XIII. fig. 45. and description. Virchow, too, had made the same observation; but Hansen was, so far as I know, the first to apply the facts in elucidation of the nature of leprosy, after having determined the specific character of the bodies in question, which both Virchow and myself had not done.

Respecting the glandular implications in leprosy, I may quote the following extract from Dr. Milroy's Report on Leprosy and Yaws in the West Indies, p. 8. "Another general feature of the disease which attracted my notice, was the very frequent enlargement of the lymphatic glands, especially of the inguinal cluster. This symptom had been noted by Dr. Shier in 17 of the 22 first cases which were received into the Asylum (at Trinidad) on its being opened in March; also in four of the six cases subsequently admitted. I had the opportunity of confirming the accuracy of these statements by my own examinations. In a few, the glands of the neck were also found to be enlarged." There is no reason to deny, I would observe, that glandular enlargements in leprosy may be of ordinary, as well as of specific character; and that both forms may co-exist. The microscope would enable us to detect both one and the other after death, but I know of no signs that distinguish either form during life.

† "Now a days, indeed, one cannot, recognise a dyscrasia, in the sense in which the term was introduced by humeral pathologists: it will not be admitted that contamination of the blood can be a permanent medium for certain definite changes, or in other words, that it is possible for the blood to undergo a primary change, which can last all life through. And the reason of this is, it is said, that the blood is a fluid of contingent nature which owes its existence and maintenance to other organs, and which therefore becomes altered only in consequence of being the medium for conveying any hurtful material from one place to another, outside itself. This is the

only ingenious but is seemingly founded on indubitable facts; it is, too, in accordance with received views as to the nature of more than one other general disease, with which leprosy has often been compared; and, undeniably, it merits the closest attention and further testing in India, where opportunities for observation are abundantly frequent.

The chief points for future study are, I conceive, that of the direct connexion between local absorption of leprosy matter and immediate infection of the system; and that of the earliest date and manner, at and in which these processes commence:\* let, too, renewed and full comparison be instituted between the phenomena of 'leprosis,' and those of 'tuberculosis' and 'syphilis.'

(b.) *Analogues of Leprosy.*—In the briefest manner only, can I touch upon this subject.

Amongst the other profound maladies to which man has become subject, some upon comparison will be found to resemble, in various degrees, the great leprosy complaint; but as regards particular identification of analogous complaints, there will necessarily exist at least as much variety of opinion, as prevails concerning the nature of the standard affection itself.

Now, taking in succession the series of opinions last referred to, I may remark that on the first of the hypothesis mentioned under heading (a.) of this Chapter, the following analogies present themselves.

1. Regard being had to the very commonly accepted view of the origin of leprosy in defects or errors of diet, it might be thought that scorbutus, anæmia, chlorosis, goitre, or even the gouty diathesis, would offer some similar general characters to those noticed in leprosy; yet I do not hesitate to say that no true analogy is here manifest. Scurvy is now even rare among lepers in Norway and India.

Once again, I would repeat that leprosy is a disease which affects the healthy, robust, and well-fed, as badly and as often as the weak and impoverished subject.

2. Supposing, however, that that leprosy be due to exposure to variations of temperature and moisture; does its 'dyscrasia' resemble in any way the rheumatic? It would be, perhaps, mere ingenuity to here institute a comparison; but I should mention first, that rheumatism is one of the very few non-specific complaints which is equally wide-spread with leprosy, that 'leprosy fever' has a tendency to appear at certain seasons of the year when inclemencies most abound, it is sometimes called 'catarrhal' fever from resembling the 'cold,' which may be associated with

"infection-theory which now prevails; and it is held that the peccant material enters from outside the body and poisons the organism: nay, further, it is sought to establish, by facts, the view that this *materies morbi* now deposited in some part or other of the frame, may under special favourable circumstances become disengaged and then implicate the entire body. Thus, from this point of view the so-called dyscrasia is really a secondary event. Many phenomena are undeniably better understood on this theory than on that of a blood-erisis; but with regard to leprosy it may yet be that a permanent dyscrasia is its head-spring." In these words Danielssen, in his Triennial Report, 1868-70, p. 6, inclines to the newer hypothesis, and seems to abandon that first put forward in his and Boeck's work of 1848. For my own part, I should not hesitate to follow the same course, were the 'infection-theory' competent to explain the remarkable and special implication of the peripheral nervous system, which is perhaps the most

invariable symptom of leprosy in both Norway and India. At present, I offer no criticism upon this tempting subject, but, in the interests of the reader, will not withhold any such facts and opinions as seem to be well-founded.

\* Can it be that systemic infection takes place at a period of time, far earlier than the date of first outward manifestation of leprosy; and are the so-called 'prodromata,' the indications of advancing leprosis? If so—and there are no just grounds for denying the supposition—then much light is thrown upon a number of obscure symptoms appertaining to the earlier clinical history of this disease, which have long been too obscure; and the prolonged 'incubation' of the malady, under certain circumstances, becomes intelligible. Thus, would mild infection, however, arising, produce a long series of mild prodromata; and would strong infection produce the so-called 'acute' onset of the disease: regard in both cases being had to both amount of *materies morbi* and idiosyncrasy of subject?

rheumatism; the 'leprous eruption' which precedes the advent of 'tubercles,' has often a remarkable resemblance to *erythema nodosum*, and is best seen during cold weather; 'chilblains' on the finger-joints, also first seen in winter, are an early sign of leprosy (*nodosa*): and lastly, leprous pains in the limbs have been compared to the 'rheumatic.'

Rheumatism is not, however, more common in leprous districts than elsewhere (*e.g.*) in Norway; and it has its own special characters.

3. If atmospheric vicissitudes be in co-operation with other injurious influences, 'Purpura' may arise, which, however, has no real analogy that I know of to 'leprosis.'

4. Nor does leprosy appear, like typhus fever and the like, solely under conditions of bad hygiene. Leprosy and the essential fevers are not incompatible with each other, as I have mentioned above; but they are not necessarily associated in either conditions or character.

On the adoption of the *second* of the hypotheses in question, that, namely, of leprosy being a disease of the tissues—not much light from analogy does, I admit, show itself respecting the nature of leprosis. I have, however, pointed out that many of the skin-changes here, are fairly comparable with those known to arise from local and similarly associated nerve-disease; instancing the consequences of mechanical injury, and 'herpes,' 'urticaria,' &c., as neurotic complaints.

The pathology of 'diabetes' does not elucidate that of leprosis; but on the adoption of some later views, a kind of connection may appear between the latter and Bright's disease; (so-called) of the kidneys, &c. This subject I am, unfortunately, not able to further touch upon; but I will here express my opinion, that many of the so-called 'nervous symptoms' which attend the final stages of leprosy and its close, are strictly due to blood-poisoning from kidney-disease, and (as other sources of information also show) not to leprous affections of the great nerve-centres.

On the theory *last-named* of all, that of systemic infection from without, more full and precise analogous illustrations of leprosy become available.

1. I would first mention the endemic complaints which have been associated with this disease. A 'malarious' origin has, thus, been attributed to leprosy, but the view is successfully combated in Norway, and if 'malaria' means the same influence as that causing the 'intermittent fevers,' then there is no necessary connection between it and leprosy. *Febris intermittens* is rare in Norway; and in India its connection with leprosy has never been, so far as I know, substantially admitted.\*

Also associated as an endemic complaint, in India, and even especially so in the opinion of some observers, is the remarkable affection known as *Elephantiasis Arabum*. This is a malady which is really far more localised than leprosy, and which would not, at first sight, appear to be connected with it; but for the reasons indicated in the note below, I have cursorily introduced the

\* In the year 1870, only 143 cases were treated in the whole of the kingdom of Norway, and a part of these were seamen who had contracted the fever abroad. Ague is commoner around Christiania, &c., than on the west coast, where alone leprosy prevails.

Respecting India, I may here refer to the statement contained in Dr. Van Someren's Report of the Leper Asylum at Madras, 1873. "Antecedent fever. Of 117 cases in which the inquiry was made, it was found that in 65 antecedent fever, malarious in its origin, had occurred, and in 52 the disease had supervened without any previous febrile action." Probably this premonitory fever was not always malarious, but sometimes of the true leprous character; but even if

not, these data do not seem to point to any peculiar feature of leprosy, since 'malarious' fever is common amongst all natives of the country. Dr. Wong, at Canton, observes "in nearly all the patients who have come to me for malarial cachexia, anemia, enlarged spleen, dropsies, or otherwise suffering severely from ague, I have not observed a single case of leprosy; nor, on the other hand, has leprosy been generally seen in individuals suffering frequently from malarious fevers." That leprous fever and the malarious are not identical, has been shown above sufficiently well; and that there is not even a subordinate connexion between the two, as regards their occurrence in time or place, is tolerably apparent.

subject in this place.\* 'Elephantiasis' occurs in Norway, though very rarely; and it then has the same external characters as the Indian affection. Some other remarks upon this disease will be offered in the second part of this Memoir.

2. The analogy of leprosy with the ordinary exanthemata, and with the acuter forms of blood-infection (including syphilis), is a subject capable of being treated at some length, by aid of the hypothesis now under consideration, but it is not possible for me to attempt this task. Respecting the classes of disease just named, they are, like leprosy, marked by an infection-

\* The remarks of Mr. F. Day, of the Madras Medical Service, which were published so far back as October 1860 (Mad. Quart. Journal), appear to me sufficiently valuable to be introduced in this place; for they afford a good clinical description of a kind of 'fever' which is well worthy of study in India, and which is, I doubt not, the same in character as the 'leprosy fever' of Norway and elsewhere. Elephantiasis in India is well known to be attended with febrile paroxysms, during which the tumefaction makes progress, and, at the same time, the lymphatic glands concerned become swollen and tender. In short, I believe that a veritable poisoning of the blood takes place here, as in leprosy; and that the peccant matters are transmitted through the lymphatic glands before reaching the blood.

Day remarks:—"In both anæsthetic and tubercular leprosy elephantoid fever appears equally prevalent. . . . It is the precursor of Elephantiasis Arabum, but generally shows itself in *El. Græcorum* after that disease has existed a longer or shorter period, being ultimately present in all adult native lepers. . . . Elephantoid fever has a distinct intermittent or remitting character: during its paroxysms, an enlarged and painful gland almost invariably exists in some portion of the affected limb between the seat of the local effusion and the patient's body. . . . Beginning at the same time as the fever, it subsides without suppuration a few days after the pyrexial symptoms have subsided. . . . The typical number of paroxysms in elephantoid fever is three; but in some instances, only two or one occur. Cases which have three paroxysms at one attack, almost invariably have three at the next; and the same regularity is perceived in those with only one or two. In no case, unless due to the supervention of malarious or irritative fever, are more than three paroxysms observed. There is no regularity shown as to the intervals of freedom from fever in each case. Its type somewhat resembles the quotidian without premonitory symptoms, but the pulse is usually quiet and regular, whilst a most severe headache remains in the apyrexial periods. . . . Hot, cold, and sweating stages are present. The cold is rarely absent, and generally of about two hours' duration." . . . "head-symptoms are often severe." . . . "In the hot stage the symptoms are augmented . . . the countenance is expressive of great suffering . . . skin hot and dry, pulse not very frequent . . . relief follows the sweating stage. The fever usually sets in

suddenly. . . . Any sudden chills or checks to perspiration may induce the fever . . . or over-exertion. . . . As a rule, the local augmentation in size of the affected part (leg or scrotum) is in direct relationship to the frequency and severity of the febrile paroxysms; or perhaps, more carefully speaking, the amount of constitutional disturbance affords a good indication of the rapidity of the effusion. . . ." Day does not admit the identity of elephantoid fever with the malarious. "The stages are indeed the same, but the paroxysms of the former always come on daily like quotidians, never as tertians or quartans, and are unchecked by anti-periodics. The cold stage is often excessive: the headache peculiar; delirium, rare in agues, is here frequent and persistent for days: pulse slightly altered; constipation nearly invariable: buboes, absent in agues, here present; feverish attacks violent, without corresponding permanent constitutional injury: effusions become organised and added to each succeeding attack. Complications, such as are commonly observed in intermittents, are also absent: no coughs, dysenteries, or dropsies, except in some few cases. . . . Europeans are usually unaffected by elephantiasis, although subject to malarious fever. In the only case in which death occurred during the paroxysms of fever, the spleen was much reduced in size." . . . "The influence of seasons in predisposing to it, is not marked. . . . Amongst the exciting causes are sudden changes of temperature, stimulants. . . . In several cases elephantiasis certainly showed itself, subsequent to the the healing of ulcers." "Recovery from the constitutional symptoms may follow the removal of the affected limb, but this does not prove it to be a local disease." (Perhaps this statement may be questioned, H. V. C.) Having seen two cases of leprosy where elephantoid fever occurred without local effusions, Day considered them as evidence "that the constitutional symptoms may exist previous to local ones becoming apparent."

This long quotation is of a value which will be appreciated by those who have to deal with the maladies in question, and, in my opinion, it is demonstrative of the common character of the infective fevers of leprosy and elephantiasis. The symptoms here described should be compared with those detailed by Danielssen, and the similar local changes in the lymphatic glandular system be borne in mind. Only in leprosy, we know the usual source of systematic infection, in elephantiasis, this has yet to be made out.

event, a period of latency, a febrile re-action of the system; commonly by an eruption on the skin or else by another form of crisis, which is followed by subsidence of all the more active symptoms.

The exanthemata are, as yet, to be distinguished by the preciseness of the infection-date (the mode and means of contagion being, however, unknown) and latent period; the regular sequence of other events, and the final immunity against other attacks which the first and only one affords. But the time when leprosy is 'caught'—even if this event be admitted—is unknown; and the other successive periods of the disease are seemingly most irregular. A main difference seems to be this, namely, that the morbid products are here of permanent character, and have self-multiplying properties, so that, in fact, the system is virtually never free after being once infected; hence, whether or not one attack of leprosy secures against a succeeding one, is not to be ascertained. The mode or event of primary inoculation and the regular sequence of constitutional symptoms are phenomena, also unknown or ill observed in leprosy; but the prominent features first mentioned remain, and being common characters, it may be allowed that this disease is of the exanthematous order, though not of the kind or species inclusive of small-pox, scarlatina, or measles.

Associated in this place with the 'exanthemata' I would mention other acute 'blood-poisonings,' such as pyæmia, or septic infection, in its numerous varieties. The order of phenomena is here quick and tolerably regular; the system is either overpowered, or restored 'whole as before.' The symptoms are those of constitutional irritation (so-called), but relief is not ordinarily effected through an eruption upon the skin. Still, if with all these subordinate differences it should appear that the circulation in 'pyæmia' and 'puerperal fever' (*e.g.*) becomes charged with particulate morbid elements, such in character as probably exist in leprosy, would not this fundamental fact, taken in conjunction with the more essential similar features, indicate a close analogical resemblance, to say the least, of the two orders of disease? The great natural group of 'infection-maladies' includes both acute and chronic forms of disease; and, obviously, these chronological distinctions are but subservient. Like 'tuberculosis,' so would 'leprosis' present examples of both forms, and probably members of the group belong to this mixed category. In these remarks I am, confessedly, proceeding upon hypothesis, but the more I consider this subject, with all the aid that is available to me, the more plausible appears the connection now intimated.

*Syphilis and Leprosis.*—Here again, simply from want of data, the analogy, which is evident enough in general, cannot be closely pursued. It is not yet known when leprosy begins, or how long it is latent before 'coming out;' but this ignorance does not militate against the view of infection and an incubating period of longer length than usual. Such differences are merely

\* Reference is now made to the researches of Prof. Hjalmar Heiberg of Christiania, whose microscopic preparations I have also had the advantage of seeing. The morbid appearances found in the lymphatics, and in the kidneys, which are depicted in his pamphlet (*Die puerperalen und pyämischen Prozesse*. Leipzig, 1873), are clearly illustrative of the presence in the system of 'Bacteria-colonies;' and subsidence of disease is marked by the disappearance of these remarkable aggregations. There are now sufficiently well known, several examples of the kind; and hence leprosy is not to be regarded as in any way exceptional, even if it be

allowed that such low organisms belong to this disease of the body. I may especially indicate Kleins' late researches on the sheep-pox, which carry the investigation a step further, by the detection of a true fungus, in connection with a developed micrococcus; and I might also properly allude to the acute febrile disorder, which has some remarkable features comparable to those of 'leprosy fever,' and which is caused by the presence in the system of an animal parasite—the *trichina*—as being also an analogous illustration quite in point. Here is a valuable and comparatively unworked field for comparative pathological research.

negative and comparative; and it seems to me probable, that the special characters of the leprous germ (to which even the appearance of its fuller growth seems to point, as something peculiar) will sufficiently account for the differences indicated. If one attack of syphilis does not protect against a second, there yet comes a time, as syphilisation has shown, when the system becomes invulnerable; hence such subsidiary points as these of comparative infectibility, relapses, halting, advance and the like, seem to be of superficial importance, when compared with the main order of phenomena and special physical changes.

There should always be marked apart a certain attendant of leprosy, namely, the highly specialised nerve-lesion; and although something of the kind has been noted in 'secondary' syphilis (*see* a previous note at page 48), yet it must be owned that there is elsewhere nothing so peculiar as 'lepra nervorum.' What are the natural consequences of this lesion, I have endeavoured to demonstrate; there are none such in other general diseases; and here is one of the very prime 'characteristics' of leprosis—if not the chief.

I have next to refer to 'tuberculosis' as an analogue of 'leprosis.' How commonly the two maladies may be associated, I have before shown in extracts from Norwegian experience;\* but it is not supposed that there is such a thing as a transformation of one into the other, and I think that Danielssen has advanced in favour of their close coincidence, all that can properly be said. Even with this admission, what a clear light flows in upon spots before wholly dark! In the order of phenomena it is the 'quantity,' next to their cause, which it most benefits us to know; and now there seems to have risen, a source of light and stimulus which will greatly aid future investigation.†

\* Some later speculations on this subject are the following:—"Whether now these disintegrated organic elements from the softened nodules, after their entry into the blood, do contain two wholly distinct irritants, which each for itself calls forth a certain special form of disease; or whether it is not that the leprous detritus without being specific, produces in the leprous organism those eruptions which some medicinal agents (*e.g.*, iodine) can also elicit, and alongside such eruption a tuberculosis, such as results from the action of a foreign irritant upon a weakened body—these are questions which should be settled. . . . So far as concerns tuberculosis, it now seems certain that it may in animals be called into existence by the most varied irritants; and that the case is not wholly different in man, there is good reason to suppose. It is on the other hand, somewhat different with leprosy; thus, while no one has succeeded by experiment, in implanting leprosy upon the lower animals, yet in lepers the same eruptions can be caused alike by numerous foreign agents (such as the preparations of iodine, chloral, carbolic acid, when these are introduced in sufficient quantity into the body), and by the leprous detritus itself, as is presumed." Speaking of a case in which renewed outbreaks of leprosy alternated with tuberculosis, Danielssen asks, "Did the tubercular detritus (probably softened cheesy matter) thus produce those leprous eruptions which followed immediately after its softening?" (*Lungegaardshospitalets Virksomhed i Trearet, 1871-73, pp. 40-41.*)

† I am not aware of many facts from India (where, however, tubercular disease is not uncommon) bearing upon the subject of the possibly close connexion between leprosis and tuberculosis; but as regards the

West Indies (where phthisis, &c. is comparatively frequent), should mention the following:—Dr. G. Milroy, in his report before referred to, observes (*p. 37, &c.*), "the malady to which it (*i.e.*, leprosy) has the greatest analogy is unquestionably scrofula." . . . "The very frequent enlargement of the sub-cutaneous lymphatic glands, unconnected with any ulceration in their proximity, is a feature which leprosy has in common with scrofula." . . . "The very frequent complication of lung and bowel disease, in the latter stages of leprosy, renders the suspicion very probable [whether the bronchial and mesenteric glands are also not affected as often as the external]. Indeed, the proximate cause of death in the majority of cases is either pulmonic or intestinal lesion. Genuine consumption is by no means an uncommon cause of death; and Dr. de Verteuil adds the interesting remark, that it is not an uncommon occurrence, in a family where there is a case of leprosy, that there also occur cases of pulmonary tuberculosis." Reference is also made by Dr. Milroy, to the coincident increase of scrofulous diseases and of leprosy in Demerara, during the last 30 years or so, . . . "as a point of extreme interest, and one calling for further investigation."

Enough has now been indicated to show that the attentive clinical observations so long carried on in Norway, have results of a wider application than only to the northern forms of leprosy; but, everywhere, it remains to collate these data with others referring to allied diseases, in order that their special force should be made clear, for upon that chiefly depends their import.

It seems to me that almost the whole of the argument in favour of the transmissibility, and the propagation within the body, of tubercular matter, applies with decided emphasis, to the leprous affection and its 'materies morbi.\*'

Lastly, respecting the analogical connection of leprosy with other constitutional maladies (so-called), which are of uncertain nature and origin, it will be sufficient to mention 'lupus' and 'cancer' as general diseases which are not without their points of affinity to the leprous. In 'lupus,' indeed, the morbid changes seem to be wholly local, but this cannot be regarded as fully proved, for the alterations in true leprosy had long a similar aspect. 'Cancer,' on the other hand, is remarkable for the mobility of its structural elements; and the lymphatic glands, spleen, liver, testes are apt, as in leprosis, to be specially affected, as an event secondary to a primary growth and not unaccompanied with constitutional disturbance.

\* I am unable to discuss, even in the briefest manner, the suggestions indicated in this paragraph; but that they are not singular is sufficiently apparent from the following remarks of Dr. Milroy, published last year, vide Report on Leprosy and Yaws, &c., p. 41:—"Leprosy appears to me to be neither more nor less contagious than scrofula. What Dr. Williams . . . has stated in regard of pulmonary consumption; one form of tuberculous disease, is in my opinion applicable to the other, cachexy:—'Although I concur in the opinion that we have no evidence that pulmonary consumption is infectious like small-pox, scarlatina, or typhus, or that it depends on a specific poison,

'yet I think that both reason and experience indicate that a noxious influence may pass from a patient in advanced consumption to a healthy person in close communication, and may produce the same disease, just as foul pus or putrid muscle will produce tubercles in an inoculated animal.'"

If such passage and the comment preceding have, in connexion with other data, a precise meaning, this seems to be practically in favour of the extraneous origin, and the possible communicability of scrofula; and no other admission could be desired with respect to leprosy, by the earnest advocate of the later views touching that disease.

## SECTION III.

## CHAPTER III.—THE CAUSES OF LEPROSY.

EVERY attempt, however brief, to discuss this important subject will be practically useless, unless it be made according to a definite method. Such methods are various; thus, the subject may be approached from the metaphysical side, and search be made, *e.g.* for the 'primary' and 'secondary' causes of leprosy; or it may be analogically discussed, that is to say, the malady itself regarded as of 'specific' or 'non-specific' origin, reference to other experience being understood; or, lastly, the leper or victim may be alone considered,—this being, one would say, the empirical method, and its object the detection of 'intrinsic' or 'extrinsic' causes of disease. Commonly, indeed, a sort of mixed plan is followed in Medicine; thus, there are said to be 'predisposing' causes (intrinsic or secondary); and exciting causes (extrinsic, but also secondary); and there is the proximate cause—the *sine quâ non*—which being present makes the complaint, and being absent removes it ('specific' cause).

So often and so variously has this topic of the etiology of leprosy been considered, without much benefit resulting, that I shall now treat of it as briefly as possible, and so according to the empirical method. Thus, supposing it to be possible to arrive at a definite acquaintance with the *vera causa* of the disease, I would take the case of India or Norway, and first remark that in the whole country not more than 1, 2, or 3 in 1,000 people are ever affected: then, narrowing the field of observation to foci of the disease, I find that amongst a community of say 500 people, living altogether under similar outward circumstances, not more than 10 are lepers. Still further concentrating inquiry, one arrives at various results; thus, often the lepers are found to belong to one family, or they are neighbours, or they are not even residing in propinquity, and are not connected by blood to other lepers. At this period of the search, inquirers are apt to diverge in opinion; and some prefer coming to a decision upon grounds which may be termed those of the 'greatest probability.' So quite impracticable is it to sift all the conditions which yet remain, even in a small community of the kind now conceived, that I should decline to uphold one opinion over another, since there is apparently no valid ground of preference. Only a very few inhabitants are ever lepers; and this fact excludes the paramount influence of locality, climate, diet, habits, &c., &c.; again, not all members of a family, perhaps not one-half, are affected, whence a doubt as to the prime importance of hereditary influence; and lastly, here is a leper who has not been in association with others like himself, and who has no relative affected, whence is excluded (to all appearance) the idea of contagion. If I next add the connecting remark, that lepers are no ways distinguished from the healthy but by their disease, I shall have brought the question of etiology to an issue.

Now commences ratiocination, and without venturing over the whole area of discussion, I should prefer here to consider only the two casual influences of 'heredity' and 'contagion,' as being, on the whole, the most important. But there is first to remark, that in my opinion leprosy never arises in a spontaneous manner; and this assumption I hold to be quite indispensable to valid research; for, if the disease may arise in more ways than one, bewilderment and confusion are the inevitable consequences. Leprosy is so peculiar and marked a disease,

that it can have but one essential or specific cause; this is a dictum which seems to me self-evident, but it by no means excludes the influence of subsidiary conditions.

Having before considered the subject in hand, I had arrived at the conclusion that, most probably, leprosy is a complaint which is transmitted from parent to offspring; that is to say, something essential to the complaint is so transmitted. Such essential element may as well be called a latent form of the malady itself, as a 'predisposition' to it; but I admit that here is an obstacle of uncertainty which is at present insuperable. I refer, of course, to the separate influences of the two sexes upon the offspring; and what the respective influence of male or female parent may be, under varied conditions, I am wholly at a loss to conjecture. No more need be added, therefore, to show that the rôle of heredity in leprosy is not at present sufficiently understood; but, so far as it is known to me, I now proceed to state. The following extract is taken from a communication made last year to the Medico-Chirurgical Society (*see* the Transactions of the Society, Vol. XLV.), and in notes are added other data.

"*Etiology.*—Of the numerous so-called causes of leprosy the following alone need be noticed here: an inherited predisposition; contagion and inoculation; endemic influences.

"Briefly, and with respect to experience in India, I am of opinion that heredity is the common cause of the complaint.\* This subject has been already referred to, but as more particularly noteworthy should be considered the fact that the hereditary disease is identical with that not known to be derived; and it is from no desire of resorting to the obscurity yet enveloping the subject of heritage in disease, that I am disposed to hold this fact as supreme.

"Respecting contagion or inoculation, the evidence of crucial test is necessarily wanting; hence opinions will vary according to degrees of accuracy in available information, and according to the felt cogency of argument.† In my Report (dated 1872) based upon returns of all known

\* At the time when my data were being collected, I was not aware of the similar opinions to my own which were already prevalent in Norway. The following is an extract from the early work of Danielsen and Boeck (p. 336):—"In 213 individuals attacked with leprosy "now in hospital, the disease was hereditary in 185, "and in only 24, had it spontaneously arisen:" these proportions being about 87 p.c. and 13 p.c. respectively. At a subsequent date, Danielsen found a less proportion of hereditary cases; thus, among 1,468 known lepers in certain districts, 837 acknowledged some form of heredity, the ratios being 100 and 58; and in India, I found much less than 58 p.c. of all lepers had owned to a family taint. The subject is again referred to below, but I may mention here that Danielsen records a per-centage of heredity of 60 in nodular leprosy, of 52 in nerve-leprosy, and of 58 in the mixed form. These are high ratios, which experience elsewhere seldom quite confirms; yet it is to be remembered that in no other country besides Norway, are the statistics regarding lepers collected so carefully and by such competent aids.

† A strong inclination to admit the possibility of leprosy being transmitted, in some way, from the diseased to the healthy, is manifested by many late writers; but hitherto the idea has not gained in clearness. Since my visit to Norway and acquaintance with the late investigations made in Bergen, the possibility in question

has become, for me, tolerably definite: and it would even appear that not only is the contagium 'particulate,' but that it may belong to the class of organisms called by De Bary—"Schizomycetes"—and including the various forms of Bacteria, Micrococcus, &c. In favour of the personal communicability of leprosy are historical records, and the known 'rapid' spread of the disease in recent time: again, the actual decline of the disease in Norway which has now steadily set in, is a fact distinctly in favour of contagion; and perhaps may be added, the peculiarity of leprosy first and chiefly attacking the more exposed parts of the body. Infection from a distance or through coin, clothing, &c.; single, temporary, or prolonged contact with leprosy emanations; vaccination; lactation or nursing—these are several modes of transport respecting which I have had occasion to briefly inquire, and I find recorded a few affirmative examples, at least, of each one method or means. But most examples are stated too briefly to allow of close criticism. Leprosy cannot be communicated to the lower animals: the inoculation of leprosy matter upon lepers themselves always fails—this statement I make on the authority of Boeck; and in a prize essay published in abstract in the *Gaz. Med. d'Orient*, Apr. 1864, p. 7, is this passage "the author "adds some notes of experiment with inoculation "practised upon 16 individuals; after 30 days he "found at the spot of inoculation no trace whatever of "the scarification made for the purpose of inoculating

lepers in the Bombay Presidency, the instances of married couples who are lepers are discussed, and it is shown that no sound inference can be based upon them; it also mentioned that while 66 widows had leper husbands, only 18 widowers had leper wives; but here again the circumstances are such that no inference is sure. The rare cases in which the disease might be traced to possible contagion or inoculation, were too few to allow of a general affirmative statement on this subject.

"With regard to endemic influences, the data from a single sphere of inquiry may be deemed defective; yet I know of no one feature of air, soil, or water which has certainly led to this disease.\* Europeans, both civil and military, inhabiting every part of Western India, often for long periods, are virtually never affected with leprosy. Exceptional instances are, indeed, so rare that, since liability to contagion is usually denied, one might resort to the supposition of latent taint.†

"the pus." Not much value in my opinion, can be attached to any of these statements; or to the numerous others like them which are scattered throughout the Report of the Royal College of Physicians, 1867; the special collection of medical reports published in Calcutta, 1865; the Report on Leprosy and Yaws in the West Indies by Dr. Milroy, 1873, &c.; but as I have intimated in the text, a difference of opinion herein prevails. If a few positive data are deemed to outweigh many of a negative character, it will be possible to establish the transmissibility of leprosy: and if the disease be thus communicable, it must on *a priori* grounds, be of specific character. If this, too, be allowed, then the *role* of heredity in leprosy becomes a secondary, or even an incompatible term; and contagion must take first rank. I may add that the rapid spread of leprosy in Honolulu has been attributed by resident medical men, to contagion, to a conjunction with syphilis, or, by Dr. Hoffman, to vaccination; but no precise data are furnished respecting this last point. In this instance, the influence of heredity is, it would seem, to be ignored altogether. With reference to the freedom of medical attendants, servants, and nurses, &c., who come into contact with lepers, there are a few known instances of their acquiring the disease; and others also of husbands and wives affecting each other. Having carefully perused these records, I must say that there is *prima facie* a probability of their being strictly true; and hence that, *in practice*, one ought to act as if contagion were possible.

When special investigation is commenced in India, attention will have to be directed to many possible sources of contamination; and close comparison with the conditions attending the maintenance and spread of diseases cognate with leprosy will have, as well, to be made. It has seemed to me that an affection so highly specialised as leprosy, is a favourable field for etiological inquiries. Attention should be given to the influence of rivers, roads, fairs, and pilgrimages upon the spread of a disease which, in times past, was undoubtedly conveyed by men from one place to another.

\* When the disposition to disease is not derived by inheritance or contagion, it is said to be acquired or

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produced, and that under the influence of external conditions. What such conditions are commonly reported to be, is perhaps sufficiently well known; but of the validity of their distinction, I own myself to be altogether sceptical. There is, however, one common character which is recognised in both East and West, and that is a certain prevalence or degree of moisture: see Appendix A.; and also this remark of Dr. Brown (Chefoo, N. China). "One cause more than any other" is assigned for the origin of leprosy by the patients "themselves—damp: whether from living near a stream" or stagnant pond, or from sleeping on damp ground "whilst watching their crops by night or from a soaking whilst overheated." Special mention is made of this particular factor, because of its essential connection with the development and growth of such low organisms, as might, upon their introduction within the body, give rise to constitutional symptoms; and I have before intimated the likelihood from the characters of the 'leprous elements,' which are to be found in both skin and viscera, that there is constantly associated with leprosy a wholly extraneous body which seems to be derived from a 'Bacillus.' Such organisms as these microzymes abound everywhere in moist localities, and hence the difficulty would be to account for the rarity and not the frequency of leprosy—a difficulty precisely parallel to that connected with the hypothesis of the sole inherited nature of the disease.

† Many cases of the kind referred to are on record; but that there has been some special influence at work in them, is evident from the fact of their comparative rarity. Of a similar nature, are the very scarce instances of leprosy appearing in subjects who have never left England; and here the special influence seems still more needed for explanation of their occurrence. Liability to contagion and hereditary predisposition are invariably denied; one is therefore left to search amongst ordinary conditions for some plausible elucidation. I have, however, noticed that these last-named cases are of the anæsthetic kind, and sometimes, at least, they have occurred in natives of Ireland where probably leprosy lingered longer than in Britain; whence a possibility of lingering taint. I also observe

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"The correlated prevalence of malaria with leprosy, not to mention closer relationship, has not been established, and the same must be said of local peculiarities in diet, habits, and hygiene.

"Admitting, however, the frequent presence of an innate predisposition to the disease, its development may be favoured by all causes leading to deterioration of health, such as an unhealthy climate, bad or insufficient food, neglected sanitation, social hardships, and the like; whence the numerous agencies to which leprosy has been attributed as effect to a cause.\* The converse also holds good; lepers do seem to improve on change of climate, and it has been assumed that the disappearance of leprosy in Europe may be directly referred to improvement in the diet and general condition of the people; but on taking a wide review, none of the external influences now named can be accepted as true causes in originating, or, conversely, in eradicating the disease.

"Lastly, no evidence is forthcoming that in India, at least, a natural tendency of the disease to subside exists."

Having, in a previous inquiry, had to arrange many data bearing upon the subject of inheritance in leprosy, I here append the results, as recorded in my late Report to the Bombay Government 1871.

#### INHERITANCE IN LEPROSY.

*Introduction.*—That, like personal features, imperfections of structure are transmitted from parent to child is indubitable; and considering how entirely dependent is the offspring for its characters, upon its progenitors, one might conclude that constitutional maladies (of which leprosy is certainly one) would almost invariably exhibit an hereditary character.

The rôle of heredity has been under-estimated; for, unless modified by other influences, it must be supreme; and it is only when any peculiarities of character or constitution are in appearance not derived by inheritance, that an explanation of their origin becomes really difficult.

By other influences are meant climate, diet, mental culture,—none of which have been found to have a tangible effect in the production of leprosy.

that leprosy should if possible be distinguished from that having other character; and I have already mentioned the remarkable observation of Fournier (see the Boston Med. Journ. 1870) that in secondary syphilis, and coincident with skin-eruption, mucous patch, swelling of the glands, or other nervous affections—mostly symptoms having their representatives in lepra—there happens a local paralysis of sensation in the hands and feet, which resembles in a remarkable manner the nerve lesion of leprosy. His patients were women, but to that sex his sphere of observations was seemingly limited. I would now also allude to another curious series of cases, recorded by Leudet in Arch. de Médecine, May 1865: here persons exposed to the vapour of carbon oxides, are found to have acquired a paralysis of the motor, sensory, and vasomotor nerves of the extremities; an eruption like erythema, erysipelas, or herpes may ensue; or even neuritis may follow, and the hand becomes atrophied and flexed just as in leprosy. Lastly, I remark that the minuter changes in such nerves as the median, which result from direct injury to the nerve-trunk, have according to Virchow the closest resemblance to leprosy changes: this eminent writer has not, so far as I know, acknowledged the validity of Hansen's identification of 'characteristic' leprosy structures in the skin, nerves,

&c., and therefore this subject remains for further consideration. Respecting the 'nodular' and other forms of true leprosy, should it be established that the new growth is due to entry into the body of man from without or through the ingesta (the mesenteric glands have been found to contain leprosy structures), of a parasitic organism allied to those whose rôle in disease is daily become better known, it will have to be supposed that like a rare or errant species, such organism had unexpectedly appeared under conditions, when infection of the individual had become possible.

\*This statement is intended to convey an idea of the true relationship of the phenomena concerned. Leprosy is so evidently a peculiar, and in every sense of the word so specific a disease, that in the present state of knowledge, one cannot admit of its production by a host of ordinary influences, whether separate or combined. It is even very uncertain how these influences can really operate; for the disease is by no means rare in individuals and communities, sufficiently well-placed as regards personal needs and surroundings. The examples of newly-affected localities are best suited for inquiry into the etiology of leprosy; and that of Honolulu is decidedly against the needful co-operation of bad food or hygiene, in the spread of the disease. Sanitary improvement may, however, be none the less desirable.

It may, therefore, be assumed that hereditary qualities are essentially ineradicable, unless by mutual antagonism, respecting which not much is known in Medicine; but these deep-seated constitutional characters are susceptible of endless modifications. Thus, by adverse outward influences, or possibly by the conjunction of opposed parental qualities, their development in the offspring may be checked or indefinitely deferred; and on the other hand, by progenital accrescence, or by favouring outward influences they may be forced into visible manifestation; so would be accounted for, the varying prevalence, form, and degree of inheritance in leprosy—it is sometimes absent through suppression, or exhibited indirectly, or strongly marked. There is one form of inheritance worthy of special notice from its frequent occurrence in this disease, namely, *Atavism*, or reversion to the characters of a common ancestor; thus, a grandparent or great-grandparent, alone, may be named by a leper as having been affected; in these cases it is presumed that the leprous tendency or taint (a term embracing also latent disease) was transmitted through individuals themselves unaffected to all appearance, *i.e.* through the parents; or the intermediate links may sometimes be found in the collateral line (and oftenest the uncle); but what are the circumstances leading to this suppressed transmission and final development, can seldom be detected in particular cases.

Without attempting further detail, it may suffice here to remark that the non-inheritance of leprosy, though much more frequently asserted than the converse, is, from the nature of the case, likely to be apparent rather than real; and that this disease commonly arises spontaneously—by which is here meant independently of parental influence;—or that eccentricities in its hereditary features can be satisfactorily explained by the so-called natural tendency to variation, are assumptions fitted to confuse more than to make clear.

Certain incidental causes which may interfere with the proof of heredity are obvious; thus, offspring may be wanting or die at an early age before the latent tendency had been manifested; and yet more noteworthy, the tainted parent may die before the development in his person of disease, but not before the same pre-disposition had been communicated to his child, and so on, these contingencies being possible from the absence in leprosy of any marked tendency to limitation by *age*, such as exists towards limitation by *sex*, which itself may lead to suppressed transmission of taint through the daughter to her children. Again, families may be dispersed while young, and so trustworthy information (at all times requiring skill and patience to elicit) be lost; there is, besides, a natural objection to acknowledge the presence of a loathsome family taint; and, finally, lepers themselves may be almost physically incompetent to correctly state the existence or absence of such predisposition.

Sufficient information, however, having been collected from all parts of the Bombay Presidency to permit a fuller account of the hereditary features of leprosy than has yet appeared, a complete list is subjoined of the relationships named by lepers of all ages and castes.

## LEPER INHERITANCE.

| Relatives.                                       | Male. | Female. | Total Instances. | M. to F.  |
|--|-------|---------|------------------|-----------|
| <i>Direct Line.</i>                              |       |         |                  |           |
| Father only - - - - -                            | 430   | 107     | 537              | 4 : 1     |
| Father and grandfather - - - - -                 | 8     | 1       | 9                |           |
| Father, grandfather, and uncle - - - - -         | 1     | —       | 1                |           |
| Father, grandfather, uncle and brother - - - - - | 2     | —       | 2                | 11 : 1    |
|  | 11    | 1       | 12               |           |
| Father and grandmother - - - - -                 | 2     | —       | 2                |           |
| Father, grandmother, and uncle - - - - -         | 1     | —       | 1                |           |
|  | 3     | —       | 3                |           |
| Father and direct line - - - - -                 | 444   | 108     | 552              | 4 : 1 : 1 |
| Father and uncle - - - - -                       | 25    | 6       | 31               | 4 : 1 : 1 |
| Father, uncle, and brother - - - - -             | 2     | —       | 2                |           |
| Father, uncle, brother, and sister - - - - -     | 5     | 5       | 5                |           |
|  | 32    | 11      | 38               |           |

| Relatives.  | Male. | Female. | Total Instances. | M. to F. |
|---|-------|---------|------------------|----------|
| <i>Direct Line—continued.</i>                             |       |         |                  |          |
| Father, uncle, and aunt - - - - -                         | 2     | —       | 2                |          |
| Father and aunt - - - - -                                 | 2     | —       | 2                |          |
| Father, aunt, brother, and sister - - - - -               | 1     | 1       | 1                |          |
| Father and cousin - - - - -                               | 1     | —       | 1                |          |
| Father and collateral line - - - - -                      | 38    | 12      | 44               | 3:1:1    |
| Father and brother - - - - -                              | 60    | —       | 60               |          |
| Father and sister - - - - -                               | —     | 5       | 5                |          |
| Father, brother, and sister - - - - -                     | 19    | 19      | 19               |          |
| Father and co-equals - - - - -                            | 79    | 24      | 84               | 3:3:1    |
| Father and wife - - - - -                                 | 2     | —       | 2                |          |
| Father and husband - - - - -                              | —     | 2       | 2                |          |
|   | 2     | 2       | 4                |          |
| Total father and others - - - - -                         | 563   | 136     | 684              | 4:1:1    |
| Mother only - - - - -                                     | 115   | 42      | 157              | 2:7:1    |
| Mother and grandfather - - - - -                          | 3     | —       | 3                |          |
| Mother, grandfather, uncle, brother, and sister - - - - - | 1     | 1       | 1                |          |
| Mother, grandmother, brother, and sister - - - - -        | 1     | 1       | 1                |          |
| Mother and direct line - - - - -                          | 120   | 44      | 162              | 2:7:1    |
| Mother and uncle - - - - -                                | 1     | 1       | 2                |          |
| Mother, uncle, brother, and sister - - - - -              | 2     | 2       | 2                |          |
| Mother and aunt - - - - -                                 | —     | 1       | 1                |          |
| Mother and collateral line - - - - -                      | 3     | 4       | 5                | 7:5:1    |
| Mother and brother - - - - -                              | 8     | —       | 8                |          |
| Mother, brother, and step-brother - - - - -               | 1     | —       | 1                |          |
| Mother and sister - - - - -                               | —     | 6       | 6                |          |
| Mother, brother, and sister - - - - -                     | 16    | 16      | 16               |          |
|   | 25    | 22      | 31               | 1:1:1    |
| Total mother and others - - - - -                         | 148   | 70      | 197              | 2:1:1    |
| Parents only - - - - -                                    | 37    | 12      | 49               | 3:1:1    |
| Parents and grandmother - - - - -                         | 1     | 2       | 3                | 5:1      |
| Parents and uncle - - - - -                               | 5     | —       | 5                |          |
| Parents and brother - - - - -                             | 5     | —       | 5                |          |
| Parents, brother, and sister - - - - -                    | 8     | 8       | 8                |          |
|   | 13    | 8       | 13               | 1:6:1    |
| Total parents and others - - - - -                        | 56    | 22      | 70               | 2:5:1    |
| Grandfather only - - - - -                                | 30    | 3       | 33               | 10:1     |
| Grandfather and uncle - - - - -                           | 6     | 1       | 7                |          |
| Grandfather, aunt, brother, and sister - - - - -          | 1     | 1       | 1                |          |
| Grandfather and cousins - - - - -                         | —     | 1       | 1                |          |
| Grandfather and collaterals - - - - -                     | 7     | 3       | 9                | 2:3:1    |
| Grandfather and brother - - - - -                         | 3     | —       | 3                |          |
| Total grandfather and others - - - - -                    | 40    | 6       | 45               | 7:1      |
| Grandmother only - - - - -                                | 1     | 1       | 2                |          |
| Grandparents only - - - - -                               | —     | 1       | 1                |          |
| Grandparent, uncle, brother, and sister - - - - -         | 1     | 1       | 1                |          |
| Total grandparents and others - - - - -                   | 42    | 9       | 49               | 4:6:1    |

| Relatives.   | Male. | Female. | Total Instances. | M. to F. |
|--|-------|---------|------------------|----------|
| <i>Direct Line—continued.</i>                              |       |         |                  |          |
| Great grandfather - - - - -                                | 3     | —       | 3                |          |
| Great grandfather and uncles - - - - -                     | 1     | 1       | 1                |          |
|  | 4     | 1       | 4                | 4 : 1    |
| Total ante-parents - - - - -                               | 46    | 10      | 53               | 4·7 : 1  |
| <i>Collateral Line.</i>                                    |       |         |                  |          |
| Uncle only - - - - -                                       | 133   | 21      | 154              | 6·3 : 1  |
| Uncle and cousin - - - - -                                 | 1     | —       | 1                |          |
| Uncle and brother - - - - -                                | 11    | —       | 11               |          |
| Uncle and brother and sister - - - - -                     | 7     | 7       | 7                |          |
|  | 18    | 7       | 18               | 2·6 : 1  |
| Total uncle and others - - - - -                           | 152   | 28      | 173              | 5·4 : 1  |
| Uncle and aunt - - - - -                                   | 5     | —       | 5                |          |
| Uncle, aunt, and brother - - - - -                         | 1     | —       | 1                |          |
|  | 6     | —       | 6                |          |
| Aunt only - - - - -  | 10    | 6       | 16               | 1·6 : 1  |
| Aunt, brother, and sister - - - - -                        | 2     | 2       | 2                |          |
| Total aunt and others - - - - -                            | 12    | 8       | 18               | 1·5 : 1  |
| Great uncle and aunt, uncle, brother, and sister - - - - - | 1     | 1       | 1                |          |
| Great aunt, uncle, and aunt - - - - -                      | 1     | —       | 1                |          |
|  | 2     | 1       | 2                |          |
| Cousins - - - - -  | 22    | 2       | 24               | 11 : 1   |
| Total collateral line - - - - -                            | 194   | 39      | 226              | 5 : 1    |
| <i>Co-equal Line.</i>                                      |       |         |                  |          |
| Brother only - - - - -                                     | 241   | —       | 241              |          |
| Brother and wife - - - - -                                 | 2     | —       | 2                |          |
| Sister only - - - - -                                      | —     | 7       | 7                |          |
| Brother and sisters - - - - -                              | 84    | 84      | 84               |          |
| Total - - - - -  | 327   | 91      | 334              | 3·6 : 1  |
| Indefinite - - - - -                                       | —     | —       | 8                |          |
| <i>Relatives-at-Law, &amp;c.</i>                           |       |         |                  |          |
| Father-in-law - - - - -                                    | 3     | 8       | 11               |          |
| Mother-in-law - - - - -                                    | —     | 5       | 5                |          |
| Parent-in-law - - - - -                                    | 1     | 1       | 2                |          |
| Grandfather-in-law - - - - -                               | —     | 1       | 1                |          |
| Brother-in-law - - - - -                                   | 1     | —       | 1                |          |
| Brother and sister-in-law - - - - -                        | 25    | 25      | 25               |          |
| Others - - - - -   | —     | 1       | 1                |          |
| Total - - - - -  | 30    | 41      | 46               | ·73 : 1  |
| Step-daughter - - - - -                                    | 1     | 1       | 2                |          |
| Step-brother - - - - -                                     | 1     | —       | 1                |          |
|  | 2     | 1       | 3                |          |
| Husband - - - - -  | —     | 61      | 61               |          |
| Husband and his father - - - - -                           | —     | 1       | 1                |          |
| Husband and his brother - - - - -                          | —     | 2       | 2                |          |
| Husband and his relatives - - - - -                        | —     | 2       | 2                |          |
|  | —     | 66      | 66               |          |
| Husband's former wife - - - - -                            | —     | 1       | 1                | W. : H.  |
| Wife - - - - -   | 18    | —       | 18               | ·27 : 1  |

*Summary.\**—Number and proportions of blood-relations likewise affected, who were mentioned by 1,564 individual lepers (total of column 4) as detailed above :—

| <i>Direct Line.</i>     |       | Number.      | Per cent.    |
|-------------------------|-------|--------------|--------------|
| Father and others       | - - - | 684          | 43·8         |
| Mother and others       | - - - | 197          | 12·6         |
| Parents and others      | - - - | 70           | 4·4          |
| Grandparents, &c.       | - - - | 53           | 3·4          |
| Total                   | - - - | <u>1,004</u> | <u>64·2</u>  |
| <i>Collateral Line.</i> |       |              |              |
| Uncles, aunts, &c.      | - - - | 226          | 14·5         |
| <i>Co-equal Line.</i>   |       |              |              |
| Brothers and sisters    | - - - | 334          | 21·3         |
| Total                   | - - - | <u>1,564</u> | <u>100·0</u> |

N.B.—Columns 2 and 3 show all the relationships stated, while column 4 shows the number of instances in which such statements were made, and is not, therefore, the sum of 2 and 3. The actual number of relations affected, e.g., of brothers and sisters, uncles, &c., could not obviously be indicated in this list.

*Heritage in the Direct Line.*—This occurs in 64 per cent. of all instances when a taint is named, and oftenest by far through the *Father* alone (about 30 per cent.), or in combination with brother or sister: sons are affected four times as often as daughters, and though always perhaps slightly the more numerous in a family, yet the normal disproportion does not approach this high ratio: it may therefore be inferred that leprosy tends to pass chiefly on the male side—a feature in entire accordance with the fact elicited in Section II., that it prevails generally much oftener in males than in females. Uncles are frequently named in combination with father (whose brother they commonly are), and occasionally the grandfather (paternal commonly); but much less often the corresponding female relatives.

*Mother.*—Several lepers immediately derive the disease from the *mother* alone (about 10 per cent. of all instances under review), and thence too it passes oftenest to sons, but there is a tendency towards a more equable affection of the offspring, which clearly shows the influence of sex—abnormalities inclining to pass on to the sex first displaying them—an influence still more

\* There are several points of divergence between the Indian and Norwegian investigations. Thus, Danielsen and Boeck observe that here "heredity is more frequent on the maternal than on the paternal side (i.e., as 40 to 29); and that it is more common in the collateral than in direct line (232 to 148)." Perhaps one would connect the first statement with the larger number of women who are lepers in Norway, than in India, where the paternal line is so much the oftenest named. The manner in which the statistics of the two countries are arranged, hardly allows of full comparison as to the line of transmission of the leprosy taint; but in my tables, the direct line was much the oftenest followed. The authors just named continue—"It is noteworthy how hereditary influence is continued from generation to generation. The disease not only skips some, but it also reappears with greater force in the second and fourth generation than in the first and third; and if it have spared the first, it generally appears in all the individuals of the second, who

"transmit its germs to succeeding generations . . . it may avoid the second and third, and only appear in the fourth succeeding generation, thence to spread, as would seem, with renewed energy." "No outward conditions seem to favour this erratic course, for we have seen the children of lepers living in the most unfavourable circumstances, who yet were free from all disease; and, on the other hand, we have seen their children affected, or others, who were placed in good circumstances, and some of whom had even removed from their homes to another district."

Experience of this kind is also to be obtained in India; but there are immense difficulties in the way of the still closer investigation, which is needed to clear up all difficulties.

No reference has been made to the theory of 'pan-genesis,' as applicable (for so it seems to be), to the instance under notice: because the available facts must be sifted, till none remains but those perfectly free from error, and this appreciation of data has yet to be made.

marked when several children are affected, for then nearly as many daughters as sons become lepers, or about the normal proportion. Thus were the mother's influence the sole originating cause, it may be supposed that it would operate equally on children of either sex, in families at all considerable. The association of mother with other relatives is not sufficiently common to warrant general inference.

While it is evidently a main character of leprosy to affect the male sex and to be transmitted in that line, it should be remembered that each progenitor combines in person numerous, perhaps numberless, hereditary qualities; and that the implication of the offspring depends upon conditions imported by the other parent, as well as on influences acting from without, in hastening or retarding the development of an inherited predisposition.

*Parents.*—As conjoint lepers, both *parents* are not named oftener than 1 in 22 of all instances: when so mentioned the proportion of leper children is large, a fact indicating both the intensity of taint, and the slight effect on fecundity of leprosy. With regard to the sex of the offspring, sons still predominate in a ratio between 4 and 2·7 to 1, or intermediately to the separate influence of father and mother, as might be anticipated: yet here again in large families there is a tendency to a more equable affection of sons and daughters.

*Grandparents.*—Grandparents are far seldomer named than the parents, one or both; and great-grandparents very rarely indeed: probably omissions are partly due to ignorance. The *grandfather* alone, or associated with uncle (the combination with fathers has been noticed), is oftenest entered in the Returns: he is commonly the father's father. Other entries under this head may be seen in the list, but they are too few to permit of comment; the whole series forms an illustration of that reversion to a past type (termed Atavism), which is so well known as to have given rise to the popular idea, that until the third generation has passed away, one cannot be sure of a constitutional complaint not being hereditary, or if so, that it has become extinct: but in fact the limit is a much wider one. A very noteworthy feature in leprosy seems to be that reversion is witnessed much the most frequently in males: and it will be again referred to.

*Heritage collaterally shown.*—This occurrence is singularly frequent in leprosy, and cannot be attributed to coincidence alone: hence as the causative influence of external agents is, at best, most vague, there remains only that of Heritage to account for this phenomenon, or at least of some force emanating from procreation. It is by no means irrelevant, however, to surmise that to a form of Atavism, or reversion, some of the present instances should be relegated. The brother or sister of either parent being not seldom affected at the same time, uncles or aunts are freely named in the list with parents; but the present remarks apply to those instances when they are alone mentioned or with co-equals: thus, including cousins, these collateral connections amount to 14·5 per cent. of all stated relationships.

The *Uncle* as a leper largely predominates, and alone, is named by men six times as often as by women, a circumstance which tends to support the atavic view of this form of heritage; he is commonly the father's brother (4 to 1), and when the maternal uncle is named, it is oftenest by women. The *Aunt* is seldom mentioned, and then nearly equally as often by nephew as by niece: it cannot be determined from the vernacular terms employed in the leper Returns, if 'aunt' means sister of father or a mother, or father's brother's wife; but the same tendency of leprosy taint when on the female side to pass to the corresponding sex as was observed among mothers, is again evinced.

The combination of uncle and aunt with other relatives is very frequent.

*Cousins* alone are not uncommonly named as co-lepers. Here the two groups stand connected only by a common ancestor one generation removed; this bond of itself is no evidence of a common taint, yet the assumption that through such ancestor the leprosy taint may have descended, is even less forced than in the cases above considered, and it offers the most consistent explanation of the subject yet available. As appears to obtain in the more latent forms of descent, characteristic tendencies become prominent, thus the tendency to affect the male sex is as marked when cousins alone are affected, as when the purest form of atavism prevails, there being 11 instances among males to 1 among females—a fact quite noteworthy.

*Brothers and Sisters* (co-equal line).—The concurrence of leprosy in one family alone might not unreasonably be regarded as evidence of a taint hitherto dormant in either parent, but by a combination of favouring influences at length aroused to manifestation in the offspring:

commonly, however, it is to be supposed that the disease had appeared *de novo* in the family amongst two or more members. These instances are the predecessors of many collateral relationships exhibited in the following generation, as of parents and uncle or aunt, as well as of the not uncommon cases where more than one uncle was a leper. From isolated examples it is known that several members of one family may escape while others suffer, whence it is not to be inferred that *parental* influence (should that of descent or inheritance, strictly so-called, be set aside) had no part in the selection; on the contrary it is to such influence directed by agencies operating after conception, that these instances are with least hesitation to be referred.

*Brothers* alone—two, three, or four—are by much the oftenest found: in 241 instances no sister is named with them, although it cannot be doubted that often there were sisters in the same family. *Sisters* alone are so rarely mentioned (there may be more than two) that it is possible they constituted the whole family. Both sexes were combined in 84 instances, and the entire series form upwards of 20 per cent. of named relationships: the males were as 3·6 to 1, a ratio clearly indicating their greater proclivity, yet less than obtains in the bulk of lepers.

It was before observed that in families inferred to be of considerable size from several children being affected, daughters as lepers were generally found as well as sons; and this remark here applies, for although a parent is not visibly implicated, yet it is conceivable that a latent predisposition existed in one or other parent, and it seems not unlikely that when the father is, as usual, the affected progenitor, the mother may become tainted through her early offspring, or through the same channel a latent predisposition in herself be roused to activity, the result in either case being that daughters subsequently born become lepers as well as sons; and this view, it may be added, holding as it were an intermediate position between that advocating the influence of a concealed hereditary taint, and that attributing the origin of isolated disease to amalgamation in the offspring of contrary temperaments, latent predispositions and other inherited qualities of the two parents, is perhaps especially applicable to the conditions found in India, where unquestionably the taint of leprosy, in many degrees, is most widely diffused amongst the people.

*Husbands and Wives, &c.*—Women having leper husbands are much oftener entered in the Returns than men having leper wives (66 to 18): both classes belong, of course, to the same category; and the reason why so many 'wives' (who were generally of age beyond the mean) are entered may be that their husbands were either dead, or had separated themselves from their wives. No inference respecting the contagious properties of leprosy, can be supported from the fact of some married couples being lepers, for, as previously shown, 75 per cent. of all female lepers are married, and hence there would be about 1,100 affected wives, of whom about 8½ at the most (some 'husbands' had lost their wives) were simultaneously diseased with their partners, a proportion so small as to be fairly explicable on the supposition that a previous taint existed on both sides; especially as these and the similar instances of affected *law relatives* are noted oftenest in a district where the leprous taint is most widely diffused and in a caste particularly liable to the disease (Kunbis in Rutnagherry): the rather considerable number of law-connections (46) is itself evidence of the intermarriage of tainted families, and that chiefly, be it observed, on the part of women, who to avoid the stigma of celibacy it may be, became associated with other tainted individuals, or those whose relatives were known to be affected.

The very rare occurrence of 'step' relatives is readily explained.

In this short summary of the recorded relationships of lepers, reference has not been made to the more complicated instances, some of which are striking examples of the range and intensity of natural heritage in disease: all however, have been indicated in the above list, or, sometimes with more detail, in the descriptions of the several districts: and an attempt to discuss this vital subject in a more technical manner seems not to be called for in the present Report.\*

\* A noteworthy class of cases is referred to by several observers in different parts of the world (see the College Report, pp. 4, 20, 31, &c.): here the father is a leper and the children become affected, but the mother remains well. I do not recollect any instance where the *mother* and children were alone diseased; and I

cannot but mention, in connexion with the cases first referred to, the great frequency with which the testes and its secretion are found (in Norway, at least) to be charged with leprous structures. I have already said that these organs may be quite healthy in appearance, and yet contain such characteristic structural elements,

In conclusion, it is found that separate instances of hereditary or family taint occur as often as 1 in 5·7 of all entries; amongst men the ratio is 1 in 5·8, and amongst women 1 in 4·6, there being clearly a more marked predisposition among the latter, in proportion to their numbers, than among the former.

Of all lepers, men are to women as 4·38 to 1; of the tainted only, the ratio is 3·64, to 1; so that the effect of hereditary influence is to mitigate, in however small degree, the overwhelming tendency which leprosy exhibits to affect the male portion of the community.

When a leprosy taint is wholly denied, that is, when the disease appears to rise spontaneously—and this happens, as just stated, less frequently among women than among men—the ratio of the sexes is as 4·73 to 1, which is somewhat greater than obtains amongst all lepers, and especially amongst the tainted only; in fact this high proportion of males approaches nearest to that observed among lepers who have derived their taint through reversion, more particularly in the collateral line, and it may be suggested that many, at least, of these instances of so-called spontaneous disease are really examples of reversion to the characters of a remote ancestor. Discussion of the grounds upon which this suggestion is based, would not be appropriate to the present occasion, but it may be remarked that the spontaneous form of leprosy resembles the transmitted form not only in all general characters, but in its preference for one sex, while external influences, such as climate, diet, &c., operate equally on the whole population; and this similarity is presumptive evidence that the two forms are specially identical. If such conclusion be entertained, there almost necessarily follows the supposition of a similar originating cause; and as in the one form this cause is indubitably an hereditary or parental influence, so in the other the same occult influence may have originated the disease: indeed, these remarks will have been offered in vain if it do not hence appear that the force of inheritance is of many degrees, some of necessity being so obscurely indicated as to be liable to non-detection under ordinary circumstances, and hence spontaneity of origin asserted when in reality an innate predisposition—or what is nearly the same thing, lurking disease—was the effective cause of the subsequent visible manifestation.

The chief value of the facts above recorded lies, however, in their illustration of the direction and the force assumed by the leprosy taint, when observed on a large scale. No precise definition of what constitutes an hereditary disease is current in Medicine, but it is improbable that leprosy should be excluded, though only about 20 per cent. of lepers have acknowledged a taint; in fact, it may be advanced that every leper is likely to transmit his malady.

As regards the large majority of instances where the disease seems to have spontaneously arisen, no clear light as to their origin, comparable to that afforded by the principles of inheritance and of parental influence, is yet available.

and one late instance is the following;—in a young leper who died at Bergen in 1872, “the vesiculae seminales contained a thick, yellowish matter, like jelly, in which were no traces of spermatozoa, but, on the other hand, no inconsiderable number of large and small brown particles, of varying depth of tint, and several with one or more uncoloured vacuoles. On compressing the vas deferens, there issued a fluid which contained only cylindrical epithelium. The testes were of normal size and consistence; but on microscopic examination there were found abundant brown

“bodies (leprosy formations) of all dimensions; the epithelium of the seminiferous tubes was loaded with fat. The external lymphatic glands were leprosy.” *Quoted from Danielssen.* Whether any similar appearances are to be seen in the female organs of generation, I do not know. Lepers are not necessarily sterile, and there are numerous instances of the males begetting even large families. Whether under these circumstances, the semen has a special property or not, may be worth some consideration, especially with reference to the above genealogical tables of Indian experience.

## SECTION IV.

## PROGNOSIS AND TREATMENT OF LEPROSY.

## CHAPTER I.—THE PROGNOSIS OF THE DISEASE.

UNDER all circumstances, that is to say, in every form and at any stage of his complaint, the future of the leper is to be regarded as full of forebodings; but when the nodular type prevails in its full development, the prospects of recovery may be said to be reduced to the minimum.

Even at the earliest stage which admits of sure diagnosis, and when, for example, there exists but a few patches of eruption upon the skin, there is ground for great apprehension; because, so far as I know, further progress of the disease is inevitable, and instances of the so-called spontaneous cure of leprosy never occur during this period of the disease. It is, indeed, stated that at such time medical treatment may be very effective; but I am not aware that any considerable amount of clear evidence to this effect, has as yet been put upon record. So well-known indeed has always been the general course of leprosy, that the closest scrutiny of mere incipient spots was everywhere practised, in the conviction that already the doom of the patient was being determined by such examination; and experience has constantly shown that the worst forms of disease may follow after seemingly innocuous signs. It is one great defect of present knowledge that we cannot, that I am aware of, be at all certain whether the severer or milder phases of the disease shall follow mere patches on the skin, or even numbness of the fingers or toes; and since the question of prognosis is chiefly concerned with the varying course of the malady, this is a point which should claim the earnest attention of observers in future. Marks of the advent of true 'nodular' leprosy would, of themselves, be sufficient to indicate that almost certainly the gravest symptoms will follow.

Having above discussed the course and terminations of leprosy, it will not be necessary to again refer, at any length, to these topics; but I may repeat that the disease shortens life most commonly by inducing the advent of other more acute affections, which hasten if they do not cause death. Signs of the occurrence of such intercurrent maladies, would necessarily add to the gravity of prognosis; thus, scrofula and albuminuria—and perhaps even syphilis\*—as adjuncts to leprosy, must be of unfavourable import. Of the liability of the individual leper to any one of these intercurrent complaints, nothing certain that I am aware of, can be laid down; but,

\* I have added this parenthesis on the strength of the increased predisposition, or exacerbation of leprosy, which syphilis has of late been said to induce—having the instance of Honolulu more immediately in mind;

and on general grounds, the statement is defensible, without its leading to the presumption of a real affinity between two diseases which are well enough known to be quite distinct.

unquestionably, a careful examination of every patient is desirable, because some indications of value in prognosis would probably be thus elicited.

Special allusion may be made, in this place, to the 'febrile exacerbations' so common in leprosy, and which seem to indicate renewed absorption of leprosy matter, followed by fresh deposition in the skin or nerves. Although these events do not immediately lead to a fatal termination, yet they often undoubtedly predispose thereto by their immediate influence upon the frame;\* and they indicate, as I have before shown, a deeper implication of the whole system by the disease. Frequent febrile attacks of this character, are usually of ominous import.

But leprosy is said of itself to cause death. This it never does like cancer or even scrofula, because the amount of leprosy growth in the vital organs of the body is comparatively small, and not sufficient (as it seems to me) to greatly impede the functions of the viscera, which is its seat: thus, there are no large tumours or nodules to be seen in the leprosy spleen or liver, nor formations of such size as could compare with the 'tubercles' in the skin. This is a noteworthy circumstance. Here, then, the analogy of the disease passes over towards syphilis; and like this malady, leprosy is in its advanced stages attended with extensive lardaceous or amyloid degeneration of several internal organs, and so, it would seem, finally entails decease. As it does not appear that leprosy is more prone to this complication, than other complaints attended with prolonged ulcerations and suppuration of bone, &c.; and since diagnosis of amyloid degeneration is not practicable during life, no aid to prognosis is derived from a knowledge of the complication in question, beyond the inference that medical treatment is little likely to be of benefit in old subjects of leprosy.

Respecting the prospect of spontaneous cure of the disease, I have before said that this event means the subsidence of the worst signs of the malady. Such events are extremely rare; and how to ascertain their likelihood in individual cases, is only possible upon the most general considerations.†

The prognosis of leprosy, then, being unfavourable upon any hypothesis as to the nature of the disease,‡ is best understood upon that of the chronic-infection theory; and on such view may be thus stated:—When the amount of leprosy matter in the skin and nerves, is originally small, and remains in a quiescent state, the prognosis is favourable. If instead of decay and gradual

\* The great, and it would seem almost special, wearing and exhaustion of the frame which attends these short febrile attacks, are particularly apparent in European forms of leprosy. Besides the consumption of tissue needed to maintain the persistent high temperatures, there is said to be waste leading to the excessive production of urea; and some well-detailed cases of the kind are to be found in Bergmann's pamphlet—a patient in one instance having lost upwards of 14 lbs. weight in the course of a few weeks, after two or three febrile attacks. Yet recovery of strength is generally pretty rapid.

† Having before mentioned some instances of the survival of old lepers, taken from Norwegian sources, I may here refer to similar experience in the West Indies. Dr. Fidde (Rep. R. Coll. of Phys. p. 14) observes:—“In tubercular leprosy, the morbid action is very seldom removed, but implicates the organism more and more; and in an advanced stage the case is all but hopeless. But in anæsthetic leprosy, not unfrequently the disease expends itself when the patient

“may live through the ordinary term of life, showing no trace of the disease except the mutilation of the extremities and the leprosy expression of the countenance.” The case of a negress who had attained the age of 80 and was still in good health, is also mentioned. It is added, “I have seen in some cases of recovery that there was not only a reduction of the nerves (the nervous trunks of the affected extremity) to their natural size, but also a restoration of sensibility in the mutilated extremity.”

‡ The older Norwegian authors remark that “the more the disease is developed, the more unfavourable is the prognosis.” They had before said that the sanguine views of former observers were probably based upon incorrect diagnosis. The hereditary form of the malady has been said to be the most inveterate: I do not know that this is a valid distinction to be made. That form of leprosy which begins with fever, has been said to be more easily cured than the chronic form; and the remark has, in rare instances, some significance. (*Traité de la Spél.*, p. 106.)

absorption of this material, there arises, from any outward or other cause, activity of its growth followed by quick absorption, then the system inevitably becomes affected, and, more than at first, the patient becomes liable to a repetition of such general movement of the neoplasm in his frame, with the almost inevitable results of more disease and greater weakness,—if not the springing up of other maladies which may still further render impossible the continuance of life. The conditions under which these changes and multiplication of the new growth occur, are not yet sufficiently known; but I should look for them in both local state of cutaneous circulation, &c., and in more general disturbances of the system, especially such as are prejudicial to health.

Nodular leprosy is the worst form, probably on account of the larger amount of infecting material which it indicates to be present, and because of the evident predisposition to infection which is also made manifest by it. Yet the converse is not invariable, for active leprosis may commence by very small outward manifestations; and in no case whatever, whether early or late, can it be positively asserted that the deep-seated viscera are free from the presence of a material, which may serve as starting-point for a diffusion through the whole system. On the whole, the prognosis of leprosy may be compared with that of scrofula, as modified by certain characters pertaining rather to the syphilitic infection.

## SECTION IV.

## CHAPTER II.—THE TREATMENT OF LEPROSY.

THE information which I have collected respecting this important subject may be arranged under the following heads:—

1. *Prevention* of leprosy by means of segregation of the affected individuals.
2. *Mitigation* of the disease by improvement of hygienic conditions, and by the use of suitable drugs and outward applications.
3. *Cure* of leprosy by specific remedies—an object yet to be attained.

It will be convenient to first consider the means referred to in the second and third of the above sections; and I therefore proceed to discuss the GENERAL TREATMENT of leprosy.

This disease being properly regarded as an affection whose early seat, at least, is in the skin, it becomes evident that attention is particularly needed to the state of the integument. Whence the great importance that has, in all ages, been paid to the use of baths. Of medicated baths I shall presently treat, and it may suffice to insist in this place upon the almost supreme importance of personal cleanliness, the removal of hurtful contacts, and protection from exposure to extreme variations and degrees of temperature and moisture.\*

The importance of good and sufficient diet is manifest.†

\* The influence of 'climate' upon the leprosy disease requires to be further elucidated. In a leprosy country, as India, China, or Norway, &c., removal from one part to another is not known to cure the disease, when once this is established; but it may seemingly lead to its prevention. I am acquainted with authentic facts telling against any single set of opinions; and, on the whole, do not consider that climatic influence is curative, or generally preventive. It may even be adverse. Thus, it has often been remarked that lepers from the tropics become worse, instead of better, in a climate like that of England. Norwegian leprosy is even more severe than the tropical disease. These facts do not militate against the view that incipient leprosy is best treated by a bracing climate; but, in my opinion, confirmed lepers should shun the cold. Dry and pure air, of moderate temperature, is to be recommended. Members of a leprosy family should remove from their native soil, if convenient; but emigration to a distance does not (as emigrants from Norway to America have shown), necessarily eradicate the taint. See also p. 109, text and note. Contrary to what has been observed in phthisis, leprosy seems to lose its virulence in towns; at least in Norway, instances of the seeming eradication of taint on removal from the country to a town in the same locality, were mentioned to me—Bergen being the example quoted. I have before mentioned how 'chills,' 'wettings,' and 'exposure' to inclement weather, probably act in rousing the leprosy growth, and hence the frequency with which such influences are named as 'causes' of the disease.

† As may well be supposed, the recommendations

of a particular diet for lepers are innumerable. In Norway, fish enters largely into the ordinary diet of inmates of the asylums (see my late Report on Leprosy and Leper-Asylums in Norway, &c., p. 46), and Danielssen has therefore tried the 'cure by meat' (kjödkur), and I quote below a 'case' from the Bergen experience. Too much salt, or too little; the excessive use of oily food, and not to do more than mention the vagaries of national diets—these have all had much importance attributed to them as true causal influences. I believe it would be possible to set off one peculiarity against another, so that the result would be purely negative, except in showing that the rôle of diet in leprosy is of the secondary order; but as far as information yet exists, it would be more ingenious than useful to search here for special causes. Leprosy is too wide-spread a disease to be allied to one form of food or one kind of climate, or to a single race of men, &c.; and I can now only repeat this brief statement.

*Meat-cure.*—One form of the plan of treating leprosy by means of fresh meat, either solid or in form of soup, was tried in three well-marked cases of nodular leprosy; the results were not apparently encouraging.

*Case.*—*Anne Marie Iversdatter*, married, 28 years old, entered hospital April 16th, 1866. Present state as follows: bodily frame slender; hair abundant; eyebrows scanty; everywhere on the face, ears, and upper part of neck are numerous small nodules, the size of a hemp-seed or pea, and partly projecting above the level of the skin, or wholly imbedded within the latter. On the forehead they are more flattened and confluent, thus giving rise to a uniform infiltration; on the arms there

The surroundings of the leper are to be regarded: thus, the air he breathes should be abundant and pure, and free from special contamination, such as malaria and other hurtful emanations. The water drunk should be free from organic and inorganic impurities. The soil should be clean and dry.

Besides, there are considerations belonging to mental discipline, rectification of injurious habits and the enforcement of self-control—for all these points have, at times, had much importance attributed to them in the treatment of leprosy.\*

Concerning these several topics, the extent to which the condition of the leper is to be improved, must obviously be a question for settlement in the individual localities where disease abounds; but if it be supposed that leprosy is essentially dependent upon defective personal or general hygiene, and is to be eradicated by means of the improvements now indicated, I must demur to the assumption upon the ground that it is not in accordance with our increased acquaintance with the leprosy complaint, and that no one has ever traced the extinction of the disease directly to the adoption of such general measures alone.

So numerous, indeed, are the conditions implied in these comprehensive rules of practice that it has hitherto been practically impossible to connect leprosy with one sole condition; but many attempts have been made to associate the pest with a natural group of like influences such as the dietetic, climatic, geodic, &c.

The response to these suggestions is the same as before—if leprosy be everywhere a definite, and specific disease, its causation must be the same under all circumstances; but a wide review of its distribution over the globe, tends immediately to subvert every one of the hypotheses just indicated.

What common state or material may underlie such of these more limited generalisations as seem most plausible, has yet to be precisely determined; but I submit that it no longer suffices to use indefinite terms only, when discussing the object of rational treatment by even the broad means in question. Precision of aim and agent, is essential to success.

The result of a very brief inquiry into the subject of the cure of leprosy by MEDICINAL DRUGS, is to show, first, that no agency at all promising of good effect has been neglected; and next, that some of the most unlikely means have been recommended. But amongst the whole number of asserted remedies, there are few which have retained, for even a short while, the

are found reddish, little elevated spots the size of a pea, beneath which may be felt nodules of the same dimensions; and on each side of the spine from scapula downwards, the colour of the skin is deep-brown, with a few lighter patches on each shoulder. Both lower limbs have livid spots on them, and the legs present a marbled appearance; the skin over the shin-bones and legs, thickened and rather glistening; a sore and scab on the left shin. Inguinal and cervical glands on the left side swollen; and on the right side the coats of the jugular vein feel a little thickened. Sensation everywhere good; no muscular atrophy at present, although the ulnar nerves, and especially the right one, are somewhat thickened. She has been married for three years; has always, except as to head-aches, been well, and never suffered from any serious malady; has no leprosy relatives; has no children. The disease was noticed half a year before, in the form of nodules on the face. Menses always regular.

May 14th she began the meat-cure,—in the morning, half a pint of milk, with wheaten bread, but no butter; at mid-day 1½ pints of meat soup, with onions, but without barley, and prepared from 12 ozs. meat, which every second day is browned with a little butter; in the afternoon, a quarter of a pint of red wine tempered

with water and wheaten bread. June 3rd, the portion of wine was increased to half a pint daily. August 24th, the meat used was increased to 18 ozs. September 28th: condition unchanged; iodide of potassium ʒj. daily in the soup. October 12th: nodules on the face larger, somewhat redder, and the neighbouring skin somewhat swollen; complained of headache and oppression of the body. The iodide to be discontinued. December 30th; the nodules have gradually increased in volume, and have in several places, especially on the face, become confluent, thus imparting a more swollen aspect; fresh nodules have also made their appearance. She complains of general oppression and ill-health. January 1st, 1867: the meat treatment was discontinued.

\* I cannot venture into the domain of the literature of leprosy, but may here refer to a striking case narrated by Daniëlsen and Boeck (*Traité, &c.*, p. 369), where a young woman, who had been much benefited by treatment, suddenly became much worse from the shock of hearing from a medical man, that her disease would return very soon,—“c’était un spectacle effroyable à voir que la vitesse avec laquelle la maladie procéda de nouveau.” Instances of this kind are not very rare.

confidence of practical men; and there are absolutely none which are, by universal consent, adopted as proving especially useful.

It may be that a spirit of true scientific inquiry has hitherto been wanting, and that in consequence hardly one of the more effective medicinal agents has been thoroughly studied, with reference to action upon the leprous disease, under various conditions of season, place, or stage. And probably it is as true as ever, that attempts to cure by drugs are often crude essays not worthy the name of experiments; and that the custom still obtains of resorting to any new device, rather than patiently and variously testing the means in hand.

Whatever be the view taken of this matter, it is evident that at present leprosy must be regarded as incurable, in the ordinary sense of the word.

Unfortunately, it is not the only affection of the kind whose practical domination is yet beyond our capacity. But, perhaps, it has not been wholly a blessing to medicine that an exception exists in a complaint—syphilis, to wit—which offers not a few analogies to leprosy, and which is commonly regarded as altogether amenable to a specific treatment, founded upon abstract properties and relations determined only upon empirical grounds. This prominent instance pervades, so to speak, the whole series of allied disorders; and to the neglect of rational therapeutics, search is as regards them also made rather for a specific cure.

In the interest, however, of the unhappy leper, I propose to offer some illustrations of the more recent use of medicines in leprosy; and, first, would refer to the long and persevering trials made in Norway by Dr. Danielssen, who has always indulged a sanguine hope that a true remedy for the disease will eventually be found. There is here, I would add, no risk of such defective diagnosis and prognosis, as has many times led to corresponding error in the appreciation of therapeutic agents, and the dissemination of groundless opinions.

The following is a short summary of the results of treatment recorded by Danielssen and Boeck, in their original work (1848):—

It is observed that *calomel* and *corrosive sublimate* have commonly produced intractable vomiting and diarrhoea; and even when these accidents were not present, there was manifested a scorbutic state of the system in the occurrence of hæmorrhagic spots, bleeding from the swollen and discoloured gums, and general debility. These results followed especially the use of calomel, and 10 to 15 grains were enough to produce them. Salivation was, however, rare; and, besides, the disease itself remained unchanged.

*Arsenical preparations, Fowler's and Pearson's solutions, the Asiatic pills, Arseniuret of copper, &c.* These remedies have generally been used in small and increasing doses. Often they have determined enteritis or peritonitis, and then the tubercles have sensibly lessened in size; but as soon as the inflammation subsides, they begin again to grow.\* In many cases, these

\* The following is other experience of practised observers in Jamaica: Dr. Bowerbank (Rep. R. Coll. of Phys., p. 14) observed, "in only one case did medical treatment seem to keep the disease in check. During 18 or 20 years, the patient, a female, had repeated attacks of apparently intermittent fever, and on each occasion the characteristic spots made their appearance; she had also anæsthesia and slight enlargement of the eyebrows and lobules of the ears. The use of Fowler's solution always checked the disease . . . . I understand a son of hers has shown unequivocal signs of the malady." Dr. W. Nicholson, of Antigua (*loc. cit.*, p. 21), remarks, "Arsenic is the only remedy which in my practice has had any effect in arresting the disease, and that only for a time. I have seen the tubercles disappear under its use, sensation restored to fingers that were incapable of

"feeling and using a needle, so that the patient was enabled to sew; yet the disease returned and proved fatal." The co-existence in these cases of malarious cachexia is not mentioned, but it should be specially noted in future; because such complication is an element upon which arsenic and quinine would beneficially act, and so appear to improve the whole state of the patient. The spleen being perhaps especially affected in leprosy, Danielssen has fancied that quinine has a particular good effect upon early or mild "leprosy" fever; and this suggestion may be added to the preceding, as worthy of attention in India. Probably the grounds upon which 'quinine' was recommended for trial in leprosy, had reference to the frequent occurrence in this disease of the fever termed above by Bowerbank, 'apparently intermittent,' but which is really not of the ordinary malarious character.

remedies produce indurations in the abdominal organs, and twice there supervened during their use such emaciation as to lead to death; one of these cases had for a time taken the arseniuret of copper.

*Preparations of Iodine, Tincture of Iodine, Iodide of Mercury, of Iron, and of Potassium.* We have found that in the tubercular form of leprosy these remedies in ordinary doses excited a burning sensation in the skin, which became red, swollen, and so painful as to necessitate the discontinuance of treatment; when, however, the doses used were very small—thus potassic iodide a scruple in eight ounces of distilled water, one spoonful given three or four times a day—these inconveniences no longer appeared, and after persisting some time in the remedy, there followed a diminution in size of the tubercles; but this was only of temporary duration. In the anaesthetic form, these means caused the pains in the bones, so often attending this form, to almost disappear; yet the chief affection remained unbenefited.

*Donovan's solution*; it was given to seven lepers for a long time, in increasing doses; four cases were tubercular, three anaesthetic, and in none was any benefit experienced.

*Bromide of potassium*; in very small doses—a scruple in eight ounces of water, a spoonful thrice daily—it removes the pains connected with the bones, which are common to both forms of leprosy.

*Chloride of potassium, and Chloride of zinc*; these, too, have been tried, but without success.

Besides these means, we have used *laxatives* and *decoctions* of various vegetable drugs, but without decided results.

*Local and general blood-lettings* belong to the remedies customarily used, and by their means a relief, even if temporary, is obtained.\*

We have also tried *topical means*, such as vesicating remedies, antimonial ointment, setons, friction with Naples-ointment, with iodide and chloride of zinc, scarifications, and these without other than momentary alleviation of the deep-seated pains.

Yet these attempts to cure now referred to, should not be wholly depended upon, or be made the basis of a definite conclusion, because they were prosecuted under the most unfavourable circumstances . . . . .

The authors then proceed to other details, some of which may also be usefully introduced here.

Under the admission that leprosy is a dyscrasic malady, it was inferred that the principal indication of treatment should be to remedy the abnormal composition of the blood; and with this view we have subsequently prescribed a completely *regular diet*; and as medicines, *cod-liver oil*, &c.,† and the use of artificial *sulphur baths* . . . . . Further, in the tubercular form of

\* In their appended narratives of 'cases,' will be found several instances in which bleeding from the arm was freely employed. At present, this practice is not followed in either Christiania or Bergen. 'Cupping' is, however, commonly practised; and the patches of eruption which I saw in Norway, had all been scarified at the margins, which are usually vascular and raised. Doubtless this procedure is beneficial, and it is worthy of adoption generally; for reduction of hyperemia is tantamount to reduction in the active 'movement' of the new growth, and so far protects the system: perhaps, too, the scars which are left, act in repressing development of the neoplasm, just as similar ones act on 'lupus,' as I have seen; there is here, however, no other consideration but that of *aid* to cure.

† To enumerate all the remedies which have subsequently been employed in Norway, would be a difficult task. I am informed that no trouble or expense is spared to procure supplies of the so-called 'cures' for leprosy amongst drugs, &c., and a comparatively large sum of money is annually granted to the Lungegaards

Hospital at Bergen, for the purpose of carrying out the intention of Government to afford every possible help to the lepers who seek for aid. That Danielssen is himself a sanguine physician, as well as a most experienced one, is sufficient guarantee that no rational efforts are spared on behalf of the executive medical staff.

Respecting experience elsewhere, I gladly refer to Bombay results; thus, "ground-nut oil, cod-liver oil, carbolic acid, arsenic, sulpho-carbolate of soda, camphor, bavanchi (*Flacourtia sopida*) and sulphur; and the indra-java seeds (*Holartheca antidysenterica*)" have all been used. "They have not yielded satisfactory results. If anything afford relief from the leprous malady, the oils, in my opinion, have the best evidence in their favour. Under their use, improvement, very slight, indeed, in some cases, was noticed to have taken place. A case under ground-nut oil (a bland, domestic oil) was sent out remarkably improved. In cases treated by cod-liver oil, the disease evidently seemed to have been arrested in its progress, the

the malady we have sought to imitate the manner in which nature frees the skin of tubercles deposited therein, and since this process of deliverance is effected through their destruction (softening) and absorption, we have had recourse to measures likely to produce the same effect . . . . the morbid and congested state of the skin has been combatted by blood-lettings, the use of *laxative derivatives* . . . . the use of *caustics*, such as the nitrate of mercury, one drachm, dissolved in two drachms of fuming nitric acid, the solution applied to the more prominent tubercles; if these latter were limited to the face and arms and were less prominent, they have been painted every day, or second day, with a strong caustic solution of potassa; but if widely dispersed, a caustic *bath* has been used of 6 to 8 ozs. of carbonate of potash and 6 to 8 ozs. of quicklime, separately dissolved in warm water and then added to the bath, to which also may be put 5 or 6 ozs. of sulphuret of potassium. The patients have been placed in such bath from a quarter of an hour to three-quarters, the head being frequently dipped, and then immediately douched with cold water. The baths were given every day or every other day . . . . Caustic potash mixed with honey has been applied to the upper part of the larynx, has proved beneficial in averting the dangerous and often fatal paroxysms of suffocation, so common in leprosy.\*

In the anæsthetic form, our attention has been chiefly fixed upon the central organs of the nervous system, with the object of checking or arresting morbid processes existing there; thus were used frequent cupping to the spine and rubbing in of ointments; moxas . . . . In this way, although no subject has been cured, yet it has been found that several of the remedies indicated have an essentially favorable influence upon the leprous complaint . . . . Then follow notes of cases treated at Bergen, in 1847, and amongst other remedies named may be here mentioned, pills of *cynoglossum*, gr. iij. in each, taken night and morning; also the root of *Asclepias gigantea* (Mudar) used in anæsthetic cases, without, however, the least benefit resulting.†

I now quote from Dr. Danielsen's later reports, which are known as the "Lungegaards-hospitalets Virksomhed," and are published every three years.

"health of the patients tolerably improved, and they gained in flesh and strength; but no perceptible change took place in the symptoms themselves." Mr. S. Arjoon, *loc. cit.*, under date June 1873.

I should also refer to the valuable, even if negative, experience derived from the practice at the leper-hospital, Madras, which has been carefully summed up by Dr. Van Someren in his last report. I regret that I cannot quote from this record more fully, but it has been lately made known through one of the English medical journals. (See the *Med. Times and Gaz.*, March and April 1874.) Dr. Van Someren remarks that the *Phosphate of Lime* "has certainly seemed useful in removing some of the symptoms of the disease," but prolonged trial "does not justify me in regarding it as possessing any remedial power" in leprosy.

\* Some later experience of Danielsen is the following. Hearing that the Kreuznach baths had proved effective, he learnt that one case of leprosy out of two had really been benefited, and was enabled to repeat the experiments by means of artificial baths made with common salt and Kreuznach salt dissolved in water and raised to a temperature of 95° F. The strength of the solution was considerable, and was gradually increased: the patient remained in the bath from half-an-hour to two hours. No internal medicine was given, and the full series of baths (the 'cure') numbered 46. Five lepers were thus treated, viz., four of the nodular and one of the nerve-form, all being early

(9986.)

cases. The results are given in detail, and Danielsen considers them to be but negative, or not more favourable than might follow so many baths of sea-water. As the Kreuznach water is 'strongly iodized,' as well as saline, there was some ground for good anticipation; but this has not been realised. An instance is also mentioned of a leper in good circumstances who went from Norway to Kreuznach and passed through the 'cure.' His was a case of nodular leprosy and not far advanced, but except that his spirits and hopes were raised, no beneficial change was effected; and a year afterwards, there was no marked improvement, although he had steadily used sea-baths and been regularly cupped. Baths of fresh and salt water, and, in form, the warm, douche and vapour baths, are in much esteem and constant use in the Norwegian course of treatment.

† Since the date of Robinson's strong recommendation of the last-named drug, 'Mudar' has been extensively tried in Europe, as well as again in India; but faith in its efficacy has not been maintained. I have always regarded this instance as showing one of two things; first, either that the European forms of leprosy are not so amenable as the Eastern, to the influence of the drug, or that the earlier experience was fallacious; and I record this observation because it applies to so many other similar instances. On the whole, the latter of the two inferences commonly seems to be the correct one.

B B

*Digitalis* was used for many months during the year 1865, in several cases of leprosy, but did not produce any particularly favourable results; when given in extreme doses for a long period, its toxic effects appeared, rendering its disuse imperative. It was administered both as powder and in solution with iodide of potassium, which seemed to render the system more tolerant of it than usual, while the speedy operations of the iodide was not itself interfered with.

*Spermacedia clavata* was tried in three cases without producing any good effect upon the disease, although its use was continued for some months. All three instances were of the anæsthetic form, and the complaint remained quite unchanged.

*Calabar bean* in the form of powder (dose, grs. ij., thrice daily) with sugar, was given to two lepers, and continued for some time. One of these cases was that of a young man affected with tubercular leprosy, who took the medicine for a month, without any effect being produced upon the leprosy nodules and patches, or upon the general health. The other case was that of an adult woman suffering from mixed leprosy, who took the medicine in increasing doses, without any benefit as regards her complaint. Daniëlsen narrates this instance in full, and though it has no special interest in a therapeutic point of view, yet the following comments upon it may not be unacceptable:—In small doses the bean produces no visible effects, even when continued for a period of three months; and only when the dose was increased to 16 grains daily, given for nine full days, did there appear special symptoms of its operation, such as cardiac oppression, coated tongue, headache, slight febrile disturbance; quick pulse, and contracted so as to become imperceptible in one arm; increased temperature, increased secretion of tears, saliva and sweat, diminished urinary secretion, clonic spasms. Daniëlsen considers that Calabar bean acts as irritant not only upon the nerves of organic life, but also, and that chiefly, upon the motor nerves, though not on the spinal cord itself; and he continues—"whether the skin is a special eliminating organ for the drug, I cannot say, although many things seem to indicate this; but this elimination is not so rapid as has been supposed . . ." subsequently to entire subsidence of all these toxic signs, the patient found herself just as well as before, and on the leprosy malady the drug had exerted no influence whatever; further to remark, is the fact that the spasms of certain facial muscles, which had been present at first, and were increased by the action of the bean, again went back to their original state, after all other muscular irregularities had fully ceased; and on spasms of this kind the Calabar bean had evidently no favourable effect.

Quite recently *phosphoric acid* has been tried in leprosy at Bergen, without showing any beneficial results as regards the disease; and also the *pure phosphorus* in pill or solution, and in doses of 2 to 3 m. grm. thrice daily, has been administered with similarly negative results.

It may serve to relieve the tedium of this long enumeration, if I here introduce a case from the Bergen records, which illustrates the influence some drugs undoubtedly possess of rousing, as it were, a latent deposit; and so giving rise to fresh auto-inoculation of the system. This is a danger to be avoided, just as other more direct forms of cutaneous, or even other mode of stimulus or excitement.

*Case.* Aslak I. Ljøine, 20 years, admitted into hospital in September, 1869, suffering from nodular leprosy. On the left border of the glabella there were four small nodules; one near the roots of the hairs in the middle line, one about 8 mm. long, and 4 mm. broad, over the inner end of the right supercilium. On the right cheek, close to the nose, a flattened nodule, about 6 mm. in diameter; and on the lower lip a couple of smaller ones. On the sclerotic coat of the right eye, close to the outer side of the cornea, a very prominent thickening, where several dilated blood-vessels may be seen; and a small nodule encroaching on the cornea itself. The fore-arms are beset with small, scattered nodules, and on the back of the right hand is a somewhat larger one, which was flattened in form. On the front of the right thigh several flattened nodules, one or two being in an ulcerated state; and on the left thigh a few quite small ones. The legs and back of the feet occupied by many scattered, flattened nodules, some of which were ulcerating. The cervical, axillary and inguinal glands, especially the latter, were enlarged. Sensation seemed to him somewhat deadened in the hands and feet; on trial he felt the slightest touch in the hands, not so in some places on the outer side of the back of the feet. General health good.

The 18th November. After two doses of chloral hydrate (the one of 40 grains, the other 3j.) given as anæsthetics preparatory to removal of the small nodule in the eye (and which produced no other effect than a short light sleep, followed by headache and anorexia which lasted some days) there appeared on the same day a large florid patch under the right eye, accompanied by a general indisposition. The following day, the eruption spread partly on the face, partly on the thighs, where it soon (on the 23rd) began to subside; and meanwhile he felt pain and tenderness in the limbs. These pains were allayed by sub-cutaneous injections of morphia; but both *nervei peronei*

had become tender to the touch and decidedly thickened: otherwise he seemed on the 1st December, to be again well. Attending this outbreak, which lasted about 12 days, and which showed itself first in the skin, then in the nerves, there was febrile disturbance. The pulse rose to 112, and temperature varied between  $40\cdot6^{\circ}\text{C}$ . and  $38^{\circ}\text{C}$ . being only occasionally below this. During the months of December and January the patient continued well, although his appetite was but indifferent; but in the beginning of February he had an outbreak of red and tender nodules in the extremities, attended with febrile disturbance. The ulnar nerve of the right arm became thickened and sensitive to touch; and the peroneal nerves also were similarly affected. Afterwards an eruption of nodules partly in the face (leading to much tumefaction here), partly on the thighs; meanwhile he remained feverish. Pulse steadily at 100; and the temperature oscillated between  $38^{\circ}\text{C}$ . and  $40^{\circ}\text{C}$ ., being once only below  $37^{\circ}\text{C}$ . At the close of February, the eruptions ceased; and he was found to have become rather emaciated.

It would here seem as if the chloral hydrate had set up a disturbance of leprous-matter, possibly till then resting quiescent in some place or other of the body, and had so produced the eruptions above described; there being indeed a resemblance to what I have often commented on—namely, the effect of preparations of iodine—and giving, as I think, an indication that the dyscrasia had become more marked. (Dr. Daniëlssen.) See first foot-note at page 175.

*Carbolic acid* has been made trial of both inwardly and outwardly; the crystallised acid being given in the form of a mixture in augmenting doses. At first grs. viij. of pure acid to ʒ viij. of water, dose a large spoonful four times daily; afterwards rising to grs. xx.—ʒ viij.: and although this was employed in 30 lepers during periods of from three to eight months, yet I hesitate to say whether or not the medicine has any special influence upon the leprous disease. So much, however, appears, that after it has been given for a time, there happens an eruption sometimes of spots, sometimes of nodules without particular febrile disturbance, which eruption again subsides after a shorter or longer period, without leaving any disorder in the organism.\* Further experiment will bring more certainty. As an external application, carbolic acid does not produce any other effect upon the leprous exudation, than do similar irritating substances which produce an erythematous inflammation in the skin, and occasionally some absorption of the nodules or tubercles.† No inconvenience has been found to result from its use (Bergen experience).

Daniëlssen's later experience is thus expressed—"in not one of the 52 cases in which it was exhibited has carbolic acid wrought such changes, that I could say its effects were "beneficial." . . . "Both patches of eruption and nodules have not shown under its influence any tendency to subside, and the general health has not, as a rule been improved." . . . "Yet this drug may be regarded as a useful aid in combination with external applications, and perhaps it will be found to maintain a cure when once this has been effected." (Report 1871-3, p. 3).‡

\* Carbolic acid in doses 2, 3 or more drops, in water, twice a day was being exhibited at the large hospital in Christiania last autumn, but after long trial its utility had not yet become apparent. Respecting the effect of the acid noted above, I find Mr. Succaram Arjoon, L.M. in charge of the ward for incurables, Jamsetjee Jeejeebhoy Hospital, Bombay, stating in his report for last year, as follows:—"Carbolic acid in five minim doses (three times a day) made into a mixture with cod-liver oil and mucilage, was given for nearly 12 months. Under its use, the symptoms were noticed to have actually grown worse and the patients had to be placed on Chaulmogra oil." It is added in a foot note, "the same may be said of the sulpho-carbolate of soda."

† The external application of this acid Dr. J. M. Fleming (Ind. Med. Gaz. vol. VI. 1871) finds to be a slow but certain means of curing leprosy, in the early stages of the disease. His formula is Ac. Carbol. ʒj., Ol. lini, ʒij. m. to be applied night and morning: it is noted that the drug "given internally, does not add to the effect," and thus exhibited it sometimes caused dysenteric symptoms. Seven cases are briefly related by the

author, but, however, promising they seemed, none of them were followed up. The acid thus used seemed to have a local action somewhat like that noticed during the use of cashew-nut oil: and this subject is worthy of future notice. Lately, Dep. Surg. Gen. W. Johnstone, Madras P., is said to have successfully treated leprosy, by means of carbolic acid vaporised by heat, and so applied to the skin; and some time since, the late Dr. Lalor, Bombay P., found this drug to be very useful: other less favourable experiences of the kind might be added, were it necessary.

‡ A modification of the simple *carbolic acid* plan of treatment may be here briefly described, as one said to have been successful in Northern India. The author (I. N., in Ind. Med. Gazette, vols. ii. and iii.) believing that leprosy affects by preference the gelatinous tissues of the body, thought of using *acetic acid* as the chief means; and believing also that the morbid agent here is of zymotic character, would add thereto *carbolic acid*, whence the following formula:—Acid carbolic. puv. ʒ xlviij., Ac. Acetic. puv. ʒij., Quiniaz gr. xxx., Spirit. Sacchar. ʒvj., Syrup. simpl. ʒviij., aquæ ʒxxiv.; take ʒjss., diluted with water twice daily after food. Vinegar may be used for

I now proceed to offer an appreciation of certain specific methods of treatment, which have of late been brought into prominent notice; and I would merely premise that while trial is still being carried on in India respecting all of them, there seem to have been already obtained some fair grounds of opinion.

1. *Treatment of Leprosy by the Chaulmogra oil.*\*—The experience recently acquired in Western India is the most complete, and has been thus expressed:—"Under the prolonged and continuous use of this oil, the progress of the disease is arrested, the skin become soft and supple, the discolourations vanish, the different morbid sensations leave the patient, the mental hebetude passes away, the impaired sensibility is completely, or partially, restored; the ulcers heal and cicatrise, though ever prone to break out again, and the general nutrition of the tissues improves; patients crippled before being known to walk about unassisted, and to gain in strength and weight. The Chaulmogra oil is administered in doses of ten minims in an ounce of milk twice daily; and an application of a liniment of one part to sixteen parts of sweet oil, is used every day a few hours before the cold bath, which is itself followed by active exercise whenever this is practicable. Particular attention is paid to diet, which consists chiefly of vegetable food, with proportionate allowance of milk. Flesh; spices containing red pepper, and spirits are scrupulously avoided. Personal cleanliness is insisted upon, and ample ventilation of the hospital wards is secured.

"In the space of less than two months, perceptible changes in the disease and in the state of the patient, become observable; this having advanced favourably to the degree above stated, in most cases becomes stationary, and does not seem to be promoted by a prolonged use.

"In order that the greatest derivable benefit may be obtained from this remedy it is essential that the disease be of recent origin, that the general health of the patient be little impaired and untainted by scurvy or syphilis, acquired or transmitted; and the age not much advanced. As regards curability the tubercular form is the most amenable, the mixed next of degree, and the purely anæsthetic, with or without eruption, is the least manageable; in fact it is the incurable form of the disease. Disease hereditarily acquired is least susceptible of amelioration.

"Respecting the more or less complete cures by Chaulmogra oil, it is to be observed that their permanency and stability are doubtful points. It remains to be ascertained whether the change for the better wrought by Chaulmogra oil, will persist when the treatment is abandoned and the patient revert to his former state with regard to food, clothing and ventilation. My doubts as to the permanence and stability of the change are strengthened since the majority of the affected are paupers; and I have noticed a relapse in at least two cases. People better circumstanced in

the acetic acid and water; for patients in the advanced stages of disease, begin with a little less acetic acid, and conjoin the following pills to counteract the constipating effect of the latter:—Alterative pills containing Podophyllum, Aloes, pulv. Ipecac. &c. Nitrohydrochloric acid may be added to the mixture; strychnia does not do good; it may in doses at all large, do positive harm. Conjoined with these means are the following external applications to the ulcers: glacial acetic acid and crystallised carbolic acid; to be rubbed in over the body, chaulmogra or other oil, mixed with some antiseptic substance as turpentine, tar, kerosine oil, iodine, &c. Also to be used counter-irritation; as blisters, liniments, *plumbago rosea* applied to the skin; in anæmic patients, iron; arsenic is of no benefit in pure anæsthetic leprosy, although it may cure skin-diseases occurring with it. Respecting the circumstances under which this method of treatment was carried out, it should be added that the patients submitted to it were not at all numerous, were not supervised in a hospital, and could not be traced after a few weeks or months; still, as the author speaks with some

confidence, and is evidently a very careful observer, the method may be again better tested when occasion offers; its theoretic basis need not here be alluded to. It is proper to add that hygienic recommendations accompany this particular treatment.

\* It has been positively stated on good authority, that this oil is the basis of the drugs used by the late Mr. Bhau Daji, of Bombay; and, on the other hand, I find it asserted that the *Hydrocotyle Asiatica* is the essential and really therapeutic element of those secret remedies. A brief reference to the Pharmacopœia of India will be sufficient to teach that these and several other reputed indigenous drugs, whose names have been incidentally mentioned, are no novelties in practice; but this fact so far from inducing us to cease from further efforts at cure should rather stimulate to more precise inquiry, in order to ascertain, if possible, why these remedies have been so long distinguished as a means of mitigating the leprosy disease. At present there are not, I think, the necessary data for understanding even this preliminary subject; and only afterwards, can be estimated the comparative value of these means.

life stand a greater chance of enjoying the benefits of the change effected, and this belief is supported by my experience in practice outside hospital." (Remarks by Mr. Sakharam Arjun, *loc. cit.*)

In a further Report dated Feb. 24, 1874, which was forwarded to me from the India Office, I do not find any additional confirmation of the more sanguine hopes which have been entertained respecting the indigenous remedy under notice; for Mr. Thom, the Surgeon-General at Bombay, observes that, "there is as yet no satisfactory evidence that this drug is a cure;" and Dr. Cook, Physician to the J. J. Hospital, remarks that no cases "have been returned as positively cured." What degree of benefit may be obtained from the external use of a mild agent like this oil, will, I trust, have been made manifest in an earlier part of this memoir.

2. *Cashew-nut oil as a remedial agent against Leprosy.*—In the year 1868 a special investigation was undertaken, under the sanction of the Colonial Government concerned, by Dr. R. H. Bakewell, Medical Officer of Health for the colony of Trinidad, into the value of a special plan of treatment introduced by Dr. L. D. Beauperthuy, of Camana, in the Republic of Venezuela; and such details as seem necessary respecting this subject are given below, as extracted from various official papers.

Without attempting in this place an appreciation of the late Dr. Beauperthuy's peculiar treatment, I will only observe that it neither attempts nor promises better results than have been at other times accomplished by various known or concealed cures, so called; and the hypothesis upon which this particular method is based\* hardly, as I think, calls for criticism so much as does the imperfect style of practice adopted, which inevitably led to incomplete results altogether incommensurate with the idea that a deeply rooted and highly chronic complaint had been in any real sense of the word 'cured.'

"Dr. Beauperthuy is a highly intelligent and educated physician, possessing the diploma of Doctor of Medicine of the University of Paris—probably the most distinguished medical degree in the world. He has been settled in Venezuela about 30 years, and during the whole of that time has been engaged in the investigation and study of leprosy, and other diseases peculiar to the tropics. It having been brought to my notice through the medium of the public journals that he claimed to have discovered a method of curing leprosy, I deemed it my duty, being then Medical Superintendent of the Leper Asylum at Trinidad, to communicate with him on the subject. He replied to me, repeating the statements as to the cure. . . . It now only remains for me to add that I consider Dr. Beauperthuy has entirely fulfilled all he promised in his communication to me. He did not profess to be able to cure leprosy after it had invaded the internal organs, and he requires that certain conditions as to ventilation, diet, and bathing shall be observed. These are as much a part of his system as the remedies he uses internally and externally. He is not in a position to state at present whether the

\* The weak point of Dr. Beauperthuy's system is his erroneous theory that the disease is essentially local and parasitic. This leads him to rely too exclusively on his external medication. His internal treatment is merely directed to removing certain diatheses, particularly the herpetic and the syphilitic, which he thinks favour the growth and reproduction of the parasites. He accounts for the relapse of the first series of cases by saying that some 'germs' of the disease remained undestroyed, and they rapidly reproduced the tubercles.

There is one remark I wish to make with respect to the action of Dr. Beauperthuy's external applications. That they are local in one sense of the word is true, so

is jalap or sulphate of magnesia a local remedy. But that they act, and that very powerfully, on the whole system is likewise indisputable. The effect of an extensive application of the Cashew-nut oil, is a very sharp febrile attack, the temperature running up to 103° F. and remaining over 102° F. for several days, with a pulse of 120 to 140. Besides this the immense exudation from a large surface, continuing for several days, is largely eliminative. The baths twice a day and frictions with oil have their effect in increasing the perspiration. No one who has seen the effect of one of these applications would doubt of its powerful action on the whole system.—(Statements of Dr. Bakewell.)

disease will return after being thus treated. One of the cases has been two years without a symptom of relapse. Judging from analogy, one would say that if proper precautions are adopted the disease will not return."

The following rules embody the plan of treatment in question; and afterwards there is added a further statement of Dr. Bakewell expressing his continued confidence in the method; there is too, appended a *case* in illustration, taken from one of the earlier official Reports which are contained in the "Correspondence," &c., presented to the British Parliament in the year 1871.

*Rules for the Treatment of Lepers by Dr. Beauperthuy's Method.*

1. The patients selected for treatment should be in an early stage of the disease, that is to say, should not have been suffering from leprosy more than two years, and only those should be chosen in whom the disease is entirely confined to the skin, or has very slightly invaded the mouth. If the larynx has been attacked, and in other respects the patient is eligible, he should be distinctly informed, *if treated at all*, that it is only with a view to amelioration, and not to cure, that his case is undertaken. So far, no case has been absolutely cured in which the interior of the mouth or the larynx had been invaded. The slighter the case the more easy and rapid is the cure. Both anæsthetic and tuberculous cases are eligible.

2. The treatment is of three parts—1st, hygienic; 2nd, external applications to the diseased parts; 3rd, internal medicines.

3. The hygienic treatment, which is absolutely essential, and without which nothing but the most temporary improvement can be attained, consists of pure air; nourishing food, including a moderate quantity of fresh meat daily; abstinence from all salted meat or fish, and from pork, whether salt or fresh; a sufficient quantity of fresh vegetables must be given; and if the patients are habituated to its use, a moderate quantity of light wine may be given, but this is not necessary.

4. Each patient must have a separate room, and mosquito nets round his bed, if he resides in a climate where mosquitos exist.

5. Each patient must have separate bedding, clothing, and eating and drinking utensils. [These should all be numbered, so as to avoid confusion, as there is nothing that so much disgusts lepers as being obliged to use articles belonging to other lepers.]

6. The external applications consist of (a) soap-and-water baths twice a day; frictions over the whole of the skin with oil. Coconut-oil is always used at Trinidad and Cumana, but olive-oil might be employed if more convenient. The oil is well rubbed in and allowed to remain on for three or four hours, when the body is thoroughly cleansed by a soap-and-water bath.

7. The oil of cashew-nut is applied, by means of a small piece of sponge, to the diseased parts. This application should be made at first only over a small portion of the skin, as large, for instance, as the hand, and when the effect of the first application is seen, subsequent ones may be made larger if deemed advisable. The effect of the oil is to produce, after from twelve to twenty-four hours, vesication. The skin should, if possible, not be broken, and the exudation should be allowed to remain and dry on, so as to form a crust. In about ten or twelve days this will fall off, leaving the skin clear and free from any ulceration underneath. If the parts are numbed, but not completely anæsthetic, sensibility will in general be completely restored by the first application; if the anæsthesia is complete, it may require two or three

applications to restore it, but I have seen this latter number suffice in a case where anæsthesia had existed more than four years.

8. After the first application or two, the patients will generally be anxious to have much larger surfaces operated on. I do not think it safe, however, to do more at one application than a leg or a fore-arm, or an equal surface elsewhere. *The applications should not succeed each other at intervals of less than a week.*

9. If the patients are troubled, as is very often the case, with herpetic or other eruptions Dr. Beupérthuy employs two liniments with great success. The one called—

*Liniment No. 1* is made thus:—Saturate an ounce of alcohol with iodine. When the solution is complete add a solution of caustic soda to excess; a little more or less is of no consequence, provided there is enough to unite with all the iodine; then add twenty-four ounces of olive or cocoanut-oil. This must be well shaken up before it is used.

*Liniment No. 2.*—Take the yolks of two eggs; balsam of copaiba, four and a half fluid ounces; mix to form an emulsion; add one pint of olive or cocoanut-oil.

May be employed in all those cases where there is a squamous or scurfy condition of the skin, in lieu of the oil baths.

10. Where the feet are affected, as it is not convenient to use the cashew-nut oil\* for them, baths of hot cocoanut-oil may be used night and morning. These must be superintended by a skilled attendant, who tests the heat with a thermometer as the patient's sensibility will generally be deficient or null, and if trusted to him he might scald the feet without knowing it. The heat should not exceed 100° Fahr.

11. The internal medicines administered by Dr. Beupérthuy are perchloride of mercury (Ph. Br.), in doses of one-fifteenth to one-twentieth of a grain twice a day for adults. In cases where mercury is contra-indicated, Dr. Beupérthuy gives carbonate of soda, in doses of ten grains to a scruple twice a day. I have seen one case in which I tried the alkali, and which progressed quite as satisfactorily as those to whom the mercurial was given.

12. It is, of course, to be understood that the treatment may be interrupted or modified, if any complications occur. Should the mercurial affect the mouth, or cause any irritation of the intestinal tract, it should at once be discontinued, and the alkali given.

The treatment described above has been adopted by me at Trinidad, and has in every one of my cases more than answered my expectations. All the cases have rapidly improved; one was so nearly cured after five months' treatment, that he insisted on going home; the others are still under treatment, but the latest news received from them is of the most encouraging description.

R. H. BAKEWELL, M.D.,  
Medical Officer of Health, &c., to the Colony  
of Trinidad.

Elsewhere it is remarked by Dr. Bakewell with reference to this treatment:—"With the round hard tubercles in the lobes of the ears, a somewhat different plan is adopted. Dr.

\* Oil of cashew-nut is the oil found in the pericarp of the *Anacardium occidentale* (Linn.). This tree is very abundant in the West Indies, and probably in the East, too. The nut is an article of commerce, under the name of 'Monkey-nut,' from its resemblance to the face of that animal. The oil may be made thus:—The bruised pericarp is digested in strong spirit for a day or two; it should be shaken frequently; the tincture is poured off and allowed to evaporate spontaneously in

the sun. On no account must it be subjected to any artificial heat over 120° Fahr., as at a very low temperature the oil becomes resinous and quite inert. The oil will be found floating on the top of the tincture, and may be skimmed off. The cashew may be treated repeatedly with spirit until all the oil is dissolved out. The pericarp must be well bruised in a marble stone, wedgwood, or wooden mortar (not in an iron one).

“Beauperthuy punctures them with a needle dipped into the oil, which sets up suppuration and causes them to disappear more rapidly. This is of course merely to destroy them; the other is really a curative process.”

The local action of the applications is thus described in one part of the Reports under notice:—“The action of the external remedy on the diseased part is most peculiar, and may be fairly called specific. The first application produces, after the lapse of from 24 to 48 hours, a copious exudation, which, drying on the skin, forms a thick crust or scab. In the course of from eight to ten days this scab or crust falls off, leaving the skin underneath quite sound. There is no ulceration or sore produced. This first application was never in any of the cases I saw accompanied or followed by pain, unless, as in the last case I shall relate, applied over such an extent of surface that the mere mechanical pressure of the scab caused it. The second application even, in some bad cases, failed to awaken the dormant sensibility of the diseased parts. But in every case the third application is followed by a diminution in the thickness and hardness of the tubercle. This effect is invariably produced more rapidly in those parts of the body, like the trunk and thighs, covered from the light, and is invariably slowest in the face, neck, and ears. The applications after the first are followed by less and less exudation as the tubercles diminish in thickness; the third or fourth is probably a thin scab, and at length it becomes a mere scale, such as that formed by a slight blister; this last is transparent. When the application produces this effect the tubercle is cured. But the most remarkable point is that on the healthy skin the application never produces any effect. It peels off and causes no inflammation or exudation whatever. It is thus a test of its own results.”

*Case.*—M. H., aged 16 years, female, white. This girl, who is the natural daughter of a French physician at C. by a Creole white woman, was sent by her father to be under Dr. Beauperthuy's treatment. The disease began six years ago, and was caused by bathing while suffering from an eruption of chicken-pox (varicella). At the time she first went under Dr. Beauperthuy's treatment in January 1868, she was nearly covered with tubercles, her face was swollen frightfully, her ears large and pendulous, her arms, hands, thighs, and legs swollen with tubercles, and very many on the trunk. This is her mother's description; her uterine sister is a leper, and an inmate of the Leper Hospital. At C., on my return, I was asked about this girl, who is well known there, and her state was described to me as being just as her mother said. Her father had tried all kinds of remedies, but she got constantly worse. When I saw her she was very nearly well. The ears were still slightly thickened, but they had been large and pendulous; on the cheeks there were some slight remains of thickening, and here and there on the arms and back of the trunk there was just enough left to show that tuberculation had existed. During my residence these places were touched once or twice, and before I left, when I examined her very carefully all over, I could detect nothing wrong, but there were one or two places which Dr. Beauperthuy considered still suspicious, and which he proposed to touch again. She is naturally a thin girl. Having suffered much from worms, she has been more reduced, the consequence of which is that the change in her face and arms is very marked, and has excited the astonishment of everyone. The treatment has been well followed out, and she has had good diet. Not a single fresh tubercle has appeared since the treatment commenced. This is in every respect a most remarkable and satisfactory case. The length of time it had lasted, the dreadful state in which the patient was at the commencement of the treatment, and the fact that her father was a physician and had himself at length been obliged to entrust her to another physician's care, all combine to make the case an *experimentum crucis*.

“My opinion of Dr. Beauperthuy's treatment, after a further trial of it, remains substantially as it was expressed in my Third Report. Its rapid and thorough action when the disease has not attacked the mucous membrane of the nose and mouth is unquestionable, and its power of improving the condition of much more advanced cases, and arresting the progress of the disease, has received additional confirmation. I have a case now under treatment in London, which is

in such a state that I only undertook its treatment on the distinct understanding that I could not give any hope of a cure, and where all I expect is temporary amelioration; and yet such is the effect of even a single application that the patient cannot be convinced that he is incurable. This case has shown me that the method of Dr. Beauperthuy is with difficulty applicable in a cold country, and must be somewhat modified in such a climate. In the tropics the patients without discomfort allow the part to which an application has been made to remain uncovered until a scab or crust has formed. Here that cannot be done, and great inconvenience results, as was shown in the case under treatment."—(Remarks by Dr. Bakevell.)\*

3. *The Treatment of Leprosy by Gurjon Oil.*†—This is a recent and independent method of treatment which has been initiated by Dr. J. Dougall, the senior medical officer at Port Blair, Andaman Islands. The plan aims simply at mitigating the sufferings of the leper, by means of remedies which are both cheap and accessible; and although Dr. Dougall's experiments had not, when I received my information, extended over six months, yet their results were sufficiently encouraging; and they seem to establish the fact that "the condition of the lepers can be greatly ameliorated;" but they do not, I think, show that "leprosy, both tubercular and anæsthetic, can . . . be arrested," because the period of, at longest, six months, is not enough prolonged to warrant the belief that leprosy has been arrested in a degree calling for special notice. Having so ingeniously elaborated his plan, Dr. Dougall is entitled, in my opinion, to the credit of introducing a practical method of treating leprosy, which will doubtless be useful in localities where the miserable victims of disease abound. The term 'cure' is not, that I see, mentioned by the author himself in connexion with his instructions for treatment; and these last are as follows:—'Gurjon ointment' is made by taking lime water, three parts; Gurjon oil, one part; mix and agitate them violently, until they thoroughly unite. The compound for internal use is composed of equal parts of lime water and gurjon oil; dose, half an ounce, or more.

The leper convicts at Port Blair are directed to cleanse their skin with dry earth, to take the dose of medicine and then to rub in a certain quantity of the ointment all over the affected parts. A second time the dose and oil are issued to them, in the day; no other treatment is adopted.

\* A plan of treatment promising decided relief to the leper, was sure to attract attention in India; and in Bombay I introduced the subject to the notice of the Head of the medical department, immediately on publication of the official correspondence in England. Subsequently, this treatment has been carefully tested in both Madras and Bombay; and it has, too, been tried in Norway. I have looked over such records of this additional experience as were available, and since the results in all cases seem to have been very similar, so far as trial has gone, it may suffice if I here quote from Daniell's last report:—"The symptoms which cashew-nut oil produces upon the skin of lepers, and the general disturbance which sometimes arises from its application, have not been different here to what was noticed in Trinidad; and since leprosy does not, so far as can be judged, make its appearance in other form in the West Indies, than in Norway, it is probable that the favorable opinion expressed regarding Dr. Beauperthuy's method of cure, has been somewhat hasty." Dr. Daniell's thinks that the action of this oil may be properly compared to that of Croton oil and the Spanish fly; and he is of opinion that no external application elicits any essential change in the dyscrasic condition which underlies

the entire leprosy disease. He also points out that leprosy may spontaneously undergo changes in the course of even one year, the nodular giving place to the benumbed form; and he insists that this fact should be kept steadily in view, when estimating the value of a supposed remedy for the disease.

In the East, the use of this remedy has proved to be practically objectionable, patients being very unwilling to persevere with it.

† This oil (known also as wood-oil) is an 'oleo-resinous' substance derived from *Dipterocarpus laxis*, and other of trees allied genera; and has been used as a substitute for copaiba. The author of the plan of treatment under consideration (which is here referred to in some detail from its having attracted special notice) was led to try this substance chiefly from the facility with which it is procurable in the Andamans. I may here remark that the Oil of Cade has proved useful in "allaying irritation and itching, rendering the skin more supple and probably diminishing the intensity of the periodical outbreaks of tubercles, and the long continued form of fever which attends them." (Dr. J. Espinet, Medical Superintendent of the Leper-Asylum, Port of Spain, in his Report for 1872.)

The ointment is not in any degree irritant; "it seems to be through its constitutional effects "that the tubercles soften from within outwards." The mixture or emulsion is, in the large doses mentioned, a laxative and diuretic.

Twenty-five cases are detailed by Dr. Dougall, and all were decidedly benefited; ulcers healed, tubercles subsided, and we are assured that prolonged and marked numbness is found to give place to normal sensitiveness. This last fact is very interesting, and worthy of further investigation. The absorption of the tubercles, too, is said to be effected in a remarkable manner; thus, softening begins at the base of the cutaneous nodule and gradually approaches the surface, where a bleb forms and gives exit to a thin, serous, clear fluid; in consequence of this process the nodule diminishes in size, and after two or three repetitions, it becomes 'quite reduced.' It will be remembered that Beauperthuy considered that cashew-nut oil affected the leprous nodules in a peculiar manner; and it will be worth while attending to this point in future. Meanwhile, the above observations will continue to be of much interest.

Before summing up the results of medical treatment of leprosy, and proceeding to the subject of the prevention of this disease, I will subjoin the following cases (the only ones I have met with) referring to the treatment of leprous nerve-disease by means of ELECTRICITY.

*Mixed Tubercular and Anæsthetic Leprosy.*—Johan Johannssen Aas, aged 42, entered the Bergen hospital 24th September 1865. The skin of the face is much wrinkled and particularly on the forehead, mottled with red; on the cheeks it is infiltrated and thickened; the hairs are wanting on the enlarged parts of the eyebrows. Over the right brow is a small red spot, with thickening of the skin; on the chin another light red patch. On the right elbow a thin, bluish cicatrix; and near to this a reddish patch. The skin on the hands wrinkled and of withered aspect. On the trunk nothing abnormal. The skin over the knees of livid tint; puffy in the legs and feet, and wrinkled and harsh. All over the body, but especially on the nates and around the knees, are seen chiefly rounded—but also oblong—white, depressed cicatrices, of which the most part are the result of ulceration in his childhood. Sensation in the hands slightly diminished; but in the feet and lower part of the legs it is so much deadened that he can feel only on firm pressure. Inguinal glands swollen. The disease was discovered two years ago, beginning with nodules on the eyebrows, with swelling in the face and hands. He can give no certain cause for it, not having been more exposed to injurious influences than others in his position; he has four healthy children. A sister of his was a leper, and has been cured in this hospital. Excepting stiffness and pains in the feet on moving, he may be said to be at present well. Acid. sulph. dil. ʒj., pulv. sacch. albi. ʒss., aq. comm. ʒviij., a spoonful every second hour; vapour bath once a week; cupping on the lower limbs weekly. December 19th, improving; the sensitiveness in the feet had considerably diminished, and the skin generally had become more active; swelling less. January 10th, 1866, he commenced to have Faradisation applied to the legs and feet every second day; cupping on the patches, and the vapour bath being continued. The 24th October he discontinued the sulphuric acid mixture and the Faradisation. The patches had almost wholly subsided; and he was generally improved. Occasionally he made use of a liniment to the feet and legs, composed of ol. terebinth and alcohol, equal parts of each. May 5th, 1867, it is entered that he is steadily getting on; the tenderness in the feet has almost disappeared, there being now some numbness of feeling in the same places. All the patches and skin-infiltrations upon the body have long since subsided; and he wishes, for family reasons, to be discharged. Is written off as being 'improved.' He had, in all, had applied 277 cuppings.

Another instance, which I have only lately met with is the following:—

*Anæsthetic Leprosy.*—A robust young woman for a few months affected, whose disease began immediately after child-birth with spots on the hands and feet, followed by diffused numbness, was admitted into the Clinical Hospital at Dorpat. On examination, it was found that the sense of temperature (104°–113° F.) existed in places where tactile sensation was lost, but was not acute when excited by heat little exceeding the normal; the patient stated that lately her husband had several times put his hot pipe on her arm without her feeling it, although once a blister followed. Electric irritation caused by the Faradaic current is not felt at the anæsthetic spots, whilst the constant current from 10 elements was clearly felt on both sides of the spinal column. It required 30 or more elements to excite feeling, when the negative pole was applied to the vertebral column and the positive to one of the extremities, and when the latter pole was placed over the benumbed spots, no feeling whatever was excited. From November 20th to December 10th, the patient had the current of 30 elements daily applied in the manner just stated, but no change in the affected portions of skin, as regards either sense of impact or temperature was produced. Bergmann, *loc. cit.*

It is to be hoped that more persevering trials with this agency will be instituted, for there is some encouragement to persevere in them to be derived from experience in a few other local nerve-affections, whether motor or sensory in character. I do not suppose, however, that any marked success will be obtained in leprous nerve-affections, when 'local' disease has far proceeded; and a discrimination is needed between this instance and that of paralysis due to 'central' changes, whether functional or organic.

SUMMARY OF THE RESULTS OF GENERAL AND MEDICAL TREATMENT OF  
LEPROSY.

I know of no more ample, continuous and careful studies of these subjects than those of Dr. Danielssen; and although it may be that leprosy in Norway is treated under disadvantages appertaining to outward influences, yet experience there has not proved to be anyway peculiar, and it is so precisely recorded as to become especially valuable. Every case regarded as cured in the Lungegaards hospital at Bergen, is duly described at length, and I have collected all such cases in the appended Table, corresponding to the dates mentioned. During this period of nine years 138 patients were treated, of whom 25 were cured (or rather more than 18 per cent.); the average yearly number of patients was 51; the yearly fresh admissions were 11; the yearly cures 2½. Many patients were discharged as 'relieved;' and I have some difficulty in eliciting any essential difference between these and the 'cured.' One instance of the latter is appended as a sample of the rest, but I dare not lay any stress upon it. As has above been intimated, the cure of leprosy seems to be much less feasible than that of syphilis, without the aid of mercury; and to be no more likely than that of scrofula, the true character of which affection is now becoming better known. After these brief statements, nothing need be added, but in a foot-note I must introduce a corollary of the Table which expresses, I doubt not but a part of the truth;\* and it cannot but be observed that 'cured' cases are almost invariably of the anæsthetic form, that they are young subjects (most often women), and have commonly been in hospital for a considerable time. It cannot be truly said that medical treatment has ever contributed to the cure.

CASES OF LEPROSY REPORTED AS CURED.

Table condensed from the Triennial Reports of Dr. Danielssen of Bergen.

| No.       | Sex. | Age.<br>Years. | Form<br>of<br>Disease. | Duration<br>of<br>Disease. | Hereditary<br>Taint,<br>or none. | Remarks.                                   |
|-----------|------|----------------|------------------------|----------------------------|----------------------------------|--|
| 1865-6-8. |      |                |                        |                            |                                  |  |
| 1         | F.   | 16             | A.L.                   | 6 years                    | None                             | In hospital 1 year. Treatment various.     |
| 2         | F.   | 19½            | A.L.                   | 1½ "                       | Taint                            | In hospital 3 years. Treatment various.    |
| 3         | F.   | 20             | A.L.                   | 3 "                        | None                             | In hospital 5½ years. Treatment various.   |
| 4         | F.   | 33             | A.L.                   | 1 year                     | None                             | In hospital 3 years.                       |
| 5         | M.   | 17             | A.L.                   | 8 years                    | None                             | In hospital 1 year. Iodid., iron, &c., &c. |
| 6         | F.   | 44             | A.L.                   | 1½ "                       | None                             | In hospital 2½ years.                      |
| 7         | M.   | 30             | A.L.                   | 2 "                        | None                             | In hospital 10 years.                      |
| 8         | F.   | 36             | A.L.                   | 3 "                        | None                             | In hospital 8 years.                       |

Note.—In column 4, A.L. stands for Anæsthetic Leprosy, and M.L. for Mixed Anæsthetic and Tubercular Leprosy.

\* During my visit to Bergen I had, as part of my duty, to inquire if the 'cures' happening there were ever known to be followed by 'relapse' of disease; and I learnt that such was the case. As this occurrence is matter of notoriety, I do not hesitate to record the following valuable information which is perfectly trustworthy and highly interesting. As the record of relapses of disease is not regularly carried out, the data bearing on this subject have to be specially sought in the numerous leper-archives,—a process needing much

arduous exertion. " Since 1868, to the present time, " there were dismissed as 'cured' 47 patients: of these " 13 (30 p.c.) are ascertained to have had a 'relapse.' Of " the cured, seven had nodular leprosy, 11 the mixed " form, and 29 the anæsthetic or nerve form. Of the " relapses—only seven instances are real relapses, and all " were of tubercular character, having had fresh eruptions " of nodules after leaving hospital; in three tubercular " and one anæsthetic cases, the 'relapse' is only a further " development of 'anæsthesia.' Of two nodular cases, it

Cases of Leprosy reported as Cured—*continued*.

| No.        | Sex. | Age—<br>Years. | Form<br>of<br>Disease. | Duration<br>of<br>Disease. | Hereditary<br>Taint,<br>or none. | Remarks.  |
|------------|------|----------------|------------------------|----------------------------|----------------------------------|---|
| 1868-9-70. |      |                |                        |                            |                                  |   |
| 9          | M.   | 13             | A.L.                   | 1 year                     | Taint                            | In hospital 3 years 7 months. Treatment various.  |
| 10         | F.   | 12             | A.L.                   | 1 1/2 "                    | Taint                            | In hospital 3 years 2 months.   |
| 11         | F.   | 29             | A.L.                   | 1 1/2 "                    | None                             | 5 years in hospital. Treatment various.   |
| 12         | F.   | 10             | A.L.                   | Unknown                    | Taint                            | 9 years in hospital.  |
| 13         | F.   | 23             | A.L.                   | 10 days                    | None                             | 1 year 3 months in hospital. Vapour baths, cupping steel.                                     |
| 14         | F.   | 19 1/2         | A.L.                   | 4 years                    | None                             | 1 year in hospital. Carbolic acid, vapour baths, cupping.                                     |
| 15         | F.   | 28             | A.L.                   | 2 "                        | None                             | 1 year 3 months in hospital. Vapour baths, cupping.   |
| 16         | F.   | 16 1/2         | A.L.                   | 2 1/2 months               | Taint                            | 1 year 7 months in hospital. Carbolic acid, &c., &c.  |
| 17         | F.   | 14             | A.L.                   | 1 year.                    | Taint                            | 8 months in hospital. Cupping, vapour baths.  |
| 18         | F.   | 22             | A.L.                   | 8 months                   | None                             | 1 year 5 months in hospital. Carbolic acid, &c., &c.  |
| 19         | F.   | 17             | M.L.                   | 5 years                    | Taint                            | In hospital 3 years. Treatment various.   |
| 20         | F.   | 5              | M.L.                   | 2 1/2 "                    | Taint                            | In hospital 7 years 8 months. Treatment various.  |
| 1871-2-3.  |      |                |                        |                            |                                  |   |
| 21         | F.   | 37             | A.L.                   | 3 years.                   | Taint                            | 1 year and 9 months in hospital. Carb. a., baths, &c.   |
| 22         | M.   | 26             | A.L.                   | 1 1/2 months               | None                             | 3 years and 10 months in hospital. Treatment various. The leprosy spots followed the measles. |
| 23         | M.   | 13             | A.L.                   | 2 years                    | Taint                            | 5 years and 4 months in hospital. Treatment various.  |
| 24         | F.   | 44             | A.L.                   | 4 "                        | Taint                            | 1 year and 3 months in hospital. Carbolic acid, &c., &c.                                      |
| 25         | F.   | 47             | A.L.                   | 6 months                   | None                             | 5 years in hospital. Treatment various.   |

CASE OF CURE (No. 19). *Mixed Tubercular and Anæsthetic Form.*—Dorothea Podersdatter Bothun, 17 years came into hospital 18th November 1865. Body tolerably well developed: hairs on eyebrows plentiful: on the cheeks some brownish-red spots, not elevated above the level of the sound skin. On the outer side of the arms the skin is felt to be somewhat thickened, by a muddy, brownish-tinted, pretty uniform infiltration; and on the fore-arms, where the skin was much marbled with distended veins, are seen some brownish-red spots of about the size of a silver dollar. The axillary glands are a little enlarged. On the thighs and legs are found large broad patches, which on the left thigh, *e.g.*, embrace almost the entire circumference of the limb; the patches have a deep red-violet or livid hue, are somewhat raised above the level of the sound skin, and retain their colour, though slightly paled, under pressure of the fingers. Where the skin on the lower limbs was free from spots, it had a lighter or darker marbled appearance in consequence of congestion of the cutaneous veins; and this was particularly noticeable upon the legs and below on the feet where venous ramifications were very numerous and distinct. The inguinal glands were tolerably enlarged. Sensation in the skin, good; no pains. The disease began about five years since with an outbreak of patches upon the legs, which was not preceded by any derangement of health: and since then the spots have steadily increased. Has always been hale and well; menses began two years ago, and have been both regular and abundant. She has seven brothers and sisters, of whom two are older than herself, and all are in good health: her paternal and maternal uncles were lepers. As cause of her disease, she mentioned cold

"is not known in what manner the relapse manifested 'itself.' Comment upon these statements is perhaps needless, but I must point out that it would seem in seven out of 18 cures of 'nodular' or 'mixed' leprosy, fresh disease certainly appeared, and in two others might have done, whence a proportion of nearly or quite *one-half* of return of disease. Probably this estimate is altogether under the mark, but if correct it would result that the seeming cure of nodular leprosy is very liable to be fallacious. Now, add to this fact, the statement

that tubercular leprosy is the form most successfully treated by 'specifics' and it will become evident, in an augmented degree, what is the true meaning of the terms 'successful treatment' and 'cure.' Dr. Hansen correctly insists upon the necessity of understanding that increasing 'numbness' may be a mere consequence of earlier nerve-disease, and is therefore no mark of true 'relapse;' but many of the Bergen cures were of young subjects, in whom leprosy does not often subside of itself.

and wet, specially applied to the feet. Since her eighth year, she has been in the service of a respectable and well to-do family, and has been well treated.

She was ordered small doses of sulphuric acid, sweetened, every second hour; and she had two vapour baths weekly. In the beginning of 1866 she complained of periodic rearing pains in the legs, for which the cupping-glasses were applied. On February 2nd she discontinued the mixture. The vascular injection was less, and the spots were paler in tint. She was then cupped on the patches, especially of the leg, almost every month; and by the 16th of November had had 23 cuppings: she then complained of pain in the right foot and left hand, which were swollen and tender to touch. The tongue was a little coated; and for this rheumatic affection, which afterwards extended to both hip-joints, she took acetate of ammonia and Dover's powder, and the swollen joints were wrapped in wool. On the 22nd she was already better, and discontinued the medicine. On the 23rd February 1867, it is noted that the spots on the face and upper limbs are wholly subsided; and on the lower extremities they are much faded. The glandular enlargements have decidedly dwindled down. In the course of this year and during the two first months of 1868 the cups were applied to the thighs and legs, in all 31, and under this treatment the spots wholly disappeared: her health was particularly good. The glandular swellings faded with the spots, and on the 6th June, it is entered that all the patches are faded away: the woman to all appearance was well, and on the 14th July she was written off as cured.

#### CONCLUSIONS.

1. The general treatment of leprosy is capable of mitigating many horrors of the disease: it may be the means of checking its progress, or of diminishing the frequency of febrile exacerbations and so preventing deeper implication of the system: it may permit of the disease proceeding quietly to its natural termination, but there is no evidence whatever that leprosy is to be promptly arrested, or in its character essentially modified, by any kind of general treatment. I would repeat that the more active symptoms may of themselves subside, and for 4, 5 or as many more years, the leper may remain, in the natural order of things, seemingly well; and then, a fresh outbreak happens in an almost spontaneous manner. Hence the difficulties in estimating the value of "treatment."

2. The internal exhibition of specific drugs has not been followed by any real assuagement of disease. Tonics at one time; defervescent at another; or alteratives and the like, have not proved of any permanent or particular value in leprosy; and some more active drugs have been found to be as injurious as other unfavourable influences. There is no evidence that 'oils' or 'mineral salts,' act upon the leprosy neoplasms which are known to exist within the frame; but until these deposits are neutralised or destroyed, there may be said to exist a possibility, at least, of the disease advancing.

3. The outward employment of penetrating lubricants which serve as the vehicle for conveying agents destructive to life, would promise to be of value, upon the supposition that there exists in true leprosy growths an organism strictly foreign to the body; and, as a matter of fact, it is certain that many such applications, or even simple oils (which are perhaps also fatal to the life of Bacteria, &c.), are followed by subsidence of leprosy tubercles and even seeming annihilation of them. But that the leprosy matter in the lymphatic glands (not to mention the deep-seated viscera) is destroyed by such means is unproven; and therefore the permanence of 'cure' is improbable. In short, all the phenomena which are exhibited under the use of medicinal agents, may occur from more general causes; and it has yet to be shown that such phenomena, whenever due to medicines, are specially indicative of permanent good.

#### PREVENTION OF THE DISEASE.

I now revert to the first paragraph of this chapter, and to the heading marked No. 1. "Prevention of leprosy by means of segregation of the affected individuals."

Time does not permit me to enter upon a discussion of this prime subject; nor is such debate necessary, since in my "Report on Leprosy and Leper-Asylums in Norway," &c., I have

mentioned for illustration, what has been done by the patriotic Norwegian Government, and with what beneficial results. There now no longer exists a valid plea against instituting state inquiry in India, as a necessary preliminary to the adoption of early practical measures, resembling, in principle, these European models.

In this place, it will be enough to reproduce the closing paragraphs of the Report above referred to, and to again draw attention to the unquestionable good which has of late been effected in Europe, and which there is every reason to believe would ensue in India.\*

#### SUMMARY AND SUGGESTIONS.

Having now concisely recounted the information which I have procured in Norway,—at the same time illustrating this new experience with what I had before acquired in India,—it may be convenient to offer, in conclusion of this Report, a summary of my observations, and a series of such suggestions as appear well-founded for application to India.

#### SUMMARY.

1. The malady currently known as leprosy has retained its prominent characters in all ages (as may be inferred), and in all parts of the world (as is actually known): in particular, it is at the present day almost precisely the same disease in both Norway and India, notwithstanding differences in position, climate, race, habits, diet, &c. of people; and, however originally introduced, it probably in both countries is maintained and propagated in the same manner.

2. In Europe the disease is now limited in its distribution to certain localities: having in most parts died out, or, as I think, been stamped out.

In the East it is still widely diffused, never having by Oriental rulers been recognised as a public evil, and in consequence never been subjected to adequate and determined check.

\* Being favoured by figures in anticipation of the Annual Report for 1873, I am able to append a complete enumeration of the number of lepers in Norway, from the date of the commencement of enumeration to the present time. These figures should be compared with those at p. 19 of my Report, and they entirely bear out the opinion of the medical authorities in Norway, that leprosy is steadily declining in that country.

TABLE.

| Date A.D. | Number of Lepers. |
|-----------|-------------------|
| 1856      | 2,850             |
| 1857      | 2,779             |
| 1858      | 2,783             |
| 1859      | 2,798             |
| 1860      | 2,758             |
| 1861      | 2,743             |
| 1862      | 2,716             |
| 1863      | 2,695             |
| 1864      | 2,688             |
| 1865      | 2,660             |
| 1866      | 2,644             |
| 1867      | 2,612             |
| 1868      | 2,566             |
| 1869      | 2,481             |
| 1870      | 2,355             |
| 1871      | 2,303             |
| 1872      | 2,025             |
| 1873      | 1,856             |

The explanation of this important fact which is so full of meaning with reference to the needs of India, seems to be two-fold, thus disease is checked by abstracting from the leprosy population, first, possible progenitors of a diseased offspring; or, second, so many foci of contagion whence fresh individuals might become affected. Rationally, the last view seems the best-founded; but whatever theoretical opinion be adopted, the fact remains, that quite independently of changes in other changeable conditions, such as diet and habits of the people, leprosy has begun to decline here just as it did in Europe generally during the middle ages, and, as I think, from the same causes now as then.

There are below appended, besides two maps, a plan and a view of the asylum at Bergen, known as No. 1; and from them will be seen the kind of buildings which the state supplies in Norway. How different to the old leprosy-houses!

3. Purely medical treatment of the disease has everywhere, hitherto, been successful only within marked restrictions; and therefore it is all the more desirable that increased attention be given to this subject by physicians, with the aid of past experience and modern appliance. As was long since done in Norway, and that with unquestionable benefit, so should there in India be erected leper-hospitals for the special and thorough study of this malady, as presented for treatment by appropriate instances.

The local differences of conditions renders all the more needful this separate investigation in the East, where the more amenable forms of malady are common, and where European skill has never yet been fairly brought to bear on the affection on a sufficiently large scale.\*

4. Prevention of the disease is of paramount importance, and to this end the co-operation of the Government and lay element of the community is needful; whatever else were the sanitary short-comings of our ancestors, the measures publicly adopted, and by authority enforced, in Great Britain and in most of Europe, seem to have been co-efficient, to say the least, in eradicating leprosy. The kingdom of Norway having, however, been deprived of the means indicated, leprosy still prevails as a complaint; showing here, as in other countries, no natural tendency to subside†; but since the erection under modern enlightenment of suitable asylums, this disease has been arrested, and, so far as can be judged, it is now diminishing in a ratio which must increase with advancing years.

The application of these remarks to India needs no enforcing by me; for the illustration appears of itself sufficiently obvious to induce conviction of the need and the value of leper-asylums as conducted at the present day.

5. In Norway, both hospitals and asylums were erected, and are managed, under special guidance and advice. They appear to be admirably adapted for their purpose, and their influence may be estimated by reference to the official statistics, and to public opinion. With reference to leper statistics, the Norwegian Government wisely undertook a yearly registration of all known lepers in the country, dating from the time of establishment of asylums; for, by this means, not only is needful information acquired, but public attention and interest are aroused, inquiry excited, example copied, skilled advice followed, and in short the people are educated (as it were) to co-operate with the authorities and the profession.

Hence, the intention of the Government being obvious, confidence has grown up and coercion is needless.

6. At the present day in no other part of the world, so far as I am aware, are there equally complete, well conducted, and successful leper-asylums as in Norway; and the physicians in charge are often eminent men, versed in modern science and of European repute.

These advantageous conditions form a most striking contrast with what is known of the arrangement and direction of the lazarettos of old. They arise, of course out of the circumstances of the case; here is a decisive experiment, conducted in the eyes of watchful Europe by a nation

\* There may be, too, indigenous remedies—which abound in common repute—deserving of careful trial at unprejudiced hands.

† Danielsen and Boeck: *Traité de la Spédalskhed*, 1848, p. 184:—

“A la même époque où la spédalskhed, par les mesures énergiques opposées à sa marche, est devenue plus rare dans toute l’Europe, elle a continué à sévir dans notre patrie, elle n’y a pas été combattue avec

autant de fermeté que dans les autres pays, et, par cette raison, elle y apparaît encore de nos jours à un degré inquiétant.”

These authors had previously remarked, p. 182:—

“Sous les Croisades la spédalskhed s’accrut dans une proportion effroyable, et força à des mesures extraordinaires déjà signalées. Par suite de ces dispositions, la maladie au XV<sup>e</sup> et surtout au XVI<sup>e</sup> siècle, se mit à décliner graduellement en Europe.”

which, though small in numbers, has yet acquired a high position in the intellectual ranks of the age. No haste or apprehension preceded the establishment of asylums in Norway, but on the contrary, the greatest deliberation; and I conclude this summary with an enumeration of the heads of the several clauses in the Report of the original Committee appointed to advise the authorities there. The Report is dated Christiania, 31st December 1838.

1. Both kinds of institution (*i.e.*, hospital and asylum) ought as much as possible to be constructed in the same place, and with regard to economy and management to be placed in connexion with each other.
2. Other cases of skin disease may also be admitted into hospital, should there be room.\*
3. The buildings should be erected where provisions can most easily be had and the readiest means of communication.†
4. The hospital should be constructed after the same plan as an asylum, and with ample accommodation.
5. In both institutions the sexes to be separated.
6. Besides large wards, there ought to be some smaller nose for single patients.
7. Ample bathing accommodation is indispensable.
8. There should be separate work-rooms.
9. There should be separate exercise-grounds.
10. There should be abundance of light.
11. Plenty of warmth.
12. Regulates latrines.
13. The food is to be purchased day by day.‡
14. Regulates the establishment, economy, &c. &c.

So far as I have seen, all these recommendations have been faithfully carried out, and the spirit of them I conceive to be excellent.

#### SUGGESTIONS.

All theoretical considerations apart respecting the origin, cause, or nature of leprosy, it is practically found that the spread of the malady may be arrested.

Having now shown what plans were designed and have been executed in Norway for checking this scourge, and having also pointed out the good results which already appear from these wise and benevolent means, it may be fitly suggested that the example thus set is worthy of being followed wherever occasion demands.

Now the condition of India is, I submit, precisely one that calls for efforts on the part of its rulers, similar to those just referred to.

Objections of various kinds will arise to the course suggested; thus it may be said that the natives themselves have not asked for the intervention of Government: that the majority of executive and other officials have not expressed the necessity for intervention: that the design of leper-asylums for the whole country is novel, costly,§ ill-suited to the character of the people,

\* This clause may be regarded as optional; for skin diseases, I may observe, are frequent in Norway.

† In my opinion, the site should be selected with a view as well to salubrity of air, &c.; and not, if possible, in the heart of a leper-district.

‡ A regulation of local force, and serving probably to check the consumption of stale fish, &c.

§ It is true that active interference with the leprous scourge in India has a larger significance than in the

case of Norway; for while there existed in the latter country (in the year 1867) 2,497 lepers, there were at the same date in a part only of the Bombay Presidency no fewer than 8,220 lepers. In Norway there were in five asylums 780 lepers segregated: a similar proportion for the whole of India would obviously entail immense accommodation. The magnitude of the interests involved hence clearly appears, but not less evident, I think, is that of the evil sought to be eradicated.

and after all not certain of success : and that for carrying it out special agency might be required ; perhaps fresh laws needed.

I do not propose to answer these and the like objections, at the end of a Report which in itself contains, or points towards, a well-nigh ample reply.

It may be sufficient to state, amongst other valid reasons for the interposition of Government, that the malady under notice is an altogether peculiar one in severity and extent, and claims special consideration : that British rule in India would benefit itself and subjects by an intervention to be recommended on grounds of both policy and humanity : that delay is to be deprecated, and that the present time is well suited for enlisting the co-operation of the people, who are tolerant only from an ignorance which it is our duty to dispel by open, deliberate, and rationally founded action.

The endowment of charities is especially an Oriental gratification ; and amongst the fittest of charities would rank leper-asylums.

I venture once again to indicate the value of the experience acquired in Norway, for the illustration which the measures adopted there afford of the direct and indirect value of suitable leper-asylums, is one not only clear and decided, but in reality, it is one hardly known abroad in Europe.

It greatly strengthens the views of the few but able men, who have advised their Government to deal with the leper by special provision.

With this statement of opinion I might conclude, under the conviction that due attention will not be withheld touching a subject hitherto passed over, but which to India is of real and even urgent importance,—which is an essential item of the schemes of benevolence by tradition, and by promise, due to the country from her more enlightened rulers—which by its wise and liberal disposal in a practical manner, might prove a blessing to nations in the East, other than the Hindoo—and which in light of this new experience emanating from the most recent and trustworthy source hitherto known, cannot be longer disregarded without prejudice to ourselves.

The importance of the subject is commensurate with its scope and character ; the principles concerned have, I conceive, been sufficiently established in both Norway and India ; nay, further, there are practical measures of ascertained value which require but slight modification to become available for India. I therefore propose :—

1. That *Leper Statistics* be collected for the whole country ; and that a *Leper-census* be made yearly for, say, 10 years, in such districts as appear to be most considerably affected ; both to be done under medical supervision.
2. That the worst districts be visited by a *Commissioner* or *Inspector*, for the purpose of systematically inquiring into the conditions under which leprosy arises and persists ; and that he be duly equipped with means of investigation.
3. That without delay, a permanent *Leper-Hospital* be established in or near to those localities where disease abounds.
4. That provision be made for the erection of *Leper-Asylums* in places already well-known to be infested with lepers. It must, however, be expressly understood that no very temporary or merely experimental plans will be of avail. One can hardly hope for more favourable results in India than in Norway ; but half-measures would be fatal to this degree of success.

Finally, the recommendations now made could not, I think, be suitably carried out through either the provincial Sanitary Commissions, or by the Agricultural Department, or by the Cholera Commission, as an addition to duties already undertaken: for they concern a special subject, needing special knowledge, close attention, and continuous observation for its elucidation.

Yet not less singularly hopeful may be results, for before general sanitation is perfected, or cholera arrested, the scourge of Leprosy in India might be stamped out, as it has been elsewhere.

H. VANDYKE CARTER.

November, 1873, London.

*Note.*—Her Majesty's Colonial Office continues to pursue the practical inquiries some time since originated; thus, while these sheets were passing through the press, I have learnt the following important and encouraging proceedings, which may well be noticed in this place: *Circular.* Downing Street, 4th September 1873; addressed to the Local Governments in the West Indies: " Paragraph 17. The fact that leprosy is transmitted " from parent to child is indisputable, and as leprosy " by descent is often, through a natural error, mistaken " for leprosy by contagion, the members of one family " being naturally in contact, it is important that this " fact should be borne in mind. It is a fact which

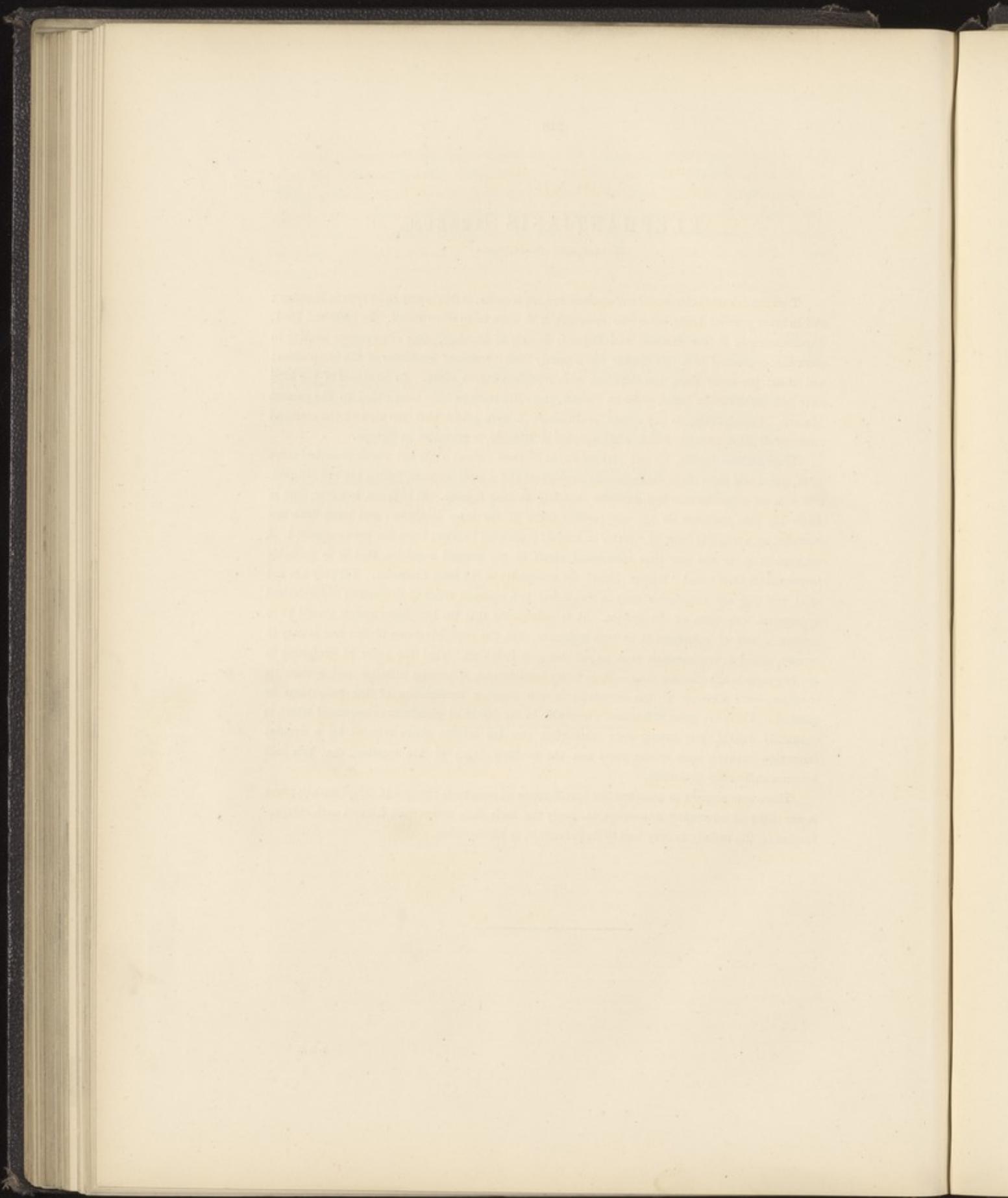
" points also to the expediency of placing asylums for " females at a distance from asylums for males, when " circumstances permit and when the numbers are such " as to justify separate establishments." In quoting the above remarks I do not necessarily endorse all that they contain, but I am glad to find the views which are not above advocated for the first time, or second, seem at length likely to be adopted by Her Majesty's Home Government, and also by the Royal College of Physicians of London. Yet in Norway they have long been recognised and acted upon, and they were independently promulgated in India.—H. V. C.

## ELEPHANTIASIS (ARABUM).

THIS remarkable affection of the scrotum and lower limbs, is frequently to be seen in Bombay ; and in other parts of India, upon the sea-coast, it is even more often found. In 1860 and 1861, I communicated to the Medical and Physical Society of Bombay, some observations tending to show that connected with this disease was a purely local 'varicose' condition of the lymphatics ; and about the same time, the drawings here reproduced were made. As no others of the kind have been published in India, so far as I know, these illustrations have been added to the present Memoir. Subsequently to my return to England, I have learnt that the view of the essential anatomy of Elephantiasis, which I had adopted in Bombay, is prevalent in Europe.

Elephantiasis occurs, though very rarely, in Norway ; many years ago Boeck described cases of it, and I saw there some characteristic photographs of a later instance, during the last autumn. But it is not supposed that this affection is allied to true leprosy. It happens, however, that in India the two maladies do not very seldom occur in the same localities ; and since both are attended by a singular form of 'fever,' a kind of connexion between them has been suggested. I consider it to be not the least interesting result of my present inquiries, that it is probable 'elephantoid fever' and 'leprous fever' are essentially of the same character. Yet they are not alike, and they are comparable only as belonging to a common series of complaints characterised by repeated infections of the system. It is noteworthy that the lymphatic system should be so marked a seat of enlargement, in both instances ; but the comprehension of this fact is easy in leprosy, whilst in elephantiasis it is as yet obscurely indicated. That the order of symptoms in the two cases is alike, seems clear,—there being simultaneous glandular irritation and systematic re-action,—and advance of the complaint is the common termination of the paroxysms in question. There are great differences observable in the degree of glandular enlargement which is outwardly visible, but having once established (*see* the articles above referred to) a decided connexion between such enlargement and the swelling (*e.g.*) of the scrotum, &c., this fact becomes sufficiently indicative.

There now remains to complete the investigation of structural changes in Elephantiasis ; and in the light of advancing knowledge, to apply the facts thus ascertained towards such comprehension of the malady as may lead to its prevention or assuagement.



## APPENDIX A.

### RESEARCHES IN NORWAY.

1. THE following observations embody the earliest results of Dr. G. Armaner Hansen's labours, and were first published in the 'Norges Officielle Statistik' issued in the year 1869, being a portion of the Annual Report (1869) of the Pleistiftelsen for Spedalske No. 1, at Bergen, to which Asylum the author had recently been posted for duty. They represent, therefore, the first fruits of a thoroughly scientific investigation of Leprosy, which has not been interrupted up to the present year (1874); and which has led to discoveries and to practical considerations, of a value exceeding any that had been, for years before, made known in Europe.

Respecting the materials of Dr. Hansen's essay, the author remarks in his official report that 37 deaths had occurred at the Bergen Asylum, in 1868; and that of the autopsies which were performed, "10 were duly recorded in full; of the others, which for various reasons were more or less incomplete, I have notes only of the more interesting discoveries." Examination of leprosy tubercles extirpated from the living subject, was conjoined with post-mortem researches; and this means has turned out to be singularly instructive. The following translation is almost a literal one, and was made specially for this work:—

PRELIMINARY CONTRIBUTION respecting the CHARACTERISTICS of LEPROSY.—By G. A. HANSEN.  
(Nordiskt Medicinskt Arkiv. Band 1. No. 13. 1869.)

In the following remarks, I shall briefly state the results of my anatomical researches, founded on autopsies of leprosy subjects, and on examination of affected parts removed during life.

Omitting for a time, a more detailed description of the 'tubercles,' I shall here more particularly mention their ramollissement, and its resulting structural elements. When a tubercle softens, the change begins either over a diffused space, or at one spot, generally near the centre of the mass. The colour here is yellowish-brown, and in sharp contrast with the surrounding parts; whose appearance is a bright white, and glistening as if moist. At a further stage of softening, there is not seldom found a cavity filled with detritus of a reddish-brown tint; the colour being due to effused blood, some of the red corpuscles of which remain almost unaffected. Such a softened part consists, almost exclusively, of more or less deep-yellow, or orange-coloured elements, whose form and size are very various; and some of which may also be detected in places outside the focus of softening. I have in vain sought for them, in firm and growing tubercles; whilst they occur in great number and variety of form, in the centre of emolliation, and in its immediate vicinity.

At the commencement of softening, one finds round, oblong, and spindle-shaped cells, with or without offshoots, and inclosing, besides a nucleus, one or more large and small, round, yellow, granular masses. Both nucleus and clear part of cell are coloured by carmine, whilst the yellow masses retain their tint unchanged. Sometimes the masses lay in a cavity in the cell; and this latter may, when it contains a single mass, present the appearance of a signet-ring, having in its centre the tinted mass. Whilst in some cells the masses lie quite distinct, in others they have no defined limit, and seem to be amalgamated with the rest of the cell. Without the aid of carmine-staining, the nucleus is in most cases difficult to detect amidst the masses; it sometimes presents a sharp, clear contour, regularly oblong or round, and sometimes its margin is irregular—it seems shrunken, and often compressed. Along with these, other cells are found, entirely corresponding in form, with their protoplasm partly clear, in part finely-granular, coloured by carmine and sometimes more or less filled with fat-granules. With more advanced softening, the appearances are more various; the colour is a more intense yellowish-brown; rounded masses or corpuscles are found, varying in size from one quarter of the size of white blood cells, to six or eight times as large, and giving the impression of being set free from cells like those above described; and this idea is confirmed by the presence of large agglomerations of such masses, often merely adherent to each other, but often also inclosed in a colourless envelope. In the interior of these compound masses I have not been able to detect any nucleus, and this is easily explicable, since even if any such existed, it could only be seen in profile, on account of the density of the mass. Corresponding to the above-named signet-ring-like cells, I have found large orange masses surrounded by an extremely thin enveloping material, having an elevation on one side; but in this spot I was unable, in the fresh state, to discern any nucleus, and have not been fortunate enough to hit upon one in a carmine-tinted preparation. In large as well as in small examples, there is frequently to be seen, in the centre, a space like a vacuole with clear contents; and this is sometimes of such considerable proportions that round about it nothing is left but a very narrow brownish ring. Almost always, a very sharp boundary is present: the interior is variously granular, and all parts, besides being minutely-granular and deep-tinted, are more or less translucent. Across the most clouded and dark-tinted specimens, other underlying elements may be clearly enough perceived; and this is most apparent, in the more monstrous forms. Such large elements,

in their simplest shape, have the appearance of an homogeneous mass, indented at the middle like a dumb-bell, or further indented as a trefoil; and the larger the mass, the more numerous these constrictions, with their corresponding hemispherical prominences, whose number in the largest specimen I have seen, was more than 20. They are elastic and tolerably tough. As seen either in motion or at rest, the outlines of the projecting hemispheres on their under surface are clearly visible. Respecting the history, and mode of origin, of these bodies; whether, that is, they are produced by enlargement of smaller elements, or by amalgamation of several of such, I have not yet come to any conclusion.

These are the same elements as are delineated (less correctly however) in Superintending-Surgeon Danielssen's work (1862), and by him described as characteristic results of the leprous products.\* Danielssen regards them as pigmented clusters of fatty granules; and such Virchow, in confirmation of Danielssen's statement, declared them to be. In 'Die Krankhaften Geschwülste' (Pathology of Tumours), v. 11. p. 530, Virchow mentions cells from the testes, which attained "die Grösse von Eizellen und den Habitus wahrer Riesenzellen, so dass manche mit ihren grossen vacuolen fast den Eindruck von Infusorien machten,"—"the dimensions of yoke-cells, and the characters of true giant-cells, so that some with their large vacuoles almost give the impression of Infusoria."

Hitherto, I have not come across a leprous testicle, but Danielssen asserts that there frequently occurs in such organs a variety of these elements of large size, which is doubtless the same as described by Virchow; and I have not yet found myeloplasmic cells, such as are seen in tubercles (strumous) and sarcoma, for example, although in leprous products multi-nucleated cells are often met with. I have never seen nuclei in these large leprous elements; and they are not coloured by carmine, as are myeloplasmic cells. I shall hereafter discuss their final stages, and comportment with re-agents.

At the same as I, during my earliest examinations of the morbid products in leprosy, almost constantly, and to my astonishment, met with these peculiar structural elements, Dr. Hjalmar Heiberg (of Christiania) communicated to me the fact of his being surprised at the appearance of the same structures, as taken from a leprous tubercle on the eye-ball; and he regarded them, also, as something peculiar. By an interchange of specimens, we have become aware of the identity of our observations. The above description is taken from preparations examined in Iodine-serum, and either removed from the dead body or extirpated during life.

As is well known, those *lymphatic glands* which are connected with the portions of mucous membrane and skin, becoming affected in tubercular leprosy, are apt to be decidedly swollen. Sections of such glands then present a characteristic appearance; the cortical ampullae forming yellow, yellowish-white, or white, opaque masses, more or less separated from each other by means of the septa passing inwards from the capsule; and the medullary gland-substance is seen to contain a network of anatomising lines having a similar yellow tint to the above-named cortical ampullae. There is often seen, too, a reddish-brown streak surrounding these ampullar dilatations along the interior surface of the capsule and its septa; and this appearance is most pronounced when, at the same time, many of the tubercles in the skin, &c. are found to present extravasation of blood at their softened centres. On microscopic examination, both ampullae and medulla of the glands are found to contain numerous lymph-cells, which for the most part are colourless, but sometimes are intermixed with the large brown leprous cells, often with vacuoles in them; and the more the disease has advanced, the more commonly are present collections of fat granules, and large or small oil drops. The appearances are identical in the Cervical, Axillary, Cubital, Inguinal, and Popliteal glands.

In the *Lungs* (still referring to the tubercular form of disease), frequently lobular pneumonia and cavernous excavations are to be seen; and in these cases, the swelling of the bronchial glands has nothing peculiar about it.

In the *Liver* is often found amyloid degeneration. At the same time, or when this is absent, the surface of the liver frequently presents a peculiar aspect, that, namely, of whitish dots scattered at tolerably regular distances over the whole surface, and distinctly visible through the smooth and unchanged capsule. On section, similar points are seen, and streaks, sometimes branching; and, so far as I have noticed, always distinctly situated between the glandular acini. When the organ was not, as well, in an amyloid condition, I have found it to be of normal size; the left lobe once very thin, with sharp, free margins; consistence tougher than usual; plenty of bile in the gall-bladder. The lymphatic glands in the 'Porta Hepatis,' have, in all these cases, presented the same appearances, both general and microscopic, as above described with reference to the external glands. Microscopic preparations of the liver show alongside the blood-vessels in Glisson's capsule, partly simple round cells of the size of lymph-cells, partly also great cells, and rounded masses like those of leprous character; and partly fat-granules or oil-globules. The stroma in the acini seems also, as well, to be augmented in thickness; sections of fresh preparations are pencilled with facility. Other details have still to be worked out.

*Spleen*.—This organ often is amyloid, yet I have several times found it to be of normal dimensions, with a strikingly dry cut-surface, of grayish colour, and once with numerous whitish dots and streaks; consistence

\* They are, too, doubtless, the same as the large, irregular, and branching cells, filled with large particles, which I found in Bombay to be present in leprous tubercles, and had figured in my earliest communication to the Medical and Physical Society, 1862. See also Plate XIII, figs. 1-4, &c.

normal. Microscopically, are found numerous, large, many-nucleated cells, the same yellowish-brown leprous elements, together with fat-granules and oil-globules. The morbid changes seem to have their seat partly in the follicles and sheaths of arteries alone; partly, also, in the pulpy intervacular reticulum. The small lymph glands situated in the hilus of the spleen, have I twice found to be swollen, and presenting the same appearances as do the external glands.

In the *small and large intestines* were once observed numerous ulcers, in every way corresponding to those of a tubercular nature; and the associated mesenteric glands showed anatomical changes, identical with those belonging to tubercular or scrofulous glands. Amyloid degeneration of the villi, and of the smaller vessels, as well in both large and small intestines, have I several times met with.

Besides tubercles in the conjuction grown into the cornea and sclerotic, with, too, nodules in the iris, I have found in one eye an affection of the ciliary processes and the conjoined part of the retina, without any simultaneous external formation of tubercles; in which the same elements as in the latter, existed in the stroma between the choroidal veins and in the retina, partly in groups, partly separate, and, as far as I could ascertain, chiefly implicating the internal granular layer. During life, were noticed the characters of iritis, the pupil being angular, and its borders adherent to the capsule of the lens: the anatomical diagnosis of iritis was doubtful.

As for the ANÆSTHETIC form of leprosy, opportunities of post-mortem inquiry are fewer; and the subjects examined, have all been in a very advanced stage of disease. Consequently, no patches in the skin were seen; the lymph-glands were always shrunk, and more or less fibrous in consistence; the affected nerve-trunks were also shrivelled, and below normal thickness.

In two instances of the *blended or Mixed* form, I found the *ulnar* nerve thickened, and on section being made in a line with the broad streaks of the thickened neurilemma, the former are seen to have a decided yellowish tint; and the fasciculi of nerve-tubules hardly project at all on the cut surface. Such section was comparatively easy to make, in the fresh nerve. Here, too, were found the same elements as in the tubercles; and also the same, in a cutaneous patch taken from a subject affected with mixed leprosy.

In neither *Brain* nor *Spinal marrow*, have I come upon anything abnormal.

Also in this form, lobular pneumonia and cavernous excavations in the lung, seem to be frequent in an advanced stage of the disease; and the same is the case with amyloid degeneration of the abdominal viscera.

Any affection of the liver and spleen resembling that now described as occurring in tubercular leprosy, have I not detected. On examination, too, of two necrosed fragments of bone, nothing peculiar was noticed.

In both forms of leprosy the *kidnies* are almost constantly affected; there being present either amyloid degeneration, with thickening of the stroma and widely patent uriferous tubes, but only a scanty amount of fatty matter in the epithelium; or simply the last-named, without amyloid affection of the vessels.

The frequent occurrence of this last-named kind of degeneration was to be expected, in consequence of the long-standing ulcerations of leprous tubercles, and the frequent necrosis of anæsthetic parts; and also its happening at an early period, in the tubercular forms, is explicable, since numerous ulcerations here generally supervene after a short duration of the disease. These events, taken in combination with the copious leprous productions, which unquestionably destroy, to some extent, the functions of a large part of the lymphatic glandular system, and probably also often of the spleen, afford a satisfactory explanation of the comparatively early supervention of cachexia and death, in the tubercular form of leprosy.

From the preceding statements, it will be gathered that I am disposed to regard the structural elements first described, as characteristic of leprous productions. I have already stated that their occurrence, is indicative of degeneration of the leprous tubercles; and there remains to consider their final stage, that, namely, of passage into a fine detritus, or into fatty matter. Earlier forms, cells with yellow masses in them, are quickly destroyed by potassic solution; those somewhat older, longer withstand its action, but finally lose their colour, and break up into pale, finely-granular fragments at the end of 12 or 24 hours. Many of the masses seem to contain a few oil-globules, of varying size. Next supervenes the distinction that some, and especially it would seem the great monster forms, become more and more opaque, retaining meanwhile their granular appearance, and, from being easily moved, elastic and rather tough, become rigid, shrivelled, and friable; thus acquiring a general resemblance to the large masses of detritus, which are of such dimensions as to be visible to unaided vision. They retain their defined contour and globular protuberances; are always surrounded by smaller forms, and have passing between them the well-preserved blood-vessels, which I have often found to be full of blood corpuscles. In this stage they are white by reflected light; by transmitted light the colour, on account of their opacity, cannot be made out, but when they have been kept some time in slightly diluted glycerine, they present the light yellow tint, which is their common character. Others, and noticeably those of rounded shape, are filled with fat, which exists either as granules or as globules, and which in great part retain (especially when the masses are of small size), the brown colour as seen by transmitted light. This is evident more particularly in the liver, when there is present, at the same time, fatty infiltration of the liver-cells; among the free floating oil-globules, it is easy to see whence they are derived. The addition of potassa destroys these differences. Moreover, such masses as

previously showed a vacuole, retain this after their fatty degeneration, and their relation to the alkaline re-agent makes it doubtful, whether or not the entire ring is fatty; thus, when the potassa reaches them, the vacuolar contents swell up, burst through the ring of enveloping material, and flow out; there remaining behind a curved fatty streak, which afterwards again may collect into drops. The more fatty matter is present, the whiter the aspect in reflected light. In the lymphatic glands, one may pretty accurately estimate the microscopic appearances, from unaided inspection alone. That not all parts are mere fat, notwithstanding their behaviour under the influence of potassa, will appear from the following facts:—Three sections of fresh nodules and lymph-glands, showing large portions degenerated into fat, being first treated with alcohol and then boiled in ether, there remained behind only coarsely-joined, shrivelled, partly still granular and faint-tinted masses, which have much in common with amyloid structures; after being thus dealt with they are not coloured by carmine. Adipose tissue similarly treated at the same time lost all its fat.

I entertain no doubt that these elementary bodies, are the result of a necrobiotic process, and it may be considered as probable, that there is some peculiar property in them, which is connected with such process; but I am not acquainted with any either described, or conceivable, structures or properties, which quite correspond with the forms in question, and with their constant peculiar tinting. I will now mention the grounds on which I suppose, after close observation, that such peculiarity, as is here intimated, really exists. These anatomical changes in the external glands are wholly different from those to be found in other swollen or enlarged glands, as described by Billroth (Virchow's *Arkiv*. B. xxi.), and as observed by myself, in preparations taken from cases of necrosis and chronic ulcerations; and, thus, there can hardly be any reason to deny that here is a specific leprous affection. If one next turns to the affections of the liver and spleen, one cannot but suppose—even without paying regard to the appearance of the brown elements—from the fact of their connection with the small round cells, from the many-nucleated cells with their degeneration into fat granule masses, and from the conjoined state of the lymphatic glands, that these affections are of leprous character. When, besides all these, one finds certain peculiar looking structures—brown-tinted masses—the conclusion seems inevitable, that here are altogether specific leprous products. The same remarks apply to affections of the ciliary processes and retina, in the eye.

Furthermore, these peculiar elements do not, so far as I have yet learnt, make their appearance in ordinary necrobiotic processes happening in leprosy, as, for instance, in destroyed portions of lung or intestine; nor are they found in superficial suppuration of the tubercles, such suppuration being quite unconnected with the process of softening, which occurs independently of superficial ulceration, and within the centre of the tubercle. I once found in an abscess of a leprous lymph-gland, numerous cells filled with fatty matter, but nothing peculiar was detected.

Continued observation will, it is to be hoped, add stability to our views.

In a clinical point of view, it would be of much interest to ascertain, whether or not there exists a connection, between the above-described affections of the liver and spleen, and the well-known clinical entry, "fever without eruption." This, evidently, is often due to the frequent occurrence of limited pneumonia, and the formation of cavities in the lungs; but there happens a form of fever attended with only slight elevations of temperature, and with daily recurring chills, upon which quinine seem to have a favourable influence, and which may possibly stand in close connection with these internal complications. Since my attention has only quite lately been directed to this subject, I have as yet nothing trustworthy to mention respecting it.

As concerns eye affections in leprosy, it has been already stated that there occurs an *iritis* or *irido-cyclitis*, quite independent of the formation of tubercles. There were two cases in the asylum when I took charge; both patients had eruptions, and, as one of them died, this gave me an opportunity of anatomical examination. In the other patient, there were already numerous adhesions between the pupillary margin and the lens, and since on them atropine had no effect, nor the combination for some months of local cupping, iridectomy was performed. Although the affection subsided immediately after the operation, it is yet uncertain if this was not superfluous. The same individual, indeed, had for a time iritis in his other eye, without any attendant eruption; and this iritis has now suddenly begun to improve, after remaining for a whole month quite unchanged. Only atropine (gr. iv.— $\frac{1}{2}$ .) is used, dropped in at first every hour or half hour, afterwards more seldom; with the effect of alleviating pain, and keeping the pupil in a state of semi-dilatation, but nothing more. This subsequent amendment, may well represent the typical course of the affection. Two other cases had a far quicker termination; the complaint having subsided in the course of 14 days, under the employment of atropine. Of one of these, it may be remarked that the iritis began with such slight symptoms, that the patient had not complained; and I only accidentally noticed the affection, after it had already advanced to the fixation of the pupil of both eyes. Atropine had the effect of liberating the pupil of one eye. At the same time, there was present a slight eruption; and the eruption and iritis, advanced and retrograded together. I have thrice performed iridectomy on account of atresia of the pupil, the consequence of previous iritis. One patient had also a tubercle on the cornea, which involved about a third part of it; and here the result was less favourable, because the wound led to an opacity of the cornea, which left but a small clear portion for sight. When a tubercle grows into the cornea, the unaffected part of the latter may retain perfect transparency, and the iris may be unaffected; but, not seldom, one finds attachment of the edges of the pupil. In

one such case, I have done iridectomy inwards and upwards in both eyes, with the result of aiding the patient's vision, until the tubercles grew over the opening of the iris. As the tubercles always begin about 1-2 lines outside the margin of the cornea, and according to Dr. Hjalmar Heiberg's observations, are originally very superficially placed in the conjunctiva, thence spreading inwards to the sclerotic and cornea, it might be worth while inquiring whether extirpation or tattooing, would not destroy them at their beginning. I have only once had occasion to try this: a nodule, the size of 3-4 pin's heads, still growing, was thoroughly treated with nitrate of silver about three months since. A slight opacity of the cornea followed; but it soon subsided after the caustic was expelled, and now there is no mark of either tattooing or tubercle. In one patient, the tubercle began to develop on the iris, starting from the angle between the iris and cornea; there was, too, an hypopion lying obliquely in the lower and outer part of the anterior chamber; here I made an iridectomy straight through the neoplasm, under the idea that the nodule might cease to grow, if the ordinary route of development were cut off, and at present (one month after the operation), the sight is good. Healing of the wound proceeded quite satisfactorily.

All wounds heal very quickly, as is known, in lepers. I have a good many times, snipped clean off tubercles in the skin; and even if the section passed through the centre of softened parts, yet complete healing within a week and without any suppuration, has, as a rule, followed after the simple application of styptic collodion. The rapid closing of artificial wounds in anæsthetic leprosy, appears still more marked in contrast with the almost absolute incurability of the spontaneous, atonic ulcerations. I have taken away necrosed and carious bone, such as the ossa metatarsi and tarsi, in 16 instances; and in all, healing of the wound has proceeded, almost without suppuration, remarkably quickly. As an illustration, I may mention a case from St. Jorgen's Hospital, where a patient for a long time has had suppuration, with fistula and exposure of the astragalus and lower end of the tibia; having made a long incision on the inner side of the joint, I scraped off the periosteum of the bones, as far as could readily be done, and with a chisel cut through the lower end of the tibia, and upper part of the astragalus. On the first day, the wound was dressed with Balsam of Peru; some suppuration followed, with sloughing of cellular tissue; water dressing was afterwards used, and suppuration soon diminished. One could both see and feel the exposed bone, now covered with granulations, and in the course of six weeks, healing was complete, notwithstanding that splints, &c. were never employed.

'FURTHER CONTRIBUTIONS towards a KNOWLEDGE of the CHARACTERISTIC FEATURES of LEPROSY (Spedalskhed)

—By G. A. HANSEN. With two plates.

(Nordiskt Medicinskt Arkiv. Band 2. Nr. 16, 1870.)

Respecting the denominations of the disease, as the name 'Elephantiasis,' which is employed by Danielsen and Boeck, continually leads to mistakes, and besides has an uncouth sound, especially in its adjectival form, I prefer the term 'Lepra' as the most manageable among legitimate names; and the rather, because in our days no misconception appertains to the term, or at least none so considerable as in former times.

I shall begin with a description of anatomical characters, joining therewith some remarks on clinical phenomena; and then try to give a connected view of the whole disease.

*Skin Affections.*—The tubercles (or nodules) are partly cutaneous, partly sub-cutaneous. The first-named are situated just under the papillary body, or occupying it as well as the subjacent cutis. They are much disposed to ulcerate, especially after a time, during which the condition is one of quasi-ulceration; and they are then covered with a thick brown crust, so strongly adherent as to lead to bleeding, on its separation. The underlying tenacious secretion consists of round cells, seemingly not mobile; of a little epithelium, and of innumerable granules. It is sometimes so abundant, however, when the tubercles are rapidly growing, that no crust is formed, and the surface is bright red, like that of a granulating ulcer. On microscopic examination one finds, indeed, that the whole surface is covered with a single or double layer of large epithelial cells, whose form is most irregular, and which are provided with long and narrow, or broad and flat prolongations, but in a few parts of limited extent this epithelium investment is wanting or broken through, as it were; and at these spots, ulceration of the tubercles goes on, without, however, being attended with such diminution in their size, as results from a previous softening of the centre or base of the tubercle. Those solitary tubercles situated below the papillary body, ulcerate far more seldom. The process here is attended with rupture of the covering of the softened mass, so that the latter comes to light; the amount of softening regulates the degree of extension, and much may be left behind, or prolonged ulceration or quick healing follow.

The sub-cutaneous tubercles, have I never seen go on to ulceration.

Whatever their seat, the formative elements of the tubercles are the same. If a preparation is taken from a young and still growing nodule recently extirpated, there will be seen chiefly round cells, for the most part the size of white blood-corpuscles; some with a distinct nucleus, others apparently without any; either quite clear or finely granular, and when perfectly isolated, they may exhibit slight amoeboid movements. Since the tubercles are well supplied with blood-vessels, these cells may possibly be derived from them. It is very rare to see a round cell with two nuclei. Here and there in the preparation, may be found extremely pale, clear, flat

cells, either spool-shaped or furnished with prolongations, and always presenting a distinct single nucleus. In a teased-out preparation may be seen, in addition, capillary vessels, sometimes dilated, and as is apparent at the torn extremities, manifestly composed of cells. The tubercle in this stage is firm, and the round cells are not very loose, but when a softer part is hit upon, the latter readily drop out, and they are now larger than white corpuscles, their form, too, becoming different; thus, some have a bulged contour, others are branched, others oval or spool-shaped. The flattened clear cells, named above, are also found, and some have multiple nuclei. Many cells have a granular centre or body, with clear branches, and sometimes are seen rather large cells, with or without prolongations, in which the nuclei are three—or four—parted. Outside the softened part, is found the same structure as described above. The further softening has proceeded, and when retrogressive elements also begin to make their appearance, the more numerous are the large granular cells, and not a few present multiple nuclei, closely resembling the well-known myeloplasmic cells; yet still there are always present the small rounded, and a few quite clear radiated cells.

For making sections, I have constantly used tubercles hardened in Müller's fluid; and placed therein immediately after extirpation from the living subject. The chloride of gold solution repeatedly failed me; inasmuch as its action was limited to the surface only.

Amongst the tubercles most superficially placed, the papillæ of the skin will be found to be densely infiltrated with round cells, and drawn out to enormous dimensions; there are but narrow interspaces left, lined with epithelium; and if the section be oblique, the latter may be traced far down into the tubercle; some traces of cutaneous glands may also be found; and it is not unusual to find at the margins, sweat-glands with hypertrophied epithelium. The degree of infiltration diminishes, the deeper down one goes; and there the round cells are widely separated by connective-tissue bands. In most sections, one sees only round cells and the lumen of large vessels; but at the edges of very thin slips, in many places and especially at the upper part, entire cells or their prolongations only, may be noticed projecting forth, and these are readily distinguished by their form and by their clearness and brightness, for the round cells commonly become granular in being hardened. Their nuclei are oblong; their contents finely granular, and at some places may also be seen these clear stellate cells amidst the round cells. (*Vide* Plate XIV.) By pencilling or shaking in water such a preparation, the round cells may be mostly removed from the thinner parts, and there is left behind a network of connective bands, in or upon which lie the stellate cells; a few of the latter may also be removed, without thereby destroying that part of the network on which they were placed. The deeper the part of the tubercle examined, the rarer became these clear stellate cells, which, when carmine is used, are seen to take the colour less readily than the round cells. They entirely correspond to the scattered, clear, branching cells visible in perfectly fresh preparation, and they may be supposed to be persistent connective-tissue corpuscles. In teased-out specimens of healthy skin hardened in Müller's liquid, I have never found isolated cells in the upper layers of the cutis; yet deeper down it is not so difficult to find isolated elements, which in form and appearance correspond to those now described, and which from their position may be recognised as connective-tissue corpuscles. As to their number, and mode of distribution, it is impossible to be certain; and, therefore, no comparison can here be made of normal and abnormal structure. If one attempts to ascertain by scrutiny of the margins of the tubercles, the part taken in the formation of the latter by the connective-tissue corpuscles, still nothing certain can be made out. Hansen proceeds to discuss this point in more detail, and then remarks that the appearances figured by Virchow (*Pathology of Tumours*, v. II., p. 574) may, and do, rather belong to tubercle-elements which are undergoing a retrogressive change.

I have already stated that the cellular composition of the blood vessels is very apparent; and this the more so, the younger the tubercles, and the quicker its growth; when marked, completely isolated cells may with great facility be obtained from the capillaries and small veins, whose 'lumen' also exceeds the normal, and sometimes remarkably so. The diameter of the vessels and the ready perception of their structure, stand in relation to each other, and both characters have I found most evident, in well-developed tubercles situated in the papillary body; the older the tubercle and slower its growth, the smaller is the lumen and the less distinct the elementary structure of the vessels in it. By 'older' is here meant that the tubercle shows signs of retrogression; but such a one may be younger in years, than another still growing; as is well known, both growth and decay of these tubercles are as a rule extremely tardy; but much variety exists with respect to these points. As an example of the chronicity in question, I may cite the instance of a tubercle which was about a year and a half old, when first seen; a year afterwards, it had not visibly grown, and in it were found only immature elements; the sectional surface being also firm, white and glistening, and no trace of decay being apparent. These peculiarities are manifestly connected with the vascularity of the tubercles: this is neither great nor little; so far as I could ascertain, there is not any new formation of vessels in the skin, but it is from those already pre-existing, that the tubercles are produced.

With regard to softening of the tubercles, sometimes large characteristic masses are found, but not constantly so, for their presence depends upon the rapidity with which retrogression takes place. It happens not so seldom that a leper having tubercles, remains comparatively well until a month or two before death, but in the course of this brief period he may become debilitated and emaciated to a degree, and with amazing rapidity the tubercles,

which previously were tolerably large, at the same time collapse and become soft; and in them one finds a uniform degeneration of almost all their structural elements, into fatty matter and detritus, so that sometimes it is only with great trouble that a few tolerably perfect cells can be detected. At the Lungegaards Hospital I have had occasion to examine one of those cases, where the old tubercles underwent acute softening in connection with a fresh eruption; thus, from being decidedly firm, they became just as soft and withered, and when one of them was examined, a uniform transformation into mere detritus was found to have occurred, only a few cells being perceptible, and these of the rounded form: the age of the tubercles in this case was not more than about one year. But, on the whole, when softening proceeds with ordinary slowness, it commences in the middle of the tubercle and extends towards the periphery; and one finds the peculiar large elements with their striking brown colour, which eventually pass on to decay into fat and detritus. Both their size and colour, are thus connected with the generally chronic advent of softening; still, under the idea that perhaps exuded red blood-corpuscles were here the source of colouring matter, I have searched for these corpuscles, but always in vain; and it is only after complete disintegration of the tubercle has occurred, that I have found them at the focus of softening. The condition of the blood vessels, as above described, speaks for the same probability; and also the fact that alongside the vessels, and amid retrogressive elements, the pale round cells are found, which can scarcely be other than emigrated white blood-corpuscles. And the circumstance that tubercles which have undergone a widely spread disintegration at their centres, still retain their original dimensions, or are sometimes burst open by increase of the retrogressive elements, would indicate that there is not necessarily any active deportation; besides, the colouring matter of the blood-globules would persist long enough to be readily detectible. I therefore conclude that the colour in question, is connected with these large brown masses, which I may here mention, as a recent observation, possess the faculty of absorbing carmine, and thereby presumably point to their not being wholly dead structures; an explanation of which fact is not yet easy. Experiments with re-agents have not led to positive conclusions, as to the nature of this colouring matter. The latter is fixed and very persistent.

Dr. Hansen has subsequently arrived at important inferences regarding these points, which will be mentioned below; he continues:—

The multiform character and the colour of these structures, depend upon the duration of their existence, hence one should not regard them as pathognomonic of leprosy, except so far as it seems, that they probably do not exist in any other new formations (pathological)—where, at least with such certainty as in leprosy, one could make out any defined relations to time and local vascular conditions.

Injections made to demonstrate a connection between the tubercles and adjoining lymphatics, have failed me; yet that such exists, is evident from the secondary affection of the lymphatic glands, so common in leprosy.

The reason why the *hairs* in affected spots fall off, seems to be that they are pressed out by the hypertrophied epithelium of the hair-sacs; and in both *sebaceous* and *sweat* glands, the epithelium is also at first hypertrophied; but in what way these and the hair-follicles finally and wholly disappear, I have not been able with certainty to ascertain. Likewise have I in vain attempted to make clear the precise relations of the *cutaneous nerves* to the tubercles; yet as these last, like the patches of eruption, are devoid of tactile sensation, it is likely that the nerves are affected, as Danielsen has shown in anæsthetic leprosy, namely, by the new formation here pressing in between the nerve-tubules, and causing their atrophy by pressure; as far as the ciliary nerves are concerned, such is certainly the case. See Plate XIV.

With regard to the *cutaneous eruption*, my experience is but limited; but, as is well-known, patches of eruption are present in tubercular leprosy, as in the so-called anæsthetic form, only they are here more elevated above the surface. I have examined such spots and found them to entirely correspond, in an anatomical point of view, with tubercles; and in one much developed patch the cutaneous veins were seen to be widely dilated, and with rows of cells along their sides; the papillæ were free; and the same I have noticed in the skin over a sub-cutaneous tubercle. More particularly, as respects the patches occurring in anæsthetic leprosy, Danielsen has in his last work shown their anatomical correspondence with leprosy tubercles; with this difference, however, that in the one case the skin is affected over a larger space, but with less intensity; and in the other, the reverse; yet here the tubercles are commonly widespread, and hence the total amount of new production, is usually more abundant in the tubercular, than in the smooth form of the disease.

*The Eye.*—Dr. Hansen next describes at great length the leprosy diseases of the eye, and the subject is a very interesting one; but since Dr. Hansen's observations have been already made known in the English tongue,\* we pass on to his remarks respecting other topics.

It results from my description, that I have not either in the skin or in the eye, found any support to the view, that the normally existing cells, contribute anything to the formation of the new granulation cells in leprosy; I will not deny the possibility of this, yet if one may lay stress upon the re-action of carmine upon both cell forms, under identical conditions, there seems little probability of its being the case. It may be truly said, however, that at least a large part of the pre-existing elements, remains apparently unchanged. Still less

\* The Leprous Diseases of the Eye, with six coloured plates, by Dr. O. B. Bull and Dr. G. A. Hansen. Christiania. Albert Cammermeyers 1873.

probability is there for the notion, that by nuclear division new leprosy cells are formed; the contrary is more likely, for the only circumstance in its favour is the very rare occurrence of round cells, looking like protoplasmic masses, and of nuclei, in still growing tubercles; otherwise, the formation of nuclei takes place under such circumstances as rather point to arrest of growth and retrogression.

The small protoplasmic masses which may be found lying free, chiefly in the supra-choroidea (in preparations, which have been carefully handled), seem to indicate formation by detachment of pieces from the older cells' protoplasm; and especially after a time, from the round cells, since the action of carmine is the same in both. The majority of these tumid cells may fairly be referred to migrated white blood-corpuscles; and particularly does this seem to be the case in the cornea, where, very plainly, the formation of vessels goes in advance of the production of the tumid cells; not to insist upon the groups of such cells, seen around the vessels at the margins of tubercles, nay, even in the midst of retrograding elements, at their centres.

If attention be paid to the history of the 'tubercles,' it might be inferred that every year, an emigration of cells occurred; and anatomical revelations (*e.g.*, the structure of the new blood-vessels) do not oppose this view, nor do the clinical symptoms. As Danielsen has insisted, the leprosy affection commences as a more or less decided hyperæmia; in the skin there appears a tense, erysipelatous swelling, which, to all appearance, may afterwards completely subside, and leave no visible trace whatever (compare with the iritic attacks in the eye); still here is a spot or *locus minoris resistentiæ*, and it is always a part before affected, which becomes implicated at every new eruption. But more commonly, the hyperæmia does not wholly subside; there remains behind a somewhat fainter redness, and the skin is not so elastic as before; again, the receding process, while it sometimes takes place over the whole of the parts attacked, may yet sometimes be complete in some, and incomplete in others. This fainter turgid remnant may stay a whole year, either as a patch, or passing into a tubercle; and it is as characteristic of one as of the other, that they may gradually increase, become turgid, or elevated for a certain time, afterwards to sink down or become pale as before. The affection may be characterised as a local or limited hyperæmia, lasting throughout the year, but tending gradually to subside, as the proliferated cells within pass on to disintegration and ultimate absorption; sometimes this metamorphosis is an acute or rapid process, and then probably, in general, entails great risk on the patient.

Entirely corresponding with the skin and eye affection, is that of the nerves; here, too, are found round cells, especially alongside the vessels lying between the nerve-fasciculi; and subsequently cells are to be seen between the nerve-tubules themselves. Their retrogression is the same as in the tubercles; and since the sheaths and neurilemma thus become thickened and shrink, just as if by a scar, it is most probably at this stage, that atrophy of the nerve-tubules first becomes general throughout the whole thickness of the nerve-trunk; but even in the shrunken nerve, one may find uninjured tubules, and this is the common condition in old anæsthetic patients. In one such case, where the man died at a comparatively early stage, have I found remnants of the leprosy productions in the form of cells; but my experience of the earlier stages is derived from instances of mixed leprosy, and I have never yet seen the nerve-affection at its beginning; retrogression to a greater or less degree, always being present.

In order to detect the disease in the least affected nerves, recourse must be had to microscopic scrutiny; then it will be seen that the peripheral layer is principally affected; there is no thickening of the neurilemma, and very few nerve-tubules are yet atrophied. As Virchow has remarked, it is also the more externally placed nerve-tubules which first become atrophied. It is well-known that the nerve-trunks suffer most where they are exposed to traction, through movements of the joints; yet at some considerable distance from the articulation, for instance, in the middle of the fore-arm, I have also found them to be affected. I regard it, therefore as not unlikely that the affection is primarily distributed over a large extent of the nerve; and that it is the constant, even if slight, pressure at the spots indicated, which here contributes to development of the affection, entailing great thickening of the neurilemma. The nerve-disease is precisely the same in the tubercular cases, when anæsthesia has showed itself—the so-called mixed or blended form of leprosy—as in the purely anæsthetic; and likewise in the level, as well as nodular, formations, in which the nerves have been examined; but unfortunately my attention has only lately been directed to this point, and hence I do not possess anatomical elucidation of the clinical phenomena mentioned below.

In the *central organs of the nervous system*, I found nothing abnormal, on examination of two instances of hydrocephalus, occurring in tubercular leprosy. Nor is there anything in the clinical phenomena of the disease which is suggestive of any affection of the *spinal marrow*; there is also found no ataxy, but, on the contrary, it is quite marvellous to see how deliberately, for instance, patients will walk, who have lost all superficial sensation in the soles of the feet; they may, however, feel the deeper pressure which results from the weight of the body. When there is any stumbling in their gait, this arises partly from the mutilation of the feet, and partly from the bones becoming too heavy for the atrophied muscles. Whether or not hydrocephalus has anything to do with leprosy, I cannot decide, but Danielsen has remarked that he has several times seen an acute hydrocephalus in leprosy. I have seen one case where there supervened on an eruption, such violent symptoms of brain-suffering, with maniacal exacerbations, that one might perhaps infer there was here laid the foundation of a chronic hydrocephalus; the patient, who was transferred to a lunatic asylum, recovered

his senses, however, and was discharged a cured from the asylum. In this place, I may also mention that several times there has been seen, under eruptive outbreak, implication of both knees, attended with slight swelling of the joint, and considerable pain and tenderness, especially if the patella were pressed against the condyles of the femur. On two occasions, has retrogression of the tubercles happened simultaneously with that of the eruption, without being followed by injurious results.

Of affections of the *nasal fossa, pharynx* and *larynx* one generally sees only the remnants or scars, at the margins of sections. On looking into the throat it may, during life, be ascertained that the parts first attacked are the follicles at the root of the tongue and in the pharynx, and I have once had occasion to confirm this by anatomical examination; the distended follicles in the pharynx being as prominent as the swollen Peyerian patches in the small intestine. And, just as in the skin, has this affection probably its constant origin in an acute eruption. Upon the tongue, especially in the median line, may be seen tubercles in every way corresponding to those of the skin; for the most part seated in the papillae, and therefore prove to superficial ulceration. These affections commonly pertain to the tubercular form of leprosy; yet I have seen one case of anaesthetic form, in which simultaneously with an eruption (the patches in the skin being much elevated), there occurred a precisely similar affection of the throat and upper air passages; there was a uniform turgidity and redness of the mucous membrane of the pharynx, epiglottis, acyteno-epiglottidean and vocal cords, and there was a remarkable correspondence with the contemporary skin-eruption; subsequently, a mere harshness of the voice remained.

I next have to treat of the affections of the *lymphatic glands*; and first of their changes in tubercular leprosy. Although, in addition to all the external glands, I have found implication of those situated in the *porta hepatis* and *hilus* of the spleen (of which more below), yet in the former alone can generally be best seen, the leprosy affection as it is connected with these organs. The *inguinal* glands with their upward prolongation the retro-peritoneal clusters, will best serve to illustrate the course of the affection; and I shall take my description from them, since the changes in the other glands are identically like. Constantly is that gland lying alongside the saphenous vein, the largest in size—sometimes it attains the dimensions of a small egg—and tumefaction of the glands lying above, gradually diminishes, so that on a level with the bifurcation of the aorta or with the kidneys, retro-peritoneal (lumbar) glands are met with, which are of normal volume. The capsule is generally thickened, especially of the external glands; and the outer surface is often uneven, from the presence of elevations and depressions. The consistence is firmer than normal, yet not hard. The lowest inguinal glands display, on section, perfectly opaque ampullae and medullary bands; the colour is rather white or yellow, or with an evident brownish tint; the capsule and bands are greyish and translucent, as seen around and between the segments of the glands; the ampullae are particularly distinct, and the more so when they are surrounded by the well-defined reddish streaks, which are due to a natural injection of the blood sinus within. This strikingly apparent change of colour in the proper gland structure, renders it possible, on near inspection, to determine with almost perfect accuracy, the extent and intensity of the affection; and in course of examination, one finds that this opacity of the glandular tissue may diminish in both degree and extent, until at last, as in the *Porta hepatis*, the use of the microscope is needed, to aid in arriving at a decision as to its presence. There, indeed, one may suddenly meet with greatly affected glands, but their affection has then proceeded from the liver itself. Amongst external glands, some may occasionally be found, in which only the outermost parts of the ampullae are opaque, and sometimes only a few of the ampullae, the rest of the swollen gland being free from implication. The lymph-vessels are, as a rule, enlarged, sometimes greatly dilated; their walls I have always noticed to be transparent, and the muscular parietes have been thickened. Their contents have always seemed to be normal, yet here I must remark that I have never yet had occasion to examine a subject, where death had occurred under an eruption.

On attempting to inject the lymph-tracts, it soon becomes evident that in the lower and most affected glands, great resistance to the injection arises; yet with equable pressure, and enough patience, one may sometimes succeed in filling the canals without attendant extravasation; the efferent vessels also become distended; and in the succeeding row of glands the resistance is decidedly less, diminishing, too, as one advances higher, so that it is not unfrequently possible to make a tolerably successful secondary injection through the vessels of a previously distended gland, situated below.

The opacity of the enlarged leprosy glands, depends upon accumulations within them of retrogressive elements; and here, as in the skin-tubercles, one may find all the transitions from single or many-nucleated cells, to the large, granular, fatty mass of detritus, with their characteristic colouring. Yet, just as in the skin, in this place, too, I have not been able to find any structures, which might be considered as foreshadowing the large agglomerations. Their most probable source is the many-nucleated cells before described, yet they rather have the appearance of originating in a large mother-cell, which included several smaller ones; but such parent cell I have never been able to detect. It is here obviously impossible to decide, by direct observation, whether newly-derived round-cells are to be found in the ampullae and medullary promulgations of the glands; but according to the clinical indications and analogy with the sub-acute swelling of the glands, this is probable, and it may with certainty be said, whenever the gland substance is, as often, filled with retrogressive elements, that these latter for the most part are derived from pre-existing lymph-cells. By their large dimensions they produce the same

effects as elsewhere, inasmuch as they distend the network wherein they lay, and by their great accumulations render it defective; and this becomes most conspicuous when only the top of the ampullæ is affected, for here the network is pencilled out with great readiness, on account of the size of the meshes, whilst even a forcible use of the brush, is often not sufficient to remove the normal looking lymph-cells from the rest of the section. Another consequence is also associated therewith: thus, these large elements, by distending the ampullæ, compress the sinus against the capsule and trabeculae, which are less yielding than they, and so when the sinus is pushed under the capsule, it may become not a little flattened, whilst lower down in the gland it retains its normal width: the more general the affection, the narrower the sinus throughout the entire gland. The same phenomena are also well illustrated after artificial injections. The condition of the vessels and meshes, comes nearest to that which is found in scrofulous glands, e.g. the adventitia remains tolerably clear, and also the nuclei at the junctions of the network; the threads of the latter are sometimes thicker and broader than normal, and sometimes thinned through expansion.

The above description applies only to the affection in its decline; and the question arises, whether one may regard the number and distribution of the retrogressive elements, as trustworthy evidence of the degree of the leprous disease. I have several times, in emaciated subjects, found fat-vesicles within the lymph-glands, sometimes in layers, which have taken the place of the glandular masses; but otherwise, I have never in leprosy seen any elements corresponding to those found in glands swollen from ordinary causes; and never any so conformably distributed as in this affection, or indicative of such close connexion between the skin and the glands as is here apparent. In what manner the affection first arises, one can only conceive from observation of clinical phenomena; and from hence it would appear, that it is the same at the onset of the disease, as at subsequent eruptions. On these occasions, the glands swell up, more or less in conformity with the violence of the eruptions, and they subside again after the cessation of the latter; afterwards, however, they still often retain a larger volume than before, and probably this state is permanent, although not very marked on manipulation. There has been made an addition; and the gland is more leprous than it was. The distribution of the affection over a long row of glands, shows that the infecting material is not wholly retained by the nearest situated glands; whilst the regular diminution of its intensity in next succeeding glands, demonstrates that out of every one of the series, less of the material passes upwards than had entered it. Lastly, the seat of the affection, namely, in the outermost part, and not necessarily in all of the ampullæ of the gland, would show that on the lymph entering the gland, there may arise a mutual attraction between it and the cells of the ampullæ; a portion of the lymph is retained by the latter, and another part proceeds on its way through the sinus, and infects a fresh gland; and having regard to the probable amount of *materia peccans*, it seems likely that, at times, a portion of it may pass through the whole series of glands, and finally be mixed with the blood. The next question is this, have the elements in the glands, the same properties as those in the skin? It might be so inferred, from their entire anatomical correspondence; and if the productions in the skin can, under special circumstances, become hurtful to the system, by infecting it, so may the same be said of the elements in the lymph-glands. In this regard, it is of much importance to know, that the glandular implication may be found to present distinct marks at least one year (and how many more I cannot say), after affection in the corresponding peripheral part, e.g., an extremity, has quite subsided; and, moreover, in conclusion, that every trace of the glandular changes may, also wholly disappear. I have examined two subjects, who originally were tuberculous lepers, but who for many years before death had been anæsthetic; and though there was no reason to suppose, that in them the glands have never been affected in the same way as is common, yet in neither case did I find a trace of leprous gland disease, unless indeed a certain degree of shrivelling of the glands be regarded as such. I have not in my autopsies, so clearly had before me the duration of sickness, that I can positively say how this subsidence of local disease takes place. I have above remarked that the surface of the glands is sometimes puckered; corresponding to these spots in the glandular mass smaller; but I have never found any reduction in the structureless detritus or minute fat-granules, at these places. Probably, however, here the elements pass away in the same way as in the tubercles in the skin.

Should there not be found in old anæsthetic cases, any leprous affection of the glands like that occurring in the tubercular form; yet, from which has just been said, this would be no proof that such affection had not once existed.

For the first time, I have quite lately had occasion to examine an individual with spotted leprosy, who died of phthisis at an early stage of the disease. The patient had on entry into Lungegaards Hospital in 1867, a few small patches on the legs; in the last two years (1869-70), these were no longer visible, but the skin near was rather thick and dry. The second metacarpal bone of the right hand was affected with necrosis, dependant on lepra. On autopsy, almost all the axillary glands on the right side, and as well, the glands in the fossa supra-claviculavis, were found to present small foci, cheesy masses, and as subsequent microscopic examination showed, sometimes distinct miliary tubercles, in which were myeloplagues. Cavens were found at the apices of both lungs, surrounded by pneumonia, &c.; pleura thickened, without miliary tubercles; bronchial glands cheesy, and with distinct miliary tubercles; in the ileum, several 'tubercular ulcers'; mesenteric glands cheesy; parenchymatous nephritis; liver fatty; spleen apparently normal (of this more hereafter); no affection of the nerves. In this case, the inguinal glands on both sides were found to present the appearances charac-

teristic of leprosy implication; the affection was not great, and included only the outer half of the ampullae, and that not of all. The majority of the cells contained large and small fat-drops, and amongst the free liquid drops in the preparation, was found a bit of intensest brown colour, and showing granular fat-drops with vacuoles. Now although this observation yet stands alone, yet I think we may safely conclude that the appearances will be the same, in all swollen glands in spotted leprosy, if they can only be examined early enough; and there is here an extreme similarity, between the nodular and spotted forms of the disease. What I now insist on, is the circumstance that the affection of the lymphatic glands, was yet very distinct two years after the skin affection had disappeared, and that this last was originally but very slight.

As to affections of the liver and spleen, I have no particular additional anatomical details to mention. In the *Spleen*, the affection has its seat chiefly in the sheaths of the arteries, and in the follicles; especially in the first named. In the earliest cases I have seen (duration of disease, two years), the transition from lymph-cells to multiple-nucleated cells and retrogressive forms, could, as in the lymph glands, be followed out; but the passage to the great agglomerations, have I not been able to see here. Here, too, it seems to be the pre-existing lymph cells which undergo changes; there is no, or at least no considerable swelling, of the arterial sheaths and the follicles themselves; and where such appear to be present, the size of the retrogressive elements is sufficient to account for it.

In the *Liver* the affection appears with round cells and their after attendants, in the capsule of Glisson; but whether proximately in the ramification of the portal vein, or in the capillaries belonging to the hepatic artery, I have not been able, from examination of injected preparations, to learn. The circumstance that the affection is generally least conspicuous in the thicker ramifications of Glisson's capsule, where are found the largest portal branchlets and also the largest number of arterial (hepatic) capillaries, would indicate that the cells primarily appear around the smaller portal ramifications. The reason for this, so far as I have been able to make it clear, would seem to be indicated in the fact that I have only twice found the lymph-glands in the hilus of the spleen affected, and that very slightly, while the glands in the porta hepatis are constantly very greatly affected; and hence one may suppose that the liver substance is attacked secondarily after the spleen, and subsequently to that, its glands in the porta hepatis. I have tried to determine upon anatomical grounds, their respective ages, and when, as in the liver, one may see round cells by the side of retrogressive elements, the supposition would be that the affection could not be of long standing; but in the spleen and lymph-glands, where the affection probably implicates the already existing cells, a valid point for comparison does not appear. The stage of retrogression may not, either, be employed for this purpose, because these stages are not marked by signs decided enough to enable one to estimate such small differences, as would be concerned in the question. Differences of age, plain enough, may be met with, but, at such times, always apparently the same in all three organs, in the same subject. The affection here, too, displays its tendency to subside. There is visible the same transition from incipient degeneration to fatty metamorphoses, more and more marked with consequent wasting, as in other localities; and the connection of this with the age of the disease, and also the correspondence between the intensity of this affection and the skin affection, is sufficiently obvious; as in this last, so in the others, may the duration of the morbid changes be very various in different instances. Yet I have seen one instance of these internal affections, lasting longer than that of the skin; the subject had been leprosy for nine years; in the spleen nothing certain could be made out, and in the liver only detritus or remnants of its implication, whilst the glands in the porta hepatis were distinctly leprosy, and they also showed the same characteristics as those situated externally. So long as one is ignorant of the conditions affecting the deportation of such detritus, an example like this cannot be so decisive as it might become, of the simultaneous and equally progressive metamorphic changes occurring in both organs mentioned. That the spleen had been leprosy may be asserted, because this subject had been tuberculous, and in such I have never failed to establish splenic affection, except in two cases (and in these the skin affection had disappeared at least three years before death); it had certainly once existed in the present instance, but had subsided prior to decease; this, too, was the same subject as that in whom no trace of the complaint could be found remaining in the external glands. Here is explained, how in anæsthetic patients nothing is found, even if the affection had once existed. Possibly more minute examination than I could make, would show still some signs, and this internal complication may, at any rate, be supposed, in conformity with the character of the skin affection, to have been but slight. In the case described above, under the topic of the *lymphatic glands*, I also found collections of fat granules here and there, not invariably but yet not unfrequently; and as well, wholly detached groups of the same, in the splenic arterial sheaths; and in the liver, round cells and a few granular collections alongside the portal ramifications; the glands in the hilus were wholly cheesy throughout; the liver affection might be tubercular, as the condition of these glands would indicate; yet I have in another case, found the liver-glands cheesy; with intestinal ulceration and consentaneous cheesy mesenteric glands, but without any tubercular deposit in the liver itself, or in either spleen or kidneys. The instance is, however, an ambiguous one; and what was seen in the spleen, makes it probable that here, at least, were the remnants of a leprosy affection. Like it, so is the case remarkable in which, as may be inferred, the spleen and liver

affection make their appearance, simultaneously with the very commencement of the disease, for in no other place has there, in these patients, been seen any trace of mature leprosy production; so too the possible occurrence of the spleen, and liver affection in a primary event, concerning which it is to be hoped, in time, some enlightenment may be gained. Here I observe that in every tuberculous subject (leprosy) examined, I have found these internal affections to be retrograding, and that to such an extent as warrants their being antedated at least one year; and from what has been revealed, nothing appears to disprove the contingencies just mentioned.

Besides the leprosy affections of these organs, amyloid degeneration is frequent, and tubercles (strumous) are occasionally found; all these may co-exist at the same time. Amyloid degeneration of the *kidneys* and *intestinal canal* is also common; parenchymatous and interstitial nephritis is likewise a common event; also intestinal ulcers, tubular pneumonia and cavities, partly tubercular, in the lungs. It generally happens, in both the nodular and so-called anæsthetic forms, at the stage when examination is made, that disease is found in two or more of these organs simultaneously; and hence, as a rule, one cannot certainly say what has been the proximate cause of death. These events supervene much earlier in the tubercular than in the anæsthetic form of leprosy, and that, too, as probable consequences of the early and often extensive ulcerations common to the first-named form; whence, again, the generally abbreviated age of its victims. Last year in asylum No. 1, the mortality was 18.0 per cent. amongst the patients affected with tubercular leprosy; 4.7 per cent. amongst those having the anæsthetic form.

Since disease of the *pharynx* and *tongue* makes its appearance, in many cases at least, first in their follicles, and in the spleen, too, has its seat in the follicular apparatus, I have most carefully searched for a possible leprosy affection of the follicles of the intestinal canal; but this is in vain. When ulceration and swelling of the follicles were present, the condition was either clearly tubercular, with secondary eruptions in the peritoneum, or the follicular swelling showed a decided tendency to pass into a state of cheesy detritus; and I never have before seen a form of degeneration, which could be compared with the otherwise characteristic leprosy products. And—what I also lay much stress on—in all cases, the mesenteric glands have been cheesy, never having the remotest likeness to leprosy change. Meanwhile, the total number of autopsies which I have made (26 of tubercular subjects, in whom one might best expect to find anything), is perhaps not sufficient to determine that such an affection is not to be found. Again, I have only once, in a rather reduced subject, found a tubercle in the *caput epididymidis*; and yet the testicle is an organ according to Danielsen, not so seldom attacked. Neither in the lungs, have I found anything which could be interpreted as leprosy; and I would here especially insist upon the fact, that the bronchial glands have always in affections of the lungs, been cheesy and partly tubercular.

I have now compared the appearances, and many phenomena of the tubercular form of leprosy, with those of anæsthetic or chronic spotted form; and for better survey will recapitulate the results. Between the tubercles and patches of eruption there is no anatomical difference; to eye-affections occurring in the tubercular form, has nothing analogous been proved for the spotted form; to affections of the *pharynx* and *larynx* happening in the tubercular form, I have seen one analogous case in the spotted. The nerve-affection is the same in both. Moreover, is the yet oftener named affection of the lymphatic glands, identically the same; and in the subjects of spotted leprosy, one perhaps may find the spleen and liver implications. It is now to be remarked, that macular leprosy have generally so long a life, that on their death as anæsthetics, all leprosy processes are found to be exhausted; there is apparent no skin-affection, and the nerve-affection is in them a mere consequence of leprosy disease, a cicatrix formation. Entirely corresponding herewith, were the appearances noted in two individuals, who originally were tubercular leprosy, but for many years had become anæsthetic; nothing any longer leprosy, was found in them. The non-leprosy affections of the lungs and abdominal organs, which are common to both forms of leprosy, may in the anæsthetic cases be supposed essentially to arise in consequence of caries and necrosis; and it then becomes a question whether these last are of leprosy character. Here is found grown into the bones, a granulation tissue; in none of the cases examined, have I found within the bones any production distinct from the surrounding soft parts; this granulation tissue is much more loose than that of 'tubercles,' the intercellular substance being gelatinous, with firm bands only here and there, and more numerous than in a fully-developed tubercle; the sectional surface is therefore greyish and translucent, not glistening, white and firm as in a tubercle; here occur large myeloplague-like cells, but these one sometimes finds located clearly as a kind of epithelium, in the cavities of the bone. Lastly, portions of this granulation tissue may subside into detritus; fatty granule-cells also appear, but yet diffused; and there is no after central softening as results in the true 'tubercles.' I therefore conclude that the anatomical characters of this granulation tissue, are not leprosy; and if, as a means of judging, one takes into consideration, the clinical phenomena, it may be decided with Virchow, that these affections of the bones are mere consequences of leprosy. They make their appearance exclusively in anæsthetic parts, and commonly first when the loss of sensation is so deep-seated, that one may operate upon the subjects without their suffering considerable pain, or indeed any at all; at other times, sensation increases the deeper one goes, and scraping of the periosteum is sometimes extremely painful. The toes and

fingers are generally the parts which are earliest consumed; thus an acute periostitis sets in, and in a few days a whole phalanx may be denuded; next to the articulations, the periosteum becomes attached, and therefore patients may be troubled for a long time, before the necrotic fragment is thrown off: here artificial removal is a great gain for them. The third phalanx is affected as often as the second. In the same way the internal bones of the foot may be exposed; but the most usual course of events here, is for the bone to become denuded by a perforating ulcer in the sole, whose origin in external causes is often plain. Thus, such ulcers come frequently on the ball of the great toe, at the outer margin or the heel, and also on places which, in walking, are most liable to pressure; the patients continuing to walk, they become deeper and deeper, until the bone is reached, and then begins the process of destruction. Here the connection with anaesthesia, of external pressure is so manifest, that one has good reason to suppose in other cases, the same concurring outwards influences; whether, however, it is true that patients have first become aware by a smell of burning, that their hands, &c. were being damaged, is difficult to satisfactorily prove.

Dr. Hansen\* next proceeds to collate his clinical experience of leprosy, with the results of his anatomical investigations; prefacing the subject with a brief review of opinions, hitherto prevalent in Norway and elsewhere. He says:—A difference is made between 'Elephantiasis tuberculosa' and 'E. anaesthetica.' The first is characterised by tubercles (nodules) in the skin, often diversified with 'spots' or patches of eruption; whilst no nerve-affection and, in consequence, no anaesthesia will be found. The second, on the other hand, is marked by this very character of nerve-disease, with resulting flexion and necrosis; but here, too, is constantly found, as Danielsen has shown, an affection of the skin in the form of eruptive patches, which precede the advent of anaesthesia. Such spotted leprosy forms are also called, in anticipation, anaesthetic, where there exists no other diminution of feeling than in the spots themselves, and hence no implication of the large nerve-trunks. Alongside these two forms is ranged a mixed or blended phase, including the instances when anaesthesia supervenes in a nodular subject; the formation of nodules and the loss of feeling making steady progress until the patient's death, yet in such a way that there seems to be an alternating advancement—"numbness and relaxation" of the skin never increase, curvature of the digits and necrosis never proceed, so long as the production of nodules goes on. But let this cease, then advances the anaesthetic phase, and exacerbation of its symptoms." This blended form of leprosy may supervene in the later stages of the malady; whilst, on the contrary, it happens that so long as the disease remains in a restricted state of development, that the one form may pass into the other, oftenest the tubercular into the anaesthetic, by subsidence of the nodules and advance of the nerve-affection, frequently under pretty smart febrile disturbance of the system. But, as well, individuals with anaesthesia already begun, or having benumbed patches, may suddenly, under febrile disturbance, undergo an eruption of nodules, and the nodular affection takes its course; whilst subsequently nothing more has been noticed of the anaesthetic form, and the two varieties may thus, as it were, "exclude the existence of each other." Hence arises an antagonism between the two forms. Danielsen and Boeck suppose that those peculiarities which separate the two, prove that the one is not, as some have supposed, a development of the other. Yet this—or rather that Nerve-lepra belongs to every lepra—I think I shall be able to maintain, and I shall try to explain the asserted antagonism, as a mere variation in that overwhelming uniformity which the disease otherwise presents.

When Danielsen and Boeck laid down so sharply the differences of the two forms, their inquiries had not yet brought to light the fact, that all cases of lepra begin with an affection of skin: it is said, with regard to the anaesthetic form, that the spots are far from being a constant symptom, but "that they appertain, whenever they appear, always to that form;" and with the idea that a difference so marked, exists between the two varieties of the disease, it would have been difficult to institute a parallelism between them. But since Danielsen has now shown that the skin affection is, in all cases, the primary symptom, and that the anatomical changes in the nodules and patches are analogous, there at once is initiated the beginning of conformity: in the nodules feeling is benumbed, as in the spots; it is the wide extent of the latter which renders the loss of feeling, as concerns them, so noteworthy, and hence the great stress which has been laid upon it. To pass on to the next point, one has to ascertain how this view holds with reference to the anaesthesia, which is the result of implication of the great nerve-trunks. Bidentkap remarks that he has found numbness amongst all the nodular subjects he has examined, as above mentioned; my anatomical data are defective, and upon referring, in consequence, to clinical phenomena, there has been elicited the following remarkable result, from an examination of cotemporary patients in the asylum, who are entered as 'nodular' and 'blended.' In this table † the extent of anaesthesia is shown also the advent of necrosis, &c.; and the condition of the nodules (tubercles) in the skin is indicated—when no remark is made (col. 12), these are in a state of full development; the 'wasting' tubercles were atrophied and collapsed, or dried up; the letters *r* and *l* sometimes appended, stand for right and left, when atrophy, &c. affects only one side of the body, as occasionally happens.

\* "Further Contributions, &c., &c.," continued. In the Nordiskt Medicinskt Arkiv. Band ii. Nr. 22. (1870).

† I have re-arranged Dr. Hansen's tables, so as to make them more easy of reference.—H.V.C.



Condition of Lepers (Tubercular and Mixed Forms of Disease), in Asylum No. 1, at Bergen—continued.

| ANÆSTHESIA.              |               |      |        |       |      |       | Atrophy. | Curving. | Necrosis. | Duration of Symptoms. | Remarks.          | No loss of Feeling. |
|--------------------------|---------------|------|--------|-------|------|-------|----------|----------|-----------|-----------------------|-------------------|---------------------|
| Dorsum of Foot.          | Sole of Foot. | Leg. | Thigh. | Hand. | Arm. | Face. |          |          |           |                       |                   |                     |
| FEMALES.                 |               |      |        |       |      |       |          |          |           |                       |                   |                     |
| (a.) TUBERCULAR LEPROSY. |               |      |        |       |      |       |          |          |           |                       |                   |                     |
| L. 1                     | —             | L. 1 | —      | 1     | —    | —     | —        | —        | —         | 1 year.               |                   |                     |
| 1                        | 1             | —    | —      | —     | —    | —     | —        | —        | —         | 1 1/2 years.          |                   |                     |
| 1                        | —             | 1    | —      | —     | —    | —     | —        | —        | —         | 2 "                   |                   | 1                   |
| 1                        | 1             | 1    | 1      | 1     | 1    | —     | —        | —        | —         | 2 "                   |                   |                     |
| 1                        | —             | 1    | —      | —     | —    | —     | —        | —        | —         | 2 "                   |                   | 1                   |
| —                        | —             | —    | —      | —     | —    | —     | —        | —        | —         | 3 "                   |                   | 1                   |
| L. 1                     | —             | —    | —      | —     | —    | —     | —        | —        | —         | 3 "                   |                   |                     |
| L. 1                     | —             | L. 1 | —      | —     | —    | —     | —        | —        | —         | 3 1/2 "               |                   |                     |
| 1                        | —             | —    | —      | L. 1  | —    | —     | L. 1     | —        | —         | 4 "                   |                   |                     |
| 1                        | —             | —    | —      | —     | —    | —     | —        | —        | —         | 4 "                   |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 4 years.              |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | L. 1     | —        | —         | 4 "                   |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | L. 1     | —        | —         | 4 "                   |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 4 "                   |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 4 "                   |                   |                     |
| 1                        | —             | 1    | —      | —     | —    | —     | —        | —        | —         | 4 "                   |                   |                     |
| 1                        | —             | 1    | —      | —     | —    | —     | —        | —        | —         | 5 "                   |                   |                     |
| 1                        | —             | 1    | 1      | 1     | —    | —     | L. 1     | —        | —         | 5 "                   |                   | 1                   |
| 1                        | —             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 5 1/2 "               |                   |                     |
| 1                        | 1             | 1    | —      | 1     | —    | —     | —        | —        | —         | 6 "                   |                   |                     |
| 1                        | 1             | 1    | —      | 1     | —    | —     | L. 1     | —        | —         | 6 "                   |                   |                     |
| 1                        | 1             | 1    | —      | 1     | —    | —     | —        | —        | —         | 7 "                   |                   |                     |
| 1                        | 1             | 1    | —      | 1     | —    | —     | L. 1     | —        | —         | 7 "                   |                   |                     |
| 1                        | —             | 1    | —      | 1     | —    | —     | L. 1     | —        | —         | 7 "                   |                   |                     |
| 1                        | 1             | 1    | 1      | L. 1  | —    | —     | —        | —        | —         | 8 "                   |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | 1    | —     | —        | —        | —         | 8 "                   |                   |                     |
| 1                        | —             | 1    | —      | 1     | —    | —     | —        | —        | —         | 9 "                   |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | 1        | —        | —         | 9 "                   | Tubercle wasting. |                     |
| 1                        | —             | 1    | —      | 1     | —    | —     | —        | —        | —         | 9 "                   |                   |                     |
| 1                        | —             | 1    | —      | 1     | —    | —     | —        | —        | —         | 9 "                   |                   |                     |
| 1                        | —             | 1    | —      | 1     | —    | —     | —        | —        | —         | 10 "                  |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | 1        | —        | —         | 11 "                  |                   |                     |
| 1                        | 1             | 1    | —      | 1     | —    | —     | —        | —        | —         | 12 "                  |                   |                     |
| 1                        | 1             | 1    | —      | 1     | —    | —     | —        | —        | —         | 13 "                  |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | 1        | —        | —         | 14 "                  | Tubercle wasted.  |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | 1        | —        | —         | 14 "                  | " " "             |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | 1        | —        | —         | 14 "                  | " " "             |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | 1        | —        | —         | 22 "                  | " " withered.     |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 24 "                  | " " wasted.       |                     |
| (b.) MIXED LEPROSY.      |               |      |        |       |      |       |          |          |           |                       |                   |                     |
| 1                        | 1             | 1    | —      | —     | —    | —     | —        | —        | —         | 2 years.              |                   |                     |
| 1                        | 1             | 1    | —      | —     | —    | —     | —        | —        | —         | 3 "                   |                   |                     |
| 1                        | 1             | 1    | —      | —     | —    | —     | —        | —        | —         | 4 "                   |                   |                     |
| 1                        | 1             | 1    | —      | —     | —    | —     | —        | —        | —         | 5 "                   |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | 1    | —     | —        | —        | —         | 5-6 "                 |                   |                     |
| 1                        | 1             | 1    | —      | —     | —    | —     | —        | —        | —         | 6 "                   |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | 1    | —     | —        | —        | —         | 6 "                   |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 8 "                   |                   |                     |
| 1                        | 1             | 1    | 1      | 1     | 1    | —     | 1        | —        | —         | 8 "                   | Tubercle wasted.  |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 9 "                   | almost wasted.    |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 9 "                   | wasting.          |                     |
| 1                        | 1             | 1    | —      | —     | —    | —     | —        | —        | —         | 12 "                  | " " "             |                     |
| 1                        | 1             | 1    | 1      | 1     | 1    | —     | 1        | —        | —         | 12 "                  | " " "             |                     |
| 1                        | 1             | 1    | 1      | 1     | 1    | —     | 1        | —        | —         | 13 "                  | wasted.           |                     |
| 1                        | 1             | 1    | 1      | 1     | 1    | —     | 1        | —        | —         | 13 "                  | wasting.          |                     |
| 1                        | 1             | 1    | —      | —     | —    | —     | —        | —        | —         | 14 "                  | wasted.           |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | 1        | —        | —         | 16 "                  | " " "             |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 16 "                  | almost wasted.    |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 18 "                  | wasted.           |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 19 "                  | " " "             |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | 1        | —        | —         | 23 "                  | " " "             |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | 1        | —        | —         | 24 "                  | " " "             |                     |
| 1                        | 1             | 1    | 1      | 1     | —    | —     | —        | —        | —         | 24 "                  | " " withered.     |                     |

The extent of the anesthesia indicates with tolerable certainty, its degree; e.g. when only the back of the foot is benumbed, it is but the slightest touch which is not felt; when loss of feeling reaches to the knees, it will, as a rule, need some pressure to excite feeling; and so on till one comes to those cases attended with necrosis, in which some operations may be performed without exciting pain. When the back of the foot alone, or the leg, is the seat of diminished feeling, it might be objected that the numbness is due to implication of a few sub-cutaneous nerves in some of the numerous tubercles, or in the uniformly thickened skin, which is such frequent attendant on nodular leprosy. Where the tubercles are isolated, there is hardly any risk of going wrong; and in other

cases, I have always detected sensation over the thickened skin. The loss of feeling may therefore be referred to affection of the *nervus peroneus*, as the branch which is generally the first attacked in the lower extremities. Of 141 patients having nodular leprosy, there were only nine without any loss of feeling; all these might be called blended or mixed cases. Respecting the connection between duration of disease and extent of anaesthesia, a marked correspondence on the whole exists between them; thus, the longer the disease, the wider spread the anaesthesia. There are some cases where the latter comes on so early, as to excite the idea that the nerves had become affected at the same time as the skin, but if this should be the case, it is not quite the rule; which seems to be that several, or a few, years elapse after the first skin-affection, before the nerves are attacked. To ascertain the exact date when this happens is, in most cases, impossible. Amongst many patients during this examination, I found to my surprise, tolerably extensive anaesthesia in parts, of which it is expressly recorded that sensation was good in them, when the patients entered the asylum; and this amongst the latter who have been only a year in the house, without any outbreak of symptoms, which might have accounted for this circumstance, so that in all probability, their nerves were already affected on their entrance. And herein is an illustration of the facility with which one may overlook the successive development of anaesthesia, in tuberculous subjects—the consecutive development from nodular lepra to the anaesthetic form. On looking through the above tables, it is seen that almost all older nodular and mixed examples are now fully anaesthetic, and no longer have tubercles; and the same with others of not particularly long duration; all such patients have the best prospect of a long life. The instances in which changes have happened in a sudden manner, are those distinguished as illustrations of transition from one form of leprosy to another, or rather as expressive of an antagonism between the two forms. It is respecting this connection, a very significant fact, that almost all patients who in the case-books are entered as 'mixed,' have already been affected for a comparatively long period of time; and Danielsen and Boeck state that it is in the later stages of the disease, that both forms become intermixed. One patient who is entered as anaesthetic, had originally had tubercles; and he would doubtless have been entered as tuberculous, had he come in at that time. I presume it is not precipitate to conclude from these tables (which clearly show the duration of disease), that it is the regular course for nodular, as for anaesthetic lepra, to terminate in anaesthesia. But only very few nodular subjects indeed attain such an age, that there is time for the disease to pass through all its phases, and leave them simply anaesthetic; for most die early of the consequences of nodular leprosy, and before the disease has worn itself out in any of the affected organs. According to Danielsen the mean duration of this form is  $9\frac{1}{2}$  years; of the anaesthetic (originally spotted form), it is  $18\frac{1}{2}$  years.

Some discrepancy of views still remains; but I shall now proceed to show in detail the general concordance of symptoms, and thereby to clear up difficulties, endeavouring to bring them under the same conformity of rule, which elsewhere prevails in the development of the disease.

Danielsen has proved that in advance of an outbreak of leprosy skin-affections—whether nodular or macular—there, doubtless in all cases, goes a deterioration of general health. Sometimes it comes on as a very characteristic form of fever, which is ushered in by one or more shivering fits, and which subsides when the outbreak in the skin has taken place; this occurs either at once or successively, and in the last case the fever is continuous, until the outbreak is finished. The patient becomes again well; there is an eruption, but he is otherwise in good health. The skin-affection may either gradually progress or apparently remain stationary, until there arrives a fresh acute outbreak. This intermitting advance of the skin-affection is regarded by Danielsen as characteristic of both nodular and spotted forms; but there is this difference, that the new eruptions are far the most frequent in the tuberculous cases. The termination of the macular form is this, that no doubt most commonly there happens no secondary eruption in the skin, but that the spots which attended the invasion of the disease, after passing their maturity, gradually subside; and this is a process, which may occupy several years. Partly during that time, partly beginning later, anaesthesia appears and uniformly extends; its extent and degree may be very various. Analogous instances to the above may be found in the nodular form; thus, there are cases where the skin-affection—'tubercles'—have subsided in a wholly gradual manner, whilst at the same time anaesthesia has become marked. There also happen cases, in which no secondary skin-eruption makes its appearance. But, as is well known, such eruptions are frequent in this form, coming on as a general rule without long intermissions, or at any rate, until a certain point of time; and herein lies the essential difference between the two kinds of leprosy. We may therefore now pass on to consider these forms of eruption on the skin.

Prior to every visible eruption goes fever, which lasts so long as are furnished new products; such as those seen at the invasion of the disease. When there simultaneously with eruption in the skin, now occurs an acute affection, *e.g.* of the nerve-trunks—an event which I have repeatedly seen in nodular subjects, and once in a spotted leper—so may skin and nerve-affection with their anatomical concordance, have really the same cause; and, moreover, when the nerves are attacked under febrile disturbance without consentaneous skin-eruption, so may the acute nerve-affections be compared with the acute skin-affection; the one is an eruption or acute leprosy affection as well as the other, and the circumstances under which one and the other appear, may be applied in elucidation of eruptions in general. When next there happens along with subsidence of nodules in the skin, in a tuberculous

leper, some acute nerve-affection, then doubtless there is a transition from skin-leper to nerve-leper; yet this event is no indication of an antagonism between nodular lepra and nerve (anaesthetic) lepra, there is here only an acute exacerbation of the commonly chronic development which is shown in my tables, and the event rather speaks for identity of the two forms of disease, because under the same or corresponding circumstances, an outbreak of tubercles may take place. Danielsen has shown that not seldom old tubercles subside or become less, at the end of a skin-eruption, and I have above in my anatomical descriptions mentioned a similar event. Such cases seem to me to throw light upon the eruptions; in the one just referred to, the patient had fever; sometime after its close his tubercles showed a notable change, from being distended and glistening, they became collapsed and withered, and under the microscope was found almost complete degeneration into a mass of detritus: sometime afterwards there supervened eruption in the skin, and presumedly also in the nerves. Here there seemed good reason to suppose that the fever and eruption proceeded from absorption of detritus; yet it might be objected that the fever was the cause of the falling away of the nodules, and not a consequence thereof. In a case of nerve-eruption, which was admitted into the asylum during the early period of my incumbency, the sequence of phenomena was more significant. A tuberculous subject: in the beginning of September, 1868, his tubercles, not very numerous though large, began to fade; the 15th of the same month, fever, albuminuria, tubercles almost quite withered: 30th idem, pains in arms and hands; both ulnar nerves at the elbow thickened and very tender, later on, implication of the nerves of the lower extremities. Pains, sometimes very acute continued all through the autumn, and little by little grew up a considerable loss of feeling. I do not know, in this case, how one could evade the conclusion that absorption from the tubercles has produced fever and eruption, and that these depend upon a self-infection, from acute disintegration of the older leprosy products. And as this applies to one, so may it to all eruptions; they have all the same character, although their duration and intensity are extremely different, since some are over in a few days, whilst others last for months. Further, I am much inclined to believe, although not in a position to demonstrate the fact, that all the fresh leprosy productions, after the first invasion of the disease, are the result of self-infection of the system. All visible affections may make their appearance at the same time as the eruptions on the skin,—thus, those of the pharynx, larynx, nose and eye. Irido-cyclitis I have seen arise, as one of the phenomena of a long-lasting eruption; also as happening simultaneously with a mild eruption, and lastly, in one of the cases where it occurs independently, as a general forerunner of an eruption.

The spleen and liver affections may appear, as I have mentioned in my anatomical descriptions, immediately on the invasion of the disease, and in that case will not depend upon later eruptions; except that here, as in other previously affected parts, an 'impulse' may be imparted by the eruptions. The shivering fits having an intermittent character, which in my essay last year, I suspected of connection with these internal complications, seemed in the cases since watched to be always associated with lung disease.

But very commonly 'tubercles' arise in a perfectly gradual manner; and the anaesthesia steals on as it were; and these very numerous cases cannot certainly be referred to an eruption. Yet that, even here, such connection exists, may be regarded as at least possible.

I have remarked that the hyperemia and swelling attendant upon an eruption, may seemingly altogether subside, but whether such is really the case, cannot of course be positively determined; there might very well remain something behind, so deep-seated and scanty as to elude detection by either finger or eye. Where the eye sees nothing, the finger may often detect a sub-cutaneous 'nodule'; and the more attentively the sense of touch is exercised, the more doubtful it seems, in many spots, whether there really exists a hardness or not. Let any one, too, consider the tardy growth of the 'tubercles,' that certainly a whole year may elapse before a nodule, once commenced, may make any decided progress. The same observation applies to the other phases of the disease, especially to implications of the nerves; and to exclude the eruptions which underlie and are essentially connected with all, would be the more inadmissible, because of a certainty many slight eruptions pass altogether unnoticed, partly because the patient suffers so little inconvenience from them, that he does not mention them; and partly because they are not, and cannot be recognised. It is very frequent that patients suffer a slight impairment of general health without any very marked symptoms, which subsides in the course of a few days, and whose true character it is practically impossible to determine; such a state may equally well be regarded as an eruptive fever, as any other condition; and especially that phase which is described by the patient as "burning, inward frost," and which is not followed by any febrile reaction, and only renders the patient indisposed for a day or two. I do not possess any measurements of temperature which might throw light on this subject. Such an interpretation of the nature of eruptions, and of the advance of the disease as dependant upon eruptions alone, seems to me to furnish a reasonable explanation why tuberculous subjects, with their copious leprosy products, have so much oftener eruptions, and besides, exhibit more complications than do the merely spotted lepers. The above-mentioned instance of implication in the pharynx and larynx, in a spotted subject may be regarded as one intermediate between the two forms of disease; there 'the spots' were very abundant, and much elevated above the level of the skin. There are, too, cases of the macular form whose termination is entirely analogous with that of the nodular form, where anaesthesia has commenced—the so-called mixed

leprosy. Both skin and nerve-affection progress to their final stage, and with regard to this, I remark that where there has been production of material in the nerves, there will anaesthesia steadily advance, since the new formation passes through its phases until there results a sort of cicatrix; and there is here really no need for the production of fresh material. Nor does such probably occur where the process is once begun (be it remembered that the affection is principally seated where the nerves are subject to pressure, although extending it may be to a longer distance), and that without regard to fresh production in other places; moreover, it should be noticed, as I have above insisted upon, that skin and nerves are not seldom attacked simultaneously under an eruption. There was for some time in the Lungegaards Hospital a patient who was admitted on December 24th, 1867, with tolerably well-defined patches, anaesthesia of the hands and feet, and also paralysis of the palpebrae. On July 29th, 1868, he had an eruption of spots; also on October 21st, on February 6th, 1869, and on August 27th, 1869. I see no rational ground for not calling this case a 'mixed' one; the patient had a simultaneous affection of both skin and nerves, and he was subject to the same fate as other mixed cases, namely, to undergo successive eruptive attacks; and furthermore, there was no surety that he would not become a 'tuberculous' leper; see the note below.\*

So long as there is present a skin-affection from which systemic infection might start, these views may be materially supported, but the instances are not so few, in which fresh eruptions occur subsequently to subsidence of the earlier skin-affections. In this connection may first be noted the cases, which Danielsen cites as examples of the nodular form superseding the anaesthetic, or in which these happens, in subjects possessing an anaesthetic basis, an outbreak of 'tubercles' subsequently to mere spots. It is very difficult, and often impossible, to procure any tolerable information concerning the old patches of eruption amongst patients; one can find sites following such, which are more or less anaesthetic, but which patients have no clear notions about, and are never able to satisfactorily account for. Amongst those who in the Lungegaards Hospital are written off as 'cured' are there such cases, in which the skin-affection at the time of dismissal has completely subsided, but unfortunately there is herein no certainty, but only a possibility of permanent cure, as is proved by the number of relapses of disease. In some of the instances concerning which I have obtained information, have there been patients who being entered as 'tuberculous' or as tuberculo-anaesthetic, have latterly become anaesthetic, and here there is a possibility, nay a probability, that a regular development of an already pre-existing nerve-affection has occurred; these subjects have during stay in hospital suffered from such pains in the legs and arms, as are generally precursors of anaesthesia, and signs of implication of the great nerve-trunks. These are the cases, too, which seem to show that an apparently quite recent anaesthesia, may have its cause in conditions initiated a year, or perhaps five or six years previously.

In other instances there happens an outbreak of 'tubercles'; thus, in a case in which when first seen there were only benumbed places on the site of former patches, there supervenes an altogether new eruption—a new production—series; and we may ask, whence does this proceed? Unfavourable conditions of life now generally bear the blame. Yet with our existing ignorance of the etiological conditions of leprosy, it is impossible to say what rôle perhaps unfavourable circumstances of life and climatic influences may serve here, whether, that is to say, these in and by themselves are conditions capable of calling forth new morbid products, or whether they are hurtful only through a possible action upon older or previous deposits. The significance of climatic influence as regards the advent of erysipelas upon parts of the skin already attacked by leprosy, is unquestionable, and experience serves to show that climate has also some influence upon the frequency of eruptions, since these mostly break out in the cold months of the year, and in raw weather. In order to render possible such contingency, one must pre-suppose the existence of leprosy deposits in the body at the time of the eruption; and I think, not without reason, such may be looked for in the lymphatic glands. Affections of these glands persist long after the previous skin-affection has subsided; and from hence may start an infection of the system, just as well as from the skin; if we admit that eruptions on the whole are indications of such infection, and if we may infer from an anatomical concordance a correspondence in other qualities. The supposition is not, in any case, wholly gratuitous, and it furnishes a reasonable explanation of those relapses which otherwise would remain as mysterious as is the first advent of the disease. And since a relapse is dependant on an eruption, like other eruptions, so may the occurrence be provisionally regarded as an accident, whether it comes in the form of patches, nodules, or nerve-affection; and here, too, there is hardly occasion to mention anything like an antagonism. Although I have ventured, on the strength of anatomical revelations, to point to the lymphatic glands as starting points for the new eruptions; yet it is not my intention to exclude the possibility of the spleen, liver, or perhaps the nerves, being also such starting point. The main point is this, that the presence of leprosy deposits in the organism may be assumed as a fact; and I have had anatomical evidence of its existence in the lymphatic glands, even in the instance of simply macular leprosy. Again, a question of much interest is this, how long after

\* There later happened additional confirmation of this; for the patient quite recently again had an eruption, and along with it a very suspicious tubercular aspect (as Danielsen himself thought);

thus there was a papular or finely-nodular rash on the forehead, which, however, again subsided.

complete subsidence of the skin-affections is the subject liable to a relapse? And with this depends the question of the curability of the disease. Hitherto only those individuals are regarded as cured in whom the skin-affection has subsided, and in whom no, or at any rate no considerable, anaesthesia has become developed; should this last extend so widely that fatal consequences threaten, then is the patient described as uncured, and his disease as still spreading. Now this is not quite correct so far as it refers to the question of the curability of the leprous state. The nerve-affection, like the rest, has its typical course; and whether it has been so severe that nearly all the nerve-trunks have become atrophied, or so slight that a much smaller number are implicated, yet in both cases the affection may have come to an end; cure has been inaugurated, so that the subject may well be regarded as healed, if simultaneous with, or subsequent to, a subsidence of the skin-affection, there has appeared a decided development of anaesthesia. In many instances when the nerves are affected to the greatest extent, is there doubtless during healing (with its cicatrix-like shrinking of the new formation) the greatest degree of anaesthesia; and unquestionably many years may elapse before this process is completed. Sometimes, on the contrary, there happen instances in which very early appears a little anaesthesia, afterwards partly or wholly vanishing, and that simultaneously with the subsidence of a skin-eruption, and several such examples may be found in the lists of those, who have been written off as cured at the Lungegaards Hospital. In these cases the anaesthesia may be caused by pressure of the new formation at its commencement; and its subsequent decline may be accounted for by the latter finally and completely disappearing without having entailed any shrinking of the neurilemma.\* As is well known, only such cases are regarded as partly or wholly cured—yet erroneously so; for the atrophied nerve is also cured as regards its leprous affection, at least just as much as an atrophied eye may be said to be cured after an attack of panophthalmia. With reference to the leprous disease in its entirety, the question remains, whether it ever arrives at such an age, or stage, that there is no longer produced in the organism any leprous material.

That such is the case is shown by anatomical observation of old anaesthetics, whether the original skin form was nodular or macular; for in them nothing leprous can be demonstrated. The point of time when the faculty of further production is lost, is obviously very different. As already above intimated, there are cases where anaesthesia appears so early that it is not only possible but even probable, the nerve-affection may commence at the same time as the skin-affection at the first invasion of the disease. If, now, in such a case the once-happened leprous production passes through the regular phases, i.e., passes to the stage of subsidence (whether or not there is developed a less or high degree of anaesthesia), and in the meantime there happens no new eruption, new products, even at any later period of the patient's life; then may such a patient be declared to be healed of his leprosy. Should, on the contrary, he undergo a fresh eruption, his condition is so much the worse, both because the new products occupy a long time in wasting away, and because he presumably is so much the more liable to again have eruptions. Since it is now clear and sure experience that the more copious these products at first, the greater the liability to eruptions; and since the cases which take a typical course towards healing without fresh eruption are, as a general rule, such as originally showed the least amount of morbid product,—so may it be said that herein is a confirmation of the view that eruptions are the expression of self-infection of the system, and hence appears, as was above shown, a reasonable explanation of the morbid phenomena in question. Again, from the few examples above adduced, it is probable that only the acute disintegration of older leprous products leads to fatal results; and that under slower softening and absorption, the old deposits may be removed gradually and without doing harm. Possibly the lung affections, especially of a tubercular (serofalous) kind, which happen in nodular subjects with their abundant masses of detritus, might be shown to be connected with the absorption of such disintegrated materials. Sometimes in emaciated nodular subjects the 'tubercles' dry up without, as it seems, ever quite subsiding even during long life; yet, under these circumstances, be it noted there are no fresh eruptive attacks. This event, too, might be called a kind of cure; and it would almost seem as if the enfeebled organism were unable to support the development of the disease.

Besides the methods of healing now mentioned, there happens another way, in which, under acute softening of the nodules, numerous ulcers are formed; and thus a means of direct elimination is established. There is now living in the St. Jørgen's Hospital an individual in whom this happened many years since, and who has had no subsequent fresh attacks; his feeling is quite unimpaired. Here the nerves were doubtless scarcely affected from the first, and as it is a rule that anaesthesia comes latest, so may its advent or absence be regarded as a criterion of cure; yet should this rather be sought in the continued or discontinued production of leprous material, and I would repeat that an increasing anaesthesia is a very uncertain indication of the healing process

\* I may here adduce evidence that a recent anaesthesia may probably have its origin in a long standing nerve-affection. A subject entered in the table (January) as having sensation unimpaired, has lately (April) died. No eruption had occurred meanwhile. Then the nerves were found to be affected and the affection was, judging from its anatomical characters, of great age; only retrogressive elements were found, but no thickening of the neurilemma and no atrophied nerve-tubercles. In the

first place, may be remarked that here some loss of feeling might have existed in the acute stage; and in the next, the affection was not yet fully subsided, so that later on may have supervened shrinking with anaesthesia; or, lastly, one may suppose that a nerve so changed would become a locus minoris resistentiae, where, too, unspecific agencies, such as pressure, bruises, or stretching might occasion further thickening of the neurilemma.

According to my interpretation, it concerns us more to know, for purposes of prognosis, whether or not there be any prospect of fresh eruption. So long as there is still an affection of the skin, one cannot be sure of this, except, perhaps, in cases like that of the old nodular leper above mentioned—where, however, the matter seems of no great moment, with regard to the remaining portion of life. We have also seen that neither can one be sure, even after the skin-affection has apparently wasted away or subsided, and it then becomes an interesting question, as regards both prognosis and right conceptions of the disease, whether or not this state of uncertainty may be resolved by us; for instance, is it possible to infer that all the leprosy deposit has been removed, or has lost, perhaps, its power of infecting the system? These questions can, obviously, be answered only by collecting as many instances as possible of relapse or eruption occurring under the circumstances indicated, due regard being also paid to the chronology of events. Unless one has been able to follow up the cases it is very difficult to make out this sequence by interrogating and examining patients. I will here mention two cases, which are, besides of interest as showing an unusual—and for the patients, an unfortunate variation in the general result.

Case 1. Pl. st. No. 911. Male.—For nearly 11 years has he perceived spots, but only on the face. The spots were livid, deep-seated, and particularly apparent on change of temperature. About the same time anesthesia began to show itself, and during the last seven years has so increased that the fingers are becoming curved or bent. He is now anæsthetic equally as far as shoulder and hip; the loss of feeling diminishing upwards, as is commonly the case. Spots he had occasionally detected until the last few years, the latest dating four or five years back. A year ago 'nodules' broke out in both face and extremities. Some of them on the face may be referred to places where there had been 'spots,' others cannot.

Respecting this case, there is first to notice that such deep-seated spots or patches as these, which impart (as in the present instance) a marbled appearance to the skin, more especially belong, according to Danielsen's experience, to the nodular form of leprosy; still they not unfrequently appear side by side with ordinary anæsthetic patches, and several instances of this conjunction will be found in the clinical records of the Lungegaards Hospital. Next may be remarked, that nodules appeared in already benumbed parts of the skin, and that some of them were situated just where the patches previously existed. This last circumstance confirms the statement that a place once attacked becomes a *locus minoris resistentiæ*. Had one full proof respecting earlier patches, the connection between their site and that of subsequent nodules or tubercles, would be of great interest as elucidating the difficult question, why some individuals are tuberculous and others merely spotted. It might be that the oft-referred-to injurious influence of exposure to severe weather and of neglected state of the skin, is partly, at least, limited to determination of the form under which the leprosy disease first appears. Personal idiosyncrasies are also, no doubt, of much significance in this respect.

Case 2. Pl. st. No. 767. Male.—Ill for 15-16 years (since 1853-54): benumbed spots, including the entire outer side of both thighs, and upon which there soon after appeared a few blebs of pemphigus. (He knows nothing of other spots, but he has probably had such; besides the hairs of the eyebrows fell off some time after the disease broke out, and it is usual to find several patches whenever the spots are so large as those upon the thighs.) Shortly afterwards, the soles of the feet began to be benumbed. In 1855-56, about the winter-season, he was confined to bed for a long time; had chills, thirst, and headache; severe pains in forearms and legs came on, and then numbers of large vesicles around the elbows and knees. Invariably as the pains subsided, anesthesia gradually crept in, becoming almost complete in both the hands and forearm; the fingers became crooked and the muscles atrophied; afterwards, the numbness declined in the left-hand and arm, and some of the fingers became rather more flexible; but later again the symptoms returned. When the sores which followed the first eruption of pemphigus were healed, he found himself tolerably well; and so until there appeared fresh vesicles. Little by little the feet became relaxed (1858-59), and sensation equally impaired in them. Excepting that he now had a plentiful eruption of scabies, in the following year he was well; yet the production of blebs still continued, especially on the thighs; as a rule he observed nothing but blebs or sores in the anæsthetic parts (*i.e.*, patches on the thighs), previously to swelling of the inguinal glands; sometimes these last became so painful, that he had to take to his bed. In 1866, he came into the asylum, and was entered as 'anæsthetic'; there being no indication of skin-affection, as he himself asserted when the patches had wholly subsided. In 1867, he began to feel ill, 'impoverished in blood,' affected with palpitations, also pricking sensations in the skin, often great heat and sweating, but so far as he recollects no shivering; and then there began to appear nodules in the eyebrows, gradually enlarging, and others on the sides of the nose, which so much increased that they entirely closed the nostrils, and formed a large ulcerating mass, looking not unlike a *lupus*-affection. Subsequently to this time, the same state of malaise has repeatedly supervened; and tubercles have appeared upon the cheeks, chin, outer side of both thighs, and on both forearms, where the skin may be cut through without his feeling any pain.

This case is full of illustration respecting the production of pemphigus; and the chronological sequences will be differently regarded, as we view such production as directly due to the leprosy disease, or as a mere consequence of it. I have formed no opinion on this point; but let it be considered that in the winter 1855-56, when the nerves were so much affected, the patient had evidently an eruption; but whether at this time the skin was otherwise implicated, than by the pemphigus-blebs which appeared after the nerve-disease, there is no evidence. Let this eruption be taken as starting-point, then up to the last one, about 10 years would have intervened; and it then becomes apparent that the interval between the eruptions may be very considerable. Almost quite corresponding to this, is the instance of a patient in whom five years after his discharge from the Lungegaards Hospital, there happened a relapse or an outbreak of tubercles; and besides this, two and a half years had elapsed before the skin-affection, attending the first invasion of the disease, had entirely subsided. The period in

question is, doubtless, greatly dependant upon the intensity of the earliest productions; but the cases just cited show that the intervals of uncertainty may yet be sufficiently prolonged.

As regards treatment, it is also from hence clear enough that the earlier patients are subjected to the possible prevention of new eruptions, so much the favourable for them; and the practice of the Lungegaards Hospital constantly furnishes evidence of this.

From what has now been laid down as the great rule, having very few exceptions, it clearly appears that the circumstance essentially determining the fate of the leper, is the skin-disease with which he is affected; and *fiat nominatio a parte portiori*. The most correct expression of this feature is implied in the distinction of the chief forms of disease, as *lepra tuberculosa*, and *lepra maculosa*. Anæsthesia is only a name for a consequence of a '*lepra nervorum*,' and this name would be most suitably employed to indicate the nerve-affection; but although it is true that this last essentially appertains to *lepra*, yet it is not legitimate to make of it a special form of disease; and one had best give up the designation of 'anæsthetic leprosy.' Likewise the denomination of 'mixed leprosy' ought to be discarded; for it only indicates a stage in the development of the disease.

Whilst I am unable to throw any light upon the difficult question of the ætiology of leprosy, I may yet offer some remarks on this subject.

Inheritance is the sole causative condition which, through the investigations of Danielssen and Boeck, has obtained any general recognition, as being of valid weight: it is the only one in support of which facts speak. But there are also facts enough, which prove that inheritance cannot be the only effective condition; and in order to explain these other instances, have men been prompted to resort more or less to the regions of conjecture. Here in our country (Norway) reference has been chiefly made to unfavourable climatic influences, especially a frequent and great refrigeration of the body; together with such common conditions as uncleanly habits and bad food. District-surgeon Holmsen has supposed that a miasm or malaria, produces the disease. In both instances recourse is had to such effects of local conditions as may be termed injurious influences, namely, such as place of residence, occupation, mode of life, &c. are supposed to exert. The deceased Superintending-surgeon Høegh suspected that leprosy was contagious; but during his lifetime could not elicit any valid proofs of this. Lastly, in the year just ended, there has appeared the little book of Drogna Landré—"La contagion, seule cause de la propagation de la *lepre*"—in which the claim of the title is vindicated.

If one tries by examination of patients to come to some results, it is speedily found that every opinion may be thus defended; examples may be had in favour of one, or of another, or of a third, and nothing whatever is demonstrated.

First, as regards the rôle of inheritance, it is my opinion that it is by no means established. So long as cases occur to which heredity cannot be made to apply, and so long as that condition which has called forth such cases, is unknown to us, so long will it be impossible to learn whether or not the same condition has not been in operation, even in instances in which the disease is believed to be derived by inheritance. So long as these two things cannot be duly weighed one against the other, must inheritance remain, if a probability yet not more than a probability.

When one has to deal with uncertain factors, there is always great scope for individual predilection, or subjective inclinations. Bidenkap has thus in his dissertation in the *Nord. Mag. f. Lagesk.* Bd. 14, where he compares the relative probabilities of various causative influences, in my opinion laid undue stress upon the significance of inheritance and local conditions, as contrasted with the possibility of contagion. I will take one of his instances (723), and quote it in its entirety:—

About 12 years ago a leprosy woman named Helene Ragnaldsdatter, came to reside in the hamlet Kosme in Førde parish. She abode with a pair of cottagers from Jølster, and during the summer tended cattle in the vicinity of a remote hamlet called Flugedal. The eldest daughter in this last-named farm, named Helga, also tended cattle, and will often have been together in the fields with the leper above-mentioned. Nine years since, leprosy broke out in this Helga; four years since her sister Anne and her brother Ole were also attacked. About the same time, the disease showed itself in the two old folks from Jølster. Two years since Helga's mother became leprosy, and during the last year the disease has appeared in another brother Ludvig. The father Johannes likewise presents marks of incipient leprosy. Besides these individuals there are only the three youngest born, who are still healthy.

The advent of disease in the farm Flugedal, which lies apart, being about five miles (English) from the water-side and tolerably high, and in a family never showing, one is assured, any taint; also the simultaneous outbreak in the two old cottagers from Jølster, are unquestionably remarkable events, and might well give rise to the suspicion of contagion. But several circumstances which I more recently have ascertained, render this instance less extraordinary: thus both the parents at Flugedal had leprosy relatives, though in a distant collateral line.\* Of the two people from Jølster has the wife a leprosy niece (brother's daughter), and probably other affected connexions; their daughter, nine years old, and away in Vefring parish, before the leper woman came to live in their house, has, since two years, become affected. The natural conditions on this farm seem also favourable to the outbreak of leprosy; thus below the houses lies a soft marsh, of some considerable extent, where grass is

\* There was no leper in the generation immediately preceding, except on the wife's side in a very distant relative.

mown every summer. At this work the inhabitants constantly stay immersed in cold water, without any water-proof protection, and that often for days in succession. On the whole, the family seems to have led a hard, overtasked existence under unfavourable outward conditions. The two old people at Koame had long lived in very restricted circumstances; of their many children, who now are out at service, none has been affected but the one daughter at Vefring, who had, however, suffered many hardships. Whatever be the force of such instances as this, they are not uncommon in districts where leprosy is frequent, and when closely scrutinised, circumstances may generally be found in them, equally suggestive (it is said) of other causative influences than contagion. In this asserted 'equality,' I cannot for my part quite agree. Let me put the question of inheritance versus contagion. If one regards heredity or hereditary predisposition in general, and specially an acquired family proclivity, which as a given factor in other instances is present in heredity, on the one hand, and on the other, a possible contagion, it may at once be admitted to the exclusion of discussion, that the former is of greatest weight. But let us consider both factors as mere possibilities (as must be done in those instances where their leprosy ancestors are wanting) then I own that contagion comes farther within the reach of my medical apprehension than does hereditary influence; because to establish this last, one has to conceive of an influence acquired from a certain mode of life and from certain local conditions, which being accumulated in previous generations becomes an inherited disposition, last of all exhibiting itself in the form of leprosy. Thus regarded, the disease appears as a result of local influences, but let the circumstances now be confronted with contagion; in the first place, it is not proved that the local conditions, in the case quoted, ever did engender leprosy; and in the second place, it comes closer to my conceptions that an immigrant afflicted with a peculiar disease, should convey the same to the inhabitants of the locality, than that a marsh, wading in cold water (mostly in summer, too), bad food, &c., should engender such disease. Let the other two possibilities against contagion be adduced, yet I cannot allow that they amount to much, because they both rest upon the same assumption, and I think that in the case above quoted, none of the conditions intimated could have imparted leprosy to the affected individuals, 'equally' as might contagion. And although the instance is not, as Bidenkap remarks, of itself convincing, since one cannot do anything with such complicated examples, yet it seems to me to convey a great inducement to pursue the search after contagious influences. With respect to local conditions, in my own opinion we have been altogether national in our estimation of them; this disease exists over the whole earth, and is exactly the same whether found in China, East Indies, Africa, South America, West Indies, Crete, at the Caspian sea, as with us in Norway. In order to arrive at some definite results in this matter, one should take into consideration all the reputed conditions prevailing in these countries, with the object of eliciting those which seem to be everywhere identical, and in this way reducing to a minimum the material with which to work; yet, when this has been done, so far as at present appears, it would result that leprosy should be generated in almost every part of the country. So far as I know, the sole condition which can with any tolerable certainty be regarded as universally prevalent in all these several localities (both at home and abroad) where leprosy prevails, is the vicinity of water, either salt or fresh. This fact points to a connexion between such vicinity and the prevalence of disease, but to nothing more. It is not my intention to inquire into the pro et contra with respect to the possibility that this vicinity to water, may engender the leprosy disease; I will, therefore, only insist that if this disease be contagious, the condition now alluded to will not unreasonably be reduced to one which is favourable to extension of the malady, and that we have no right to deny the possibility of contagion, because no one amongst us has ever earnestly sought after it; these being so many conditions which seem to be incompatible with contagiousness, that in their presence search is discontinued, and attention principally directed towards other circumstances. Bidenkap is the only one who has inquired into the matter, somewhat fully indeed, but as I think somewhat partially also, and it is certainly not apparent from his representations, that he has endeavoured to control inheritance by help of a supposed contagion. Yet there are several things which tell for contagion. There is first, the history of cases as narrated by Drogmat Landré; and though the author permits some confusion of Elephantiasis Arabum and Leprosy, yet his descriptions of cases leaves no doubt that these last were leprosy. Instances in conformity with Drogmat Landré's are known in England, and not a few such; but they unfortunately have not, so far as I could ascertain, been carefully investigated. Further, the disease has, as Drogmat Landré shows, been introduced into Surinam, and also into New Brunswick, as records in English describe. Now, could the immigrant create local conditions in these places? Unfortunately, there are no absolutely certain accounts concerning New Brunswick; but in Surinam it is sure enough, that there are so-called spontaneous instances of leprosy. If one looks into the historical portion of the work by Danielssen and Boeck, it will be seen that the disease spread gradually over Europe; here it came chiefly through the crusades, when communication with the East was very active. Subsidence of the disease from segregation of the sick in leproseries will tell for both heredity and contagion, but quite decidedly against local conditions; improved civilisation, which is also taken into account for the subsidence of the disease, would as well unquestionably diminish the number of circumstances favouring the spread of contagion. Lastly, there is the character of the malady; it is no mere skin-disease, probably not even at its very first commencement; and it has, subsequently, according to my interpretation, so much likeness to a chronic infection-disease, seems so exquisitely to carry on infection of its victim—that in this circumstance also, lies an incentive to search out whether the complaint does not originate in an infection—and so much the more so, as the phenomena at this

stage entirely correspond with those of the later eruptions; also, more especially to find out whether the malady is not, in such cases, really contagious. This is so important a question as regards the leprous pest, that I would 'unhesitatingly' put it first on the list of doubtful points concerning the causes serving to propagate the malady, which one may aspire to solve; and it has, besides, this advantage, namely that in our attempts to gain a satisfactory position, other important points cannot be overlooked. Probably also, if it exists, is this contagious property easier to find out than the essential or proximate cause of the disease, supposing that this last be still, and in all circumstances, in operation; and thus in its practical aspect there is a double incentive to strive to solve the question of contagion; let this be clearly answered, then one may proceed to determine whether contagion is the only cause of spreading the malady; let it not be solved, yet in any event one will not have worked more in vain, than has hitherto been the case.

I have still to mention a condition for guidance with reference to the demonstration of contagion. In Danielssen and Boeck is mentioned the case of a Frenchman who had sojourned eight years in the West Indies, and who six years after his return to France, became a leper; also the case of a Dutchman who had resided 10 years in Surinam, and who about the same period after his return to Holland, became leprous. It is possible that there had been symptoms in these patients during these intervals, which they had not noticed, yet whatever the cause of their disease, it may be supposed that it was encountered in the leprous countries of Surinam and the West Indies; and hence these cases show that it will be by no means easy to clearly demonstrate the rôle of contagion, but that probably, though this is not yet proved, the latter is in universal operation.

## APPENDIX B.

ABSTRACT of OBSERVATIONS recorded in the TREATISE on SPÉDALSKHED by Danielssen and Boeck ;

## I.—TUBERCULAR

| No. of Case. | Sex. | Age: Years. | Duration of Disease: Years. | Clinical History.   |
|--------------|------|-------------|-----------------------------|---|
| 1            | F.   | 10½         | 1½                          | Tubercles on the face and limbs; on the conjunctiva; in the fauces, &c. Few ulcers, stunted growth; and some œdema of the limbs. No premonitory symptoms: first signs, an eruption of livid spots. No hereditary taint. Circumstances, and general health, good. Latterly has had some hoarseness of the voice. In November 1841, a febrile accession: and in June 1842 an attack of pœmonia: death.  |
| 2            | M.   | 40          | 2                           | Tubercles on the face and palate: livid spots and nodules on the arms: nodules and infiltration in the lower limbs, with impaired sensation, thickening of the cuticle and œdema of the legs, below the knees. Commencement: nervous fever, and livid spots on the arm, followed by nodules. General health good. Is a shepherd and has suffered from exposure to bad weather. Has had good food. No taint, and his own family are all well: has lived for a long time in Bergen, and is said to be addicted to drink. March 1841; diarrhoea of dysenteric character. May: febrile accession, with swelling of the face (erysipelas): pains in the limbs and joints: swelling of the knee, cheek, pyrexia, thirst; loss of sensation in the arms and legs. Again tumefactions and fever in August and September. Ulcers on the trochanters: progressive emaciation: complete subsidence of the tubercles in the skin: failure of the vital powers (October).  |
| 3            | F.   | 34          | 3                           | Tubercles on the face: livid spots, and some infiltration in the limbs; hoarse voice. Commencement: livid spots on the face: pains in the limbs, &c. Has tended cattle in the open, from her childhood. No one else in her family affected. Menstruation ceased at the beginning of disease. Is in good health; all appetites normal. She slept with a leprosa woman for a whole year. March 1841; headache, fever, delirium, and debility. Cough, dyspœna; depression, sweating. The tubercles on the face have much diminished in volume and are softer. April: Coma and death.   |
| 4            | F.   | 29          | 3                           | Tubercles on the face: on the sclerotic coat of the eye-ball; livid spots, nodules and cicatrices on the limbs; ulcers on the legs; and on the palate, &c., the voice is hoarse. Commencement: general indisposition, cough, hoarseness, and cessation of the menses: then nodules on the chin, &c. A year afterwards, pain in the eyeball and intolerance of light, &c. (there is adherent iris and weak vision on both sides). Menstruation has lately re-appeared, but is scanty, &c. Has been much exposed since nine years of age to cold and wet. No family taint. Is in fair health; tongue clean, but has little relish for food: evacuations, and sexual appetite natural. June 1841; febrile disturbance, swelling of the face, headache, &c. The nodules afterwards diminished in size, colour and consistence. February 1842; inflammation of one of the ulcers. March: headache, fever, dyspœna, cough, and copious expectoration. September: the same series of symptoms, diarrhoea, is losing strength. November: again exacerbation of the chest symptoms; ulcerations on the nates; death in January 1843. |
| 5            | M.   | 22          | 4½                          | Commencement: pains over the brows lasting six months, followed by red and raised spots. Pains acute and lacerating in the limbs, followed by similar spots and then by tubercles. Ulceration of the nodular masses on the face and lower limbs. General health good. Erotic desires natural: no marked anæsthesia. Has suffered exposure in his youth; food frugal, but healthy. Three brothers and a sister are leprosa; knows of no leper in his family. April 1841; febrile disturbance; ulceration of the tubercles on the tongue, &c. October: swelling, redness and pain in the legs. January 1842; febrile disturbance, swelling of the face, &c. Ulceration and emaciation continue. March: the arms swollen, red and painful. June: another febrile accession; copious sweatings. Diarrhoea, November: again fever, diarrhoea. January 1843: fever, dyspœna, cough, and fatal exhaustion.   |
| 6            | F.   | 22          | 12                          | Livid patches, and small soft tubercles on the face; similar bluish, flattened or slightly elevated patches on the limbs which are also covered with a chronic eczema, voice hoarse. Commencement: constant pains in shoulders and knees, with heaviness and languor; then red spots on the forehead and legs; some of the spots were followed by tubercles; the pains ceased, when these tubercles freely ulcerated; when the ulcers closed the patient had pains in the chest, cough and hoarseness. She was much exposed to inclement weather in her youth. None of her eight brothers or sisters are affected; no family taint. In fair health, and appetites natural. Soon after her admission, February 1841, she lost flesh, acquired a cough, and showed all the signs of extensive chest disease. She died in May.   |

\* The tables do not by any means contain the whole of the observations made by the Norwegian physicians, essential particulars really different

## APPENDIX B.

translated from the text in French, Paris, 1848; and reduced to a tabular form.\*

## LEPROSY (Norwegian).

| Post-mortem Appearances.  |  |   |  |  |
|---|--|---|--|--|
| Cranial Cavity.   | Spinal Canal.  | Thoracic Cavity.  | Abdominal Cavity.  | Remarks.   |
| Brain normal - -  | Adhesion of dura-mater to dorsal vertebrae.                                      | Tubercles in the larynx; right lung hepatised.                              | No record - -  | Lardaceous infiltration of the skin of the arms and legs. Notice the stunted development. (H. V. C.)   |
| Gelatinous effusion in the sub-arachnoid spaces, and some adhesions to the falx cerebri.  | Nothing abnormal -   | Some pleuritic adhesions on the right side.                                 | Liver much enlarged: vascularity of jejunum. No other marks of disease. The vesicula seminalis of the left side was dilated.   | Much emaciation, some infiltration of the skin and subcutaneous tissues. Vessels nerves and muscles of the arm said to be normal. Was not this a case of rapid-softening of the tubercles, and infection of the system? (H. V. C.) |
| Similar effusion to the above.  | Everything normal -  | Pneumonia of left lung: a few tubercles at apices of lungs.                 | Scrofulous(?) ulcers in the small intestines; tubercular infiltrations of generative organs, and their peritoneal investment.  | This seems also to have been an instance of acute softening of the leprosy deposit, followed by tuberculosis (?).  |
| Thickening of the arachnoid, and adhesions to the dura-mater.   | Everything normal -  | Tubercles and a cavity in the left lung; crude tubercles in the right lung. | A considerable amount of serous effusion.  | Much emaciation. Inguinal glands much enlarged. 'Tubercular' (strumous?) disease of the larynx, &c.  |
| Arachnoid thickened in places, without becoming opaque.   | Nothing abnormal -   | Grey hepatisation of the left lung. Coagula in the ventricles of the heart. | Liver much enlarged. Spleen enlarged and very soft. Kidneys congested.   | Body in fair condition. Tubercular infiltration of the larynx. Great enlargement of the axillary glands; lardaceous infiltration; softening. Inguinal glands enlarged.   |
| Adhesions between the dura-mater and cranium; some ossification of the dura-mater. Gelatinous exudation over the hemispheres and some adhesions of the arachnoid to the falx. | Nothing abnormal, beyond a slight effusion between the dura-mater and arachnoid. | Pleurisy; adhesions and serous effusions. Pericarditis.                     | Enlargement of the liver: numerous abscesses (?) in its substance; adhesions. Spleen large, studded with nodules, and adherent. Well-marked tubercular (strumous?) peritonitis, with its usual atrophants — adhesions and serous effusion. | Much emaciation. The inguinal and axillary glands much enlarged. Lardaceous infiltration of the skin of the extremities.   |

but the instances given in them are not selected ones; and those omitted, as being here superfluous, are not in from these entered above.

| No. Case. | Sex. | Age: Years. | Duration of Disease: Years. | Clinical History.   |
|-----------|------|-------------|-----------------------------|---|
| 1         | M.   | 17          | 4                           | Colour of face sallow, expression dull and woe-begone, otherwise the lad is tall, strong, and healthy-looking. The orbiculation region around the right eye has lost its natural fulness; there is ectropium of the lower lid, overflow of tears, &c. The cheeks are rather puffy. On the tanned legs there are some small, superficial ulcerations. Sensation is diminished, and even in the arms and face, it is less acute than natural. There is chest disease. Commencement:—Swelling of the legs and periodic pains; large vesicles on the thigh, which leave behind the shallow ulcers. Only lately has sensation become less, and the ectropium come on. Hemoptysis three years ago. Has suffered some hardships, but not more than others, not lepers. No family taint. All the functions are normal. March 1842; severe pain, dyspnoea, haemoptysis; death.   |
| 2         | M.   | 36          | 8                           | Tubercles on the brows; ectropium of the left, lower eyelid; cheeks collapsed, and some paralysis here. Small superficial ulcers on the front of the legs. Sensation is defective on the outer side of the arms and thighs, and is entirely wanting in the feet and legs. Commencement:—Pains in the legs and feet, lasting two years, and followed by anesthesia. Afterwards the tubercles on the brows, and diminution of feeling in the arms. His nephew, and no one else, a leper. Appetite is good; is married; the sexual desire (temporarily?) ceased when he became a leper. The tubercles on the face altogether subsided; December 1842. Wasting of the cheeks, &c. continues. August 1844: seized with fatal pneumonia.  |
| 3         | F.   | 50          | 10                          | Marks of former nodules on the face. Right leg swollen and hard, a large ulcer on it; the left leg also swollen. Loss of feeling in the hands. Commencement:—A firm, red swelling on the legs, increasing and ending in the ulcer; nodules on the face, &c. She caught cold during a menstrual period. No family taint. Is in fair health, and with all the natural appetites. In May 1841, and April 1842; probably febrile attacks. January 1843: sensation becoming less in the feet; she has frequent chills, and sensibility to cold; sense of dryness; the fingers are beginning to be bent. March: ectropium beginning. June 1844: pain in chest; tenderness in belly, fever, vomiting; she died in two days.  |
| 4         | M.   | 25½         | 16                          | Wasting around the eyes; the eye-lids do not cover the ball; cheeks flabby and drawn to the right, also the upper lip when the patient speaks. All the fingers are bent. An ulcer on the sole of the right foot; cicatrices in the lower extremities. Sensation is lessened in the face, and almost lost on the arms and legs. Everywhere sensibility is rather obtuse. Blisters first appeared on the limbs, with numbness and curling of the fingers; the blisters left ulcers behind them; they continued to appear for four years; some slight necrosis of the toes and fingers. Otherwise the patient looks well; no venereal desires. Has been a shepherd, and much exposed to the weather; has had good food. His father and brother were both lepers (tubercular form); his nephew is now in the leper hospital. April 1841: an ulcer formed in the sole of the left foot; an abscess formed. January 1842: pains in the limbs, with feverishness and extensions of the ulcers. June 1844: more emaciation, paralysis of the face, "he cannot inflate the buccinators;" the anesthesia has reached the abdomen; he has periodical pains in the legs and head. Epistaxis. Cough; haemoptysis; pneumonia; he recovered. January 1845: the urine is said to contain much albumen. He is very thin and weak. Pneumonic symptoms again set in, and he died in March. |
| 5         | M.   | 49          | 20                          | Facial wasting, paralysis, ectropium. An incipient cataract in the right eye; tubercle on the cornea of left eye. Sensation diminished on the face; four fingers of one hand destroyed by necrosis, and three in the other; the remaining fingers being strongly bent inwards. Sensation absent in the skin of the arms, as far as the neck. The toes are similarly affected, and sensation is lost as far as the knees. Pains and ulceration about the ankle; an ulcer on the left heel. Otherwise, the man seems in fair condition; venereal appetite normal. (1841.) Twenty years ago he lost two toes from severe cold. Has suffered much exposure and even hunger, but has not lived on unwholesome food. No family taint; his four brothers were well. Ulceration reached the left ankle-joint; fever and low delirium. Again and again delirious and even maniacal paroxysms, with vomiting and purging. Exhaustion proceeded. July 1844, severe spasms of the trunk and limbs; permanent flexure of the elbows and knees; coma; death in October.   |
| 6         | M.   | 32          | 24                          | Facial wasting, paralysis, ectropium. Loss of several phalanges belonging to the fingers; permanent flexion of the other fingers; the great toe of the right foot is also in part necrosed. There are ulcers about the other foot and the leg; cicatrices on the arms and legs; diminished sensation in the face, &c. and greater numbness of the hands and feet. A large vesicle at the elbow was the first sign noticed; others followed, and ulcers remained. He is now in a miserable condition, tormented with diarrhoea and sexual desires. His mother, three brothers, and sister, his maternal uncle and aunt, and many other members of his family have been lepers. Pyrosis. Pains in the limbs, with swelling; fresh ulcers; swelling of the cheek, pyrexia, dyspnoea, vomiting, and diarrhoea. Death in October 1843.   |

## LEPROSY (Norwegian).

| Post-mortem Appearances.   |  |   |   |   |
|--|--|---|---|---|
| Cranial Cavity.  | Spinal Canal.  | Thoracic Cavity.  | Abdominal Cavity.   | Remarks.  |
| <p>Much venous congestion; a few adhesions along the longitudinal sinuses; and in the sub-arachnoid space, some yellowish, albuminous exudation, around the roots of the seventh and eighth pair of nerves, the Gasserian ganglia, &amp;c.</p> <p>Dura-mater strongly adherent to arachnoid; arachnoid in places opaque, and beneath it, yellowish gelatinous exudations. Cerebral substance pale.</p> <p>At certain places on the surface of the brain, and between the arachnoid and pia-mater, there were gelatinous exudations. The arachnoid was thickened. Fluid in the lateral ventricles, and their pia-mater covering them, somewhat thickened and tough.</p> <p>Adhesions and sub-serous effusions of gelatinous consistence, in the membranes. Substance of brain, anæmic, very firm and tough, so that it could be drawn out; less tough at the base of the brain and then almost normal. Some fluid in the ventricles. Considerable albuminous effusion around the seventh pair (facial nerve) and the Gasserian ganglion.</p> <p>Adhesions and sub-serous effusion of albuminous matter. The brain-substance a little injected with venous blood, and very tough. Arachnoid thickened, especially at the base of the brain, and near the origin of the seventh pair, the optic commissure, &amp;c. Two drams of serum in the ventricles in little congestion of the choroid plexus. The hemispheres of the brain were adherent, and the medulla oblongata was adherent to the cerebellum.</p> <p>hand. A similar hypertrophy exists in the radial, as in the ulnar nerve; here, however, it begins at the wrist-joint.</p> <p>Sacral plexus.—The sciatic nerves are, at their upper part, atrophied so much as to measure only three lines in breadth, and their sheaths are no longer filled with nerve-substance. The branches, both muscular and cutaneous, which issue from the sacral plexus and from the upper part of the sciatic nerve, are also atrophied. The tibial (internal popliteal) nerve, as soon as it perforates the <i>solas</i> muscle, begins to acquire a large size; and it becomes at least double the dimensions of the sciatic nerve at its upper part, and it is so hard and firm that one can with difficulty cut it. Its branches in the sole of the feet (plantar nerves) are much thicker than natural. On cutting the hypertrophied part of the tibial nerve, the primitive bundles are seen to be compressed, as it were, by a firm substance, almost cartilaginous in consistence and adherent to the main sheath.</p> <p>The frontal and occipital bones were in some parts hypertrophied to the thickness of half an inch. The arachnoid was considerably thickened, and covered with a gelatinous and serous exudation. The lateral ventricles contained only a little serosity; and the choroid plexus were empty and very pale. The substance of the cerebellum was a little softened.</p> | <p>Extreme venous congestion of both membranes and nerve-substance, here and there yellowish, albuminous exudations, between the arachnoid and pia-mater.</p> <p>Autopsy 24 hours after death.</p> <p>Venous congestion. Arachnoid and pia-mater adherent above some yellowish, gelatinous exudation between them. Substance of cord so firm and even hard that "il est impossible de l'extraire par la pression." Colour rather pale.</p> <p>Autopsy seven hours after death.</p> <p>A serous effusion amounting to one and a half ounces, between the dura-mater and arachnoid. Arachnoid and pia-mater closely united, and though transparent, somewhat thickened, so that they might easily be detached from the spinal cord. Its substance was everywhere, and especially below the upper dorsal vertebrae, hard, tough, and in some sort sclerosed; and when one pressed it between the fingers, it resisted the pressure. It was at the same time rather pale.</p> <p>Autopsy 44 hours after death.</p> <p>Veins much engorged and between the vertebrae and the dura mater much fat, especially behind. The cord was so far from this that it did not fill its sheath, and its substance was almost everywhere sclerosed.</p> <p>Autopsy 10 hours after death.</p> <p>Spinal cord considerably atrophied, being only a little thicker than a quill; it is very tough, and hence cannot, by means of pressure, be made to project out of its tunics. It is, at the same time, so hard, that it creaks under the knife (when cut into), the grey substance is of a dull yellow colour, and a little injected. The membranes are healthy.</p> <p>Autopsy five hours after death.</p> <p>There was a slight abundant effusion of serum between the pia-mater and arachnoid.</p> <p>Autopsy 25 hours after death.</p> | <p>Plemitic adhesions on the right side, extensive and of various ages. Splenisation of the right lung. Congula in the right side of the heart, and some fluid in the pericardium.</p> <p>The right lung (upper lobes) in a state of grey hepatisation. Left lung and heart healthy.</p> <p>Not examined.</p> <p>Considerable serous effusion in the left pleura. The lower lobes of the lungs were hepatised, and at their apices were to be seen cicatrices. The walls of the left ventricle of the heart were hypertrophied.</p> <p>A cavern is seen in the lower lobe of the left lung, of the size of a nut; the pulmonary tissue around it, is somewhat condensed.</p> <p>sheaths were empty. The median nerve is swollen to double its normal size, from the elbow downwards to the middle of the fore-arm and its substance is equally hard as is that of the tibial nerve (see below). The sheath and prolongations are the parts hypertrophied. The median nerve is again swollen to twice its size, at the wrist-joint; and this hypertrophy, as far as it can be followed, extends to all the ramifications in the</p> <p>Serous effusion in the left pleura; and false membranes had formed. This lung was grey, hepatised, and oedematous. The right lung contained a serous infiltration. The heart was large and distended, the pericardium was paler than usual, and it contained a little serosity.</p> | <p>Congestion of the liver and intestinal mucous membrane. Tumor glands in the mesentery. The seminal vesicles and other organs of the abdomen, in a normal state.</p> <p>Some enlargement of the liver; and some injection of the mucous membranes.</p> <p>Not examined.</p> <p>The liver was enlarged and fatty. The spleen normal; the pancreas, a little hard. The left kidney, somewhat enlarged; its substance a dead white, lardaceous, a little granular, so that one could not distinguish cortical and medullary substance. The right kidney, less hypertrophied and in its substance, especially the tubular portion, were several yellowish spots, passing quite through it. Stomach, intestines and bladder in a normal state.</p> <p>Liver is like a nutmeg; gall bladder filled with thick black bile; spleen and pancreas, are normal. Cysts in the kidneys. Mesenteric glands rather swollen; all else normal.</p> <p>On further examination of the kidneys, the cysts were found to be of small size, one being as large as a nut; and the intermediate renal substance was healthy.</p> <p>The median nerve is swollen to double its normal size, from the elbow downwards to the middle of the fore-arm and its substance is equally hard as is that of the tibial nerve (see below). The sheath and prolongations are the parts hypertrophied. The median nerve is again swollen to twice its size, at the wrist-joint; and this hypertrophy, as far as it can be followed, extends to all the ramifications in the</p> <p>A slight serous effusion in the cavity; intestines in places injected; the spleen very large and hard; the liver covered with plastic exudations, and gall-bladder distended. The kidneys, in section, had a granular aspect.</p> | <p>Body distended, limbs swollen.</p> <p>The body is slightly emaciated, and here and there may be seen some faint brownish patches.</p> <p>A small ulcer in the left leg.</p> <p>Body rather thin, pale. The fingers of the two hands strongly bent inwards. The lower extremities oedematous. Bed-sores on the hips. The inguinal glands much swollen. Hairs plentiful on the head and the pubes.</p> <p>Body considerably emaciated; hair and beard plentiful; inguinal glands somewhat swollen; bed-sores on the hips and coccyx. Luxation of the foot, with exposure and ulceration of the lower end of the tibia.</p> <p>Dissection of the nerves and brachial plexus.—Its upper and lower portion, and also the nerves coming off below, are in a state of atrophy, as far as about the middle of the arm; and on touching them it would seem as if the nerve-</p> <p>The deceased was not much emaciated. Growth of hair luxuriant. Face puffy; bed-sores on the hips. Elephantoid ulcers in the soles of both feet; lardaceous infiltration of the skin and luxation of the left foot, following necrosis.</p> |

These tables are here introduced as an illustration of the results of autopsies made in Norway, and as an indication of those points—especially as regards the state of the central nervous system in anæsthetic leprosy—which have yet to be established in Indian experience. They also show to what extent post-mortem examinations were first carried out in Europe; there being, it may be observed, but one instance (viz., No. 5 of anæsthetic leprosy), in which the condition of the nerve-trunks of affected limbs were examined; and hence becomes evident, another point of difference from more numerous the Bombay dissections.

I have not tabulated the other 10 examples of 'mixed' leprosy, which are recorded by Danielsen and Boeck in their great work; but should add the following remarks extracted from this book, p. 320:—"When we have had occasion—and such has been frequently the case—to make autopsies of lepers presenting one form of disease complicated by the other, we have always met with an admixture of the pathological alterations already described as belonging respectively to the tuberculous and anæsthetic forms of leprosy. It has been otherwise, when the anæsthetic form has become changed into the tubercular, and *vice versâ*, when the first has been displaced by the second; in these cases, our autopsies have revealed the presence of those pathological alterations which belong to the last or supervening form." These observations are, in themselves, of great interest, but they were not borne out by my experience in India; nor do I know where to look for their confirmation. Thus, in the latest similar example which I have met with (see Bergmann's pamphlet on 'Die Lepra in Livland,' St. Petersburg, 1870, pp. 31-32), it is distinctly stated that the substance of the brain and spinal cord was in a normal or almost normal state—the only unusual appearance in the preserved cord being the obliteration of the central canal, which is a morbid alteration of probably slight significance. Yet several of the large nerve-trunks in the extremities, were found to be greatly diseased, and that in the usual manner.

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## APPENDIX C.

THE following extract is a literal translation of part of the Memoir on Anæsthetic Leprosy, written by Dr. Danielssen in the "Samling af Iagttagelser om Hudans Sygdomme, " 3me Hefte. Christiania, 1862," and it is here introduced, because of the complete illustration which it affords, of the absolute identity of leprous nerve-disease in Norway and in India; it also shows that while the results of inquiry published independently, and at about the same date, in Christiania and Bombay, are closely confirmatory of each other, there is yet something peculiar to each, supplemental in value; and lastly, the conjoined researches are hardly less indicative of acquisition, than they are of deficiencies still to be made good, as regards even the ordinary morbid anatomy of leprosy in some of its forms.

These interesting remarks of Danielssen were too long to be introduced in the text, but they can readily be studied in connection therewith; and I may add, that the admirable Plates which illustrate the work now referred to, seem to fairly represent the usual appearances of leprous nerves, as seen in India.

Further reference to the general subject of nerve-disease in leprosy will be found at page 82.

After describing the condition of the skin, where the turgid patches of eruption common in anæsthetic leprosy have appeared (*see above*, p. 85, note †) Danielssen continues:—In the adipose tissue of the skin, some slender ramifications of the nerves distributed to the cutaneous surface occupied by the patches, are seen to present a slight rose tint on the outer surface of their neurilemma, and on examining with a lens these places, the red tint is found to be due to a congeries of blood-vessels. On the inner surface of the neurilemma there was no redness, nor was there any such tint in the nerve-bundles enclosed within. At a later time, when the subsiding patches, having lost their intenser colour, had become pale and almost insensible, the congestion of the capillary network had completely disappeared. The skin itself at the spot was almost anæmic; there could be no longer seen under the microscope any irregular dilatations of the capillaries, and only mere traces of the swollen and enlarged cells mentioned above, in this respect: the skin had in appearance again become almost normal. But, on the other hand, the finer branches of the nerves distributed in the sub-cutaneous adipose tissue, were considerably tumefied over an extent of several lines, or even of a couple of inches, and on their external surface they had acquired a reddish-brown colour. The same tint was found in the inner surface of the neurilemma—now a little thickened: but the nerve-bundles themselves were only of a rosy hue and slightly swollen. When the spots on the skin has become quite white, and the sensibility of this part is altogether absent, it will be found that the skin has lost a part of its adipose stratum, and the corium seems to be thinned. The previous tumefaction and enlargement of the cells have

entirely disappeared, the sebaceous follicles are contracted, the slender nerve-branches are greatly swollen in a large part of their course, and have a brownish colour, which extends through their whole thickness.

Amongst the *cutaneous nerves* which are attacked at the beginning of the disease, and whose alterations I have frequently had occasion to examine, are those of the extremities, and especially the *larger internal cutaneous nerve*, or more particularly the branches of this trunk in the skin of the fore-arm. The anterior division is usually the first attacked, and it may then be seen that some few of its branches are greatly altered, whilst the neighbouring ones remain intact, and in such instances, the spots in the skin supplied by the diseased filaments, have always been pale in colour and deficient in sensation. This observation was the more readily made, when the spots upon the fore-arm were in different stages of development. Thus, when spots situated at the lower part of the inner border and outer surface of the fore-arm were pale and anæsthetic, whilst the spots at the upper part of the same regions were more or less deeply tinted, and their sensibility but little diminished, it was found that the corresponding branches of this internal cutaneous nerve were, below, considerably swollen and of deep-brown hue, whilst on the other hand, they were but little affected above. In proportion as the cutaneous anæsthesia was developed, the nerve became implicated in its entire course; thus, I have found this trunk from its commencement to all its ramifications, of a thickness double the normal volume. The *external cutaneous nerve (perforans Casserii)* has been found swollen and brown, only below the bend of the elbow, and particularly after its division at two branches. The *lesser internal cutaneous nerve* is undoubtedly much

more rarely attacked than the two preceding. At least, I have seen it only once swollen to a slight extent.

The cutaneous nerves of the lower extremities are attacked in the same way, under similar circumstances. I have often found the branches of the posterior common cutaneous nerve (*lesser sciatic*, H. V. C.) of the thigh, especially those which pass the skin of the buttocks and back part of the thigh, as well as the branches of the peroneal cutaneous nerves to be considerably enlarged and changed in colour, and I have not seldom met with many branches of the anterior crural nerve also swollen and discoloured.

But without laying too much stress upon these alterations in the cutaneous nerves, I would observe that the large nerve-trunks are found in an abnormal condition, which is not less worthy of note. When, during life, the pains have been severe, deep-seated, and seated in the course of the great nerve-trunks; when the action of one or more muscles has been limited, then this nerve-disease is also met with; and the more marked these symptoms, the more striking, after death, these pathological changes in the nerves. I have already remarked that the deep-seated pains often commence at the elbow and pass down the inner side of the forearm to the tips of the fingers; and in this case the ulnar nerve is always diseased. This nerve is first attacked in its bed immediately above the internal condyle of the humerus. There may be seen on the outer surface of its sheath, over an extent of quarter to one inch, a rose-coloured spot, which, sometimes, does not occupy more than half the circumference of the nerve, and which is owing to a local congestion of the blood-vessels. On cutting open the nerve-sheath in its length, the inner surface which corresponds to the outer spot is found to present no change, but on the cut edge, it may be seen that the redness has penetrated to some depth below the surface. This redness now continues to increase in both extent and depth; the inner surface of the neurilemma, its prolongations between the fasciculi of the nerve, and those fasciculi nearest to them, become red and a little swollen. The redness assumes a tint more and more brown, and penetrates the entire nerve-trunk, whose fasciculi are also greatly tumefied, and thus add considerably to the volume of the affected nerve. These alterations are, at first, restricted to a small part of the trunk, or to a distance of a few inches from the internal condyle of the humerus; but they continue to extend and attack fresh parts of the nerves, or follow the direction of the trunk. In proportion as the disease advances, so does the ulnar nerve become thickened and changed in colour. I have rarely seen it undergo change at its exit from the axillary plexus; and in general this does not occur till three or four inches below the axilla, the upper portion remaining completely healthy. The lower it descends in the upper part of the arm, the greater are the changes, until over an extent of three or four inches, near the elbow, the nerve becomes so swollen as to exceed three times its normal size. Between the inner condyle and the olecranon, it becomes a little thinner and diminishes in thickness until it reaches near the lower half of the fore-arm, at some distance from the principal joint of the limb: here, however, it begins afresh to swell up, and this to such

an extent that its palmar continuation, near the wrist, may attain the same extraordinary thickness as above the elbow. All the branches to the skin and muscles in this extent may be more or less thickened and bronzed; thus, its dorsal is much thickened in all its distribution. At the same time, it must be remarked that the finer and more slender the terminal branches, the less striking are these pathological changes; and it is found that, in general, these alterations cease before the nerve-filaments become too small to be followed with the aid of the scalpel. As regards the palmar continuation of the ulnar nerve, when the digital branch to the inner side of the little finger, comes off from the greatly enlarged trunk, it retains its size as far as the last phalanx, where it again becomes almost normal. The middle branch is still more enlarged, but as soon as it has divided into its two nerves for the outer side of the fifth, and the inner side of the fourth finger, these filaments gradually assume a normal aspect, and on the last phalanx they are quite natural in both size and colour. The deep or muscular branch, is much thickened.

The median nerve is sometimes attacked at the same time as the ulnar, sometimes sooner, but oftener a little later. No alterations are seen in the main trunk, until at the bend of the elbow it passes beyond the aponeurosis of the biceps muscle. It is swollen and changed in colour in precisely the same way as is the ulnar nerve, only it does not attain the same degree of morbid enlargement. The nerve thus thickened gradually becomes thinner in the arm as far as the upper third, where it commonly assumes its natural form and colour. Below the elbow it retains its thickness over an extent of about two inches, but usually it becomes thinner towards the lower third of the forearm, where it again swells out, so as to acquire an extraordinary thickness at the interior annular ligament of the wrist, especially at the place where it divides into its inner and outer palmar branches. The internal division has attained more than double its natural size, and its two terminal branches, radial and ulnar, are thickened and reddened as far as their distribution to the fingers. At the place where the ulnar or inner branch divides into a filament for the outer side of the fourth finger and one for the inner side of the third, it becomes a little thinner, and the filaments just named diminish in size more and more, until, at the second or third phalanx, they may become quite normal in aspect. The outer or radial division with its two chief branches, inner and outer, also acquires a considerable thickness; I have, especially, found the inner branch before dividing into filaments for the outer side of the second finger, the inner side of the first, and the outer side of the first, considerably thickened, while, at the same time, these digital branches were also much changed at the beginning of their course, but at their finer extremities they often became of natural appearance.

The radial nerve (*musculo-spiral*, H. V. C.) is attacked in the same way as the two preceding, and I have been able to follow its pathological changes from a distance of two inches below its origin as far as nearly all its terminal ramifications. I have, sometimes, observed that these changes have commenced in the smaller

ramifications (for example, in the external cutaneous branch of the fore-arm), and had extended along the main trunk as far as just above the external condyle of the humerus; in other cases, the posterior division of this superficial branch was chiefly attacked, before passing on to its proper digital distribution.

With regard to the *great nerve trunks of the lower extremities*, those which are principally affected in the course of the disease, are the *great sciatic nerve* and its continuations, the *peroneal* (external popliteal), and the *tibial* (internal popliteal). I have always found one or other of these main branches, or even both of them, have been attacked long before the sciatic nerve-trunk itself.

Commonly, the *peroneal nerve*, and particularly its *cutaneous branch* to the outer side of the leg, are the first affected. This nerve may be found greatly swollen—even to twice its size—and of brown colour from its very commencement; it increases in thickness as it descends towards the back of the foot, where it divides into its two branches—inner and outer—which are also much swollen. The terminal filaments which pass off from these two branches, some of which go to the skin here, are much thickened as far as the place where they divide into the nerves for the toes, for then they begin to assume more of a natural size and colour. . . . The *peroneal nerve* itself is also considerably altered and it may be three times its usual size, and of a deep brown tint. The *tibial nerve* is one of those nerve-trunks, which, in the course of anæsthetic leprosy, undergo the greatest amount of change, and the lower down the leg, or near the sole, the greater the change. It is seldom that the trunk is perfectly healthy even in the popliteal space, but lower down it may acquire the dimensions of a finger. The *branches* which it sends to the sole of the foot and to the toes are also much thickened; but the nearer one approaches to the tips of the toes, the more healthy seem the nerve-filaments.

I have never found the *sciatic nerve* itself attacked, unless it happened that the peroneal and tibial trunks were at the same time considerably swollen; but, where this occurs, the main nerve may become so much thickened that it is difficult to believe that the turgid cord is really a nerve. Under these circumstances, some of the fasciculi of the *sacral plexus* may be swollen and of brown colour.

As to the *nerves of the face*, the leprosy disease does not spare them. I have many times found the branches of the fifth and of the seventh pair of cranial nerves

tolerably thickened and discoloured, even over a large part of their course.

When these alterations in the peripheral distribution of the nerves are attaining their maximum, the central organs of the nervous system begin to suffer in a way which leads one to suppose that the pathological processes in the nerves are propagated towards these centres; thus, when the spinal cord is implicated, it is generally at those parts which give off the roots of nerves, more or less thickened towards their distribution in the limbs. . . . Danielssen then proceeds to describe the changes which have been already quoted in notes to the text, at page 75.

Subsequently, the author proceeds as follows:—"In the tubercular form of *spedalskhed*, it often happens that one or more nerve-trunks are attacked in the same manner as in the anæsthetic form; and in such case it will always be found, that the tubercles are either quite mature or even quickly retrograding. . . . and if when the tubercles are subsiding, the nerves be examined (taking the fore-arm for example), the *ulnar nerve* will be found to be turgid and tender, and in proportion as it increases in volume, the tubercles themselves lessen and finally disappear, leaving no other traces than a few points pigmented with brown; at the same time, the skin at this spot long remains in a thinned state, as if it had lost something of its substance. In such manner, the tubercles are destroyed over one area after another, and sometimes this happens with such regularity that it would be possible to name with certainty the nerves which are attacked; for wherever these are distributed in the skin, there the tubercles disappear and numbness supervenes. As long as the tubercular form is unmixed, the skin remains the seat of marked congestions, the sebaceous secretion is more plentiful and exudation sometimes copious, frequently natural, almost nerve absent; but when the nerves are attacked and tubercles disappear, the congestion and secretions diminish until both entirely cease." Surely, here as elsewhere, I would observe, is evidence of the influence of local nerve-disease upon the progress of leprosy deposit; Danielssen, however, immediately proceeds to add:—"It seems to me that in the facts now cited, there are strong indications, if not proofs, that one should not seek for the proximate cause of the pathological phenomena in the nervous system itself; for long before the latter is visibly attacked, one notices a great number of phenomena peculiar to this disease."

## APPENDIX D.

## LEPROUS AFFECTIONS OF THE EYE.

THE following short summary of this subject is added, in order to complete the present Memoir; and it is placed in the Appendix, because of being wholly derived from borrowed sources. To Norwegian authors, both early and late, I am indebted for most of the information given below.

It is well known that blindness is not a rare sequence of leprosy; and impaired vision is even a common attendant on the later stages of the malady. All eye-affections are probably more frequent and severe in Norway than in India; but in both countries, the deeper transparent media of the globe are seldom implicated; cataract is very rare in lepers. An obvious division of the subject is that into, 1, affection of the eye-ball; and, 2, affection of the appendages of the eye; the first group is principally found in tubercular leprosy, the last in the anæsthetic form.

1. Taking the tunics in the order usually followed, I observe that the *Conjunctiva* is not liable to any special kind of complaint in leprosy; but this membrane becomes congested and thickened, &c., in connection with subjacent growths in the sclerotic; its habitually blood-shot state assists in imparting a peculiar tinge to the white of the eye; and its secretions are much changed in chronic cases of anæsthetic leprosy, when nerve-influence has been long suspended.

The *Cornea*.—Here is located the most distinctive of all leprosy affections—tubercle of the cornea—which has long been known, and often described; and besides, there may occur a more frequent opacity, perhaps, too, a special form of keratitis.

*a.* Opacity of the cornea.—This is a comparatively slight, but a very frequent affection; occurring in a large proportion of all lepers, and in all forms of their disease. It is most frequent and marked in the tubercular form; may appear at a very early stage of the malady; and usually occurs in both eyes at once. It is superficially seated, and very chronic in its course. The cloudiness begins at the upper and outer margin of the cornea, and proceeds uninterruptedly towards the centre; it seldom covers the whole of the surface, or passes the centre; but, in extreme cases, may do so, and thus impart an aspect to the cornea, which is compared to that of ground glass. At the advancing edge of the opacity, there is an appearance of minute dots or striae, which afterwards become incorporated with the more uniform cloudiness; and considerable vascularity is present in the more mature parts of the growth, rendering it comparable to a Pannus. The part is liable to exacerbation of progress attended with local congestion—just as are most leprosy formations. On minute examination, the opacity is found to be due to the growth of true specific elements, which are situated beneath the conjunctiva, and within the superficial

layers of the cornea; there is clearly a migration of white blood-corpuscles from the new and neighbouring vessels, and the adjacent corneal cells themselves become implicated. As to treatment, this is seldom required, because vision is not seriously impaired; but when the opacity seems likely to advance to the centre of the cornea, its progress may be arrested by snipping off, as in Pannus, a slip of the vascular conjunctiva, at the periphery of the growth.

*b.* Tubercle of the cornea.—This is a more copious and defined leprosy formation than the above, and just as in the skin there are intermediate degrees of growth, between the patch and tubercle, so here, between opacity and nodule; and the former always precedes the latter, when it superficially placed. Superficial corneal tubercle, almost always begins at the outer side, and usually appears in both eyes; it is preceded by vascularity of the conjunctiva and sclerotic, and by an opacity of the cornea, which is separated from the growth itself by a clear interval; then, a pale, red, elevated spot appears, which grows over the cornea, and may become so large as to impede closure of the eyelids. After a time—often long—the tubercle diminishes by softening and absorption, or more rarely by ulceration; but the eyeball itself is then also lost. When deep-seated, the nodule begins in the substance of the cornea, and is not preceded by any visible opacity; its colour is then of greyish tint. Both superficial and deeper-seated formations may take place at the same time.

The anatomy also of these growths has been fully investigated by Bull and Hansen. These authors show that the superficial tubercle begins in an episcleral formation, which advances just below the corneal epithelium; the conjunctiva itself is not necessarily implicated. The more deeply-seated nodule proceeds from the region of the canal of Schlemm, and advances into the cornea immediately in front of Descemet's membrane; "the space between the fibres of the ligamen-

" 'tum pectinatum iridis,' being also constantly and " densely filled with round corpuscles." In structure, the tubercle is, like the opacity, first formed by accumulations of white blood-corpuscles, which have migrated from the adjoining blood-vessels; the latter, too, increase, but not so as to impart a vascular appearance to the growth. The consistence of the nodule is firm; afterwards, when degeneration begins, it is softer; the changes which then occur, being the same as in skin-tubercles, for here are found the enormous, granular, brown-tinted, elementary bodies, so characteristic of leprosy growths. The corneal cells themselves also take a part in the development of the structural elements.

As to prognosis, it is these growths (with similar ones on the Iris), which seem to most often lead to blindness amongst lepers; hence their forecast is unfavourable.

And treatment is not very effective. Free cauterisation of an incipient growth may arrest advance, for a time; but when the corneal tubercle is at all grown, active interference with it does no good. "It has " repeatedly been attempted to excise parts of the " tubers, and cauterise the surface of the wound with " nitrate of silver; but the results of the operation " have not been encouraging; as the tubers have grown " uninterruptedly. The only thing to be done when " the tubers are so advanced in growth, that they begin " to cover the pupil (which is frequently fixed by films " of exudation), is to make a coremorphism behind the " most translucent part of the cornea. The operation " has no influence on the growth of the tuber, and can " only be considered as a palliative. Against the " development of tubers in the deeper layers of the " cornea, we are completely powerless; operations have " been repeatedly attempted, but without avail."

In order to complete the present short account of leprosy diseases of the eye, and to show how like some of these are as seen in Norway and in India, I will here quote a case of leprosy tubercle, from an interesting paper in Vol. X. (1870), of the Transactions of the Medical and Physical Society of Bombay, by Surgeon J. H. Sylvester, late Professor of Ophthalmic Medicine and Surgery. An adult Hindoo leper had his left eye affected:—"The tubercle on the sclero-corneal junction is about the size of a large split pea, smooth on " the surface, and precisely resembles those on the " skin, except that, wanting the brown pigment of the " dermal covering, it is of a paler flesh-colour; it is " covered by conjunctiva in which two stray tortuous " vessels ramify. It has a hard feel when taken be- " tween the blades of a forceps, and when pressed, gives " little or no pain; it is very little vascular, and firmly " incorporated with the cornea proper. It is, moreover, " surrounded by a zone of decided opacity, which " extends completely through to the membrane of " Descemet; the opaque zone slightly overlaps the " papillary aperture, which is dilated three-eighths; " the iris is as yet unaffected, and the fibres of its " stroma distinct. It causes the patient but little " inconvenience, more than a slight lachrymation. The " portion of the tubercle in the sclera, appears intimately connected with the white fibrous tissue of " that tunic."

In another instance which is mentioned, both eyes were similarly, but more severely affected. A characteristic coloured drawing is appended to the above description: and from both it is, I think, evident enough that this form of eye-disease in leprosy, has the same characters in both East and West. Mr. Sylvester adds " From all I can learn, I have come to the conclusion " that leprosy rarely, if ever, affects the eye in any " other form than a tubercle of the cornea; and, thus, " when the eye is lost in leprosy, it is by an extension " of the tubercle at its base, pressing on and involving " the iris, which, becoming inflamed, implicates the " deeper tunics of the eye-ball."

Lastly, the Norwegian authors mention the frequent occurrence in both forms of leprosy, but most often in the tubercular, of what is termed 'Keratitis punctata.' Here there is attendant iritis: the lower half of the cornea is usually first affected, and the appearance is " as if small grains of sand had been baked into its " substance." After a time, an ill-defined halo begins to form around these brown or greyish lymph-deposits; so that the cornea appears more evenly obscured; and eventually the entire affection may of itself entirely subside, leaving no trace behind. On the other hand, the punctate spots may remain for years, without alteration. This affection is of the character of an attendant, rather than a special form of eye-disease.

The Sclerotic.—This tunic of the eye is not independently affected in leprosy; it early acquires a sallow tint, once insisted upon as a sign of the disease, which is, doubtless, due to congestion and staining of its tissue; and other changes are thinness of the coat around the cornea, oedema, and the occurrence of clear granules, 'like frogs' spawn'; sensibility here seems to be somewhat diminished, whereas, in the cornea it is seldom lessened.

The Iris.—Inflammation and leprosy deposit occur in this part. Perhaps 30 per cent. of all lepers have their eyes thus affected, but the iritis in the anæsthetic form of leprosy is mostly an accident due to changes in the cornea (the result of paralysis of the *orbicularis palpebrarum*), and, therefore, only a late symptom. In the tubercular form iritis may occur at the onset of disease, but it is not then marked by any peculiar signs. It may be chronic or acute: the former event is so insidious as often to escape notice; the latter is attended with pain, congestion, and impaired sight—a symptom due to turbulency of the vitreous humour. The iritis may then subside, but it does not leave the eye sound; the 'muscæ' remain, and as it is evident the deeper coats of the eye have been implicated the affection should be known as Irido-eyclitis, or Irido-choroiditis. The usual ophthalmoscopic signs of choroiditis are not, however, to be seen in leprosy after this acute iritis, but a slight atrophy of the retina around the optic nerve is often to be detected, and the patient's sight has then been weak. Both eyes are usually attacked in leprosy iritis.

Tubercle of the iris or defined leprosy growth is not so common as in the cornea; both events may happen together. The new formation proceeds from the outer edge, and generally at the lower part of the iris; it is attended with iritis; its surface is tolerably smooth,

colour grayish, and the appearance may resemble *lypposon*; the anterior chamber may be filled and staphyloma at the same time be noticed. The anatomy of this affection is like that of corneal tubercle; round cells are founded in all the looser interstices of the tissues about the ciliary body; "also the trunks and " branches of the ciliary nerves are more or less " strongly infiltrated with round cells, whereby the " medullary sheaths of the nervous filaments mostly " disappear, while the axis cylinder, although often " compressed, are seldom quite brought to a state of " atrophy by the pressure of the imbedded cells, so as " to leave empty sheaths." Fresh blood-vessels are formed; it is not clear that the normal cells of the part have a share in the production of the characteristic leprous elements, but these peculiar masses here appear as in the cornea and skin; and they may " still be found, years after the acute phenomena " have disappeared." Although the ciliary muscle is often early and much affected, yet the power of accommodation in the eyes of lepers has not been found defective.

As to Treatment—the chief indication is to obviate the results of iritis, by the timely and free use of atrophine; morphia may be injected and leeches locally applied. Subsequent to adhesion and closure of the pupil, iridectomy will be required, and for tubercle of the iris, also, if this is to be removed.

The *Retina*.—The retinal affections in leprosy begin at the *ora serrata*—having spread from the ciliary region—produce no special symptoms, and, only by extension, approach the fundus of the eye. During life no abnormal appearances are visible; after death, minute greyish dots may be detected, in which the characteristic leprous elements will be found, but the changes previous to their formation are as yet unknown.

I should mention that Danielsen and Boeck long since described the affections above mentioned; thus, the corneal tubercle and frequent iritis are included amongst the symptoms of tubercular leprosy, and under the head of the anæsthetic form, these authors gave an account of the paralysis and eversion of the lower eye-lid, with their consequences, which are not uncommon events of the disease. With the possession, however, of so recent and elaborate an essay as that of Bull and Hansen, it is not necessary to revert to the older descriptions.\*

*Appendages of the Eye*.—Tubercles in the eyebrows are amongst the very earliest signs of leprosy, their

\* It may, however, be useful to quote the following data from Prof. Boeck's early account of Spédalskøhd. Amongst 111 cases of tubercular leprosy, 49 had some affection of the eyes; thus, there are incipient or fully-formed tubercles in the cornea in 23, opacity in 5, ulcers in 5; in 9 the iris was affected; there was staphyloma in 2, atrophy of the eyeball in 2, rupture in 1; and in 2 cases there was cataract. Overflowing of the tears, and the sallow tint of the sclerotic, were each noticed in 2 instances. Amongst 42 cases of anæsthetic leprosy, logophthalmos, or overflow of tears, was seen 20 times, and 9 times iritis, with distortion of the pupil.

At Cochin, Day found 3 blind in 30 cases of anæsthetic leprosy, and 1 blind in 17 instances of the tubercular form.

formation being preceded by falling off of the long hairs here. The eyelids are also the frequent seat of nodules—especially the upper lid—the eyelashes fall out, and much distortion results; ulceration of the nodules is not uncommon; the eyeball itself may remain perfectly unchanged. Under favourable circumstances, the tubercles may be excised if productive of pain or inconvenience.

In anæsthetic leprosy especially, the eye becomes secondarily affected from paralysis of the *orbicularis palpebrarum* muscle. Only the lower half, and usually the inner portion of the muscle loses its power; and this occurs in a very gradual manner, so that many years may elapse before collapse and eversion of the lower eye-lid takes place. At this time, the eye-ball suffers from exposure, congestion of the conjunctiva, corneal inflammation or ulceration, with their consequences; overflowing of the tears (logophthalmos), or afterwards suppressed secretion atrophy of the caruncula, &c., and finally, loss of sight may hence ensue; but these results are not directly due to leprous disease, nor do they ensue "more rapidly in lepers than in " cases where the ectropium depends on other causes." Bull and Hansen are not disposed to think that those changes in the cornea, known under the name of "neuro- " paralytic keratitis," are to be found in leprosy, because they have not found the nervous supply to this part, to be interfered with.

My own impression has always been, that it is the cutaneous branches only of the fifth cranial nerve, which are necessarily implicated in leprosy; and that the facial paralysis, so-called, is but a consequence of disease in the fifth, extending, it may be, to filaments communicating with the motor branches of the seventh cranial nerve. That this last-named trunk—the facial nerve proper—is primarily affected in leprosy, I have not seen. Danielsen and Boeck remark, that in these neuro-paralytic complications, "the lachrymal glands " are constantly found to be extremely atrophied, or " even to have disappeared."

Respecting the aid which may be given by surgical interference, the latter writers describe a plan of "sewing up the whole canthus internus as far as the " punctum lachrymale," supplemented, it may be, by turso-raphy, which affords considerable relief in restoring a channel for the tears, and a covering for the globe; and at Bergen, I was able to appreciate Hansen's operation on several cases then in Hospital.

A few supplementary remarks on the general relation of *blindness* to leprosy, may fitly be here subjoined. From what has now been stated, it appears that impairment of the sight is a very frequent occurrence in leprosy: yet that blindness or total loss of sight, is not so common. And it is evident on a wide comparison of ordinary data, that in both Norway and India, blindness is more widely—as it is more evenly—distributed, than leprosy; thus in Norway, there is one leper in 845 inhabitants, and one blind in 540 inhabitants; while in India the same ratios vary extremely. In the Bengal Presidency, there are 38,129 lepers, and 50,215 blind; in the Punjab, the corresponding numbers are 12,257 and 101,448; the ratios being for Bengal, one leper in 1,684 people, and one blind in 1,280 people; but for

the Punjab one leper in 1,600, and one blind in so few people as 173, probably this last-named proportion of blind is almost unparalleled.\* A more particular scrutiny of separate instances has shown me that, in India, leprosy and blindness are not necessarily associated; both affections may indeed prevail together, but

there may be many blind and few lepers in a given district. It is also the rule, that the two sexes are much more equally affected with blindness, than with leprosy. So that, on the whole, it cannot be maintained that the same causes which lead to one kind of infirmity, necessarily, or even usually, entail the other.

\* Census of 1868. The proportion of blind is about 15 times as great as in England in certain districts of the Punjab, and one instance is quoted in detail at page 36 of the Census Report; from this enumeration it would appear that leprosy had not caused any of the blindness, but some doubt remains as to the nature of the influence producing loss of sight in certain cases. The causes specified are the following, and they are here quoted in illustration of the remark in the text, that blindness is not

usually due to leprosy disease:—Amongst 77 blind people at Rooper, small-pox was the probable cause of lost vision 17 times, ophthalmia 29 times, other causes (principally ocellar or severe headache: ? *iritis*), 31 times; congenital blindness is mentioned only once.

If ophthalmic wards could be combined with leper-asylums, the apposition of the two might be both convenient and beneficial to the country.

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| "    "    its diagnosis - - -          | 15   | "    "    diagnosis of - - -                        | 68   |
| "    "    its nature - - -             | 18   | "    "    nature of - - -                           | 71   |
| "    "    definition - - -             | 23   | Nervous system in leprosy - - -                     | 73   |
| "    "    synonymes - - -              | 24   | Nerves in leprosy - - -                             | 82   |
| Early symptoms of leprosy - - -        | 113  | Nature of leprosis - - -                            | 164  |
| Elephantiasis - - -                    | 213  | <b>O.</b>   |      |
| <b>F.</b>                              |      |   |      |
| Fever in leprosy - - -                 | 120  | Occupation of lepers - - -                          | 153  |



PLATE I.

Fig. 1. The characteristic 'leper-spot' or 'plague,' drawn from the patient whose case is described as No. 2, at page 7.

Fig. 2. The hand of the same man, showing the appearances of comparatively early nerve-disease; the *ulnar* nerve at the elbow being decidedly enlarged.

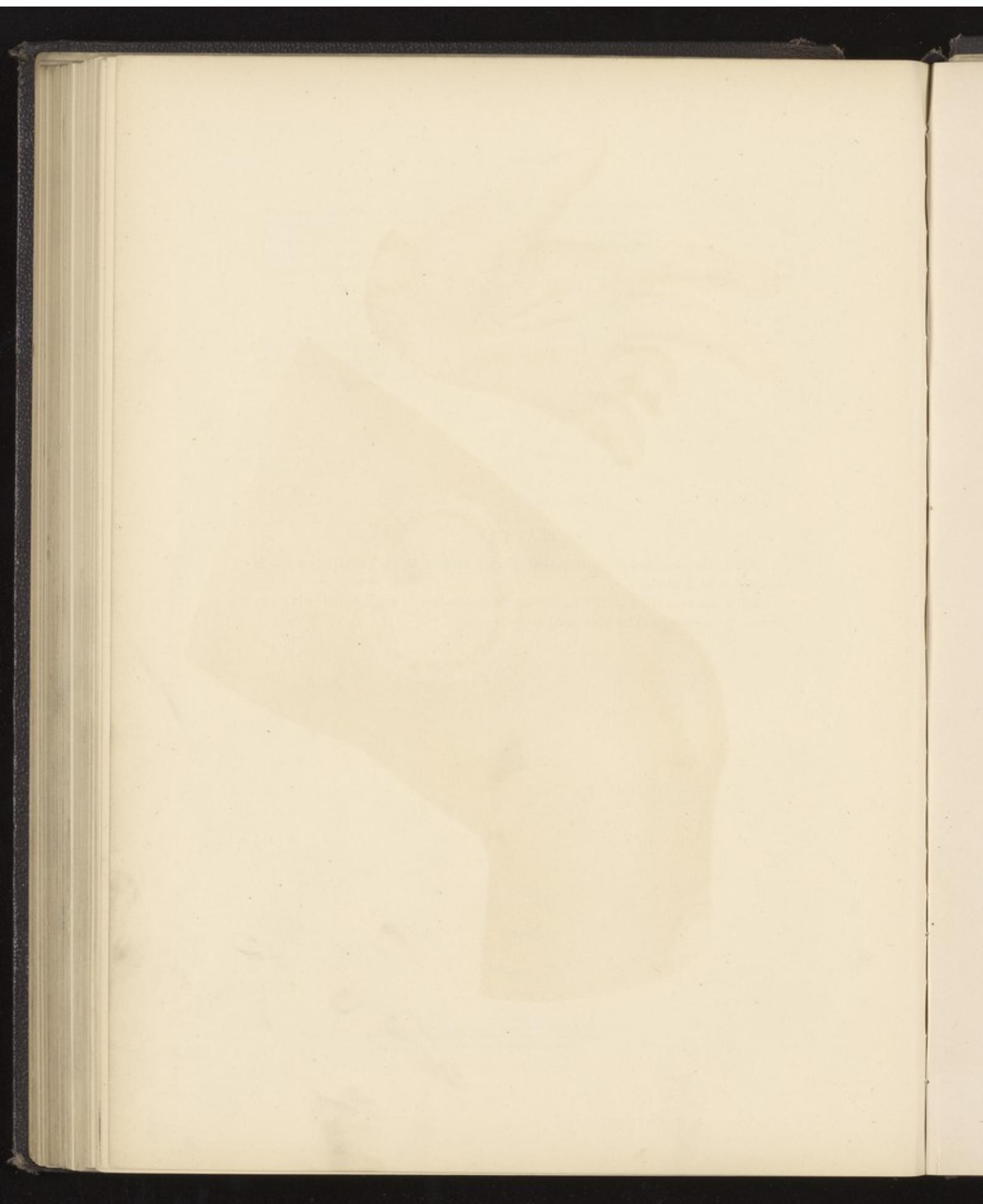
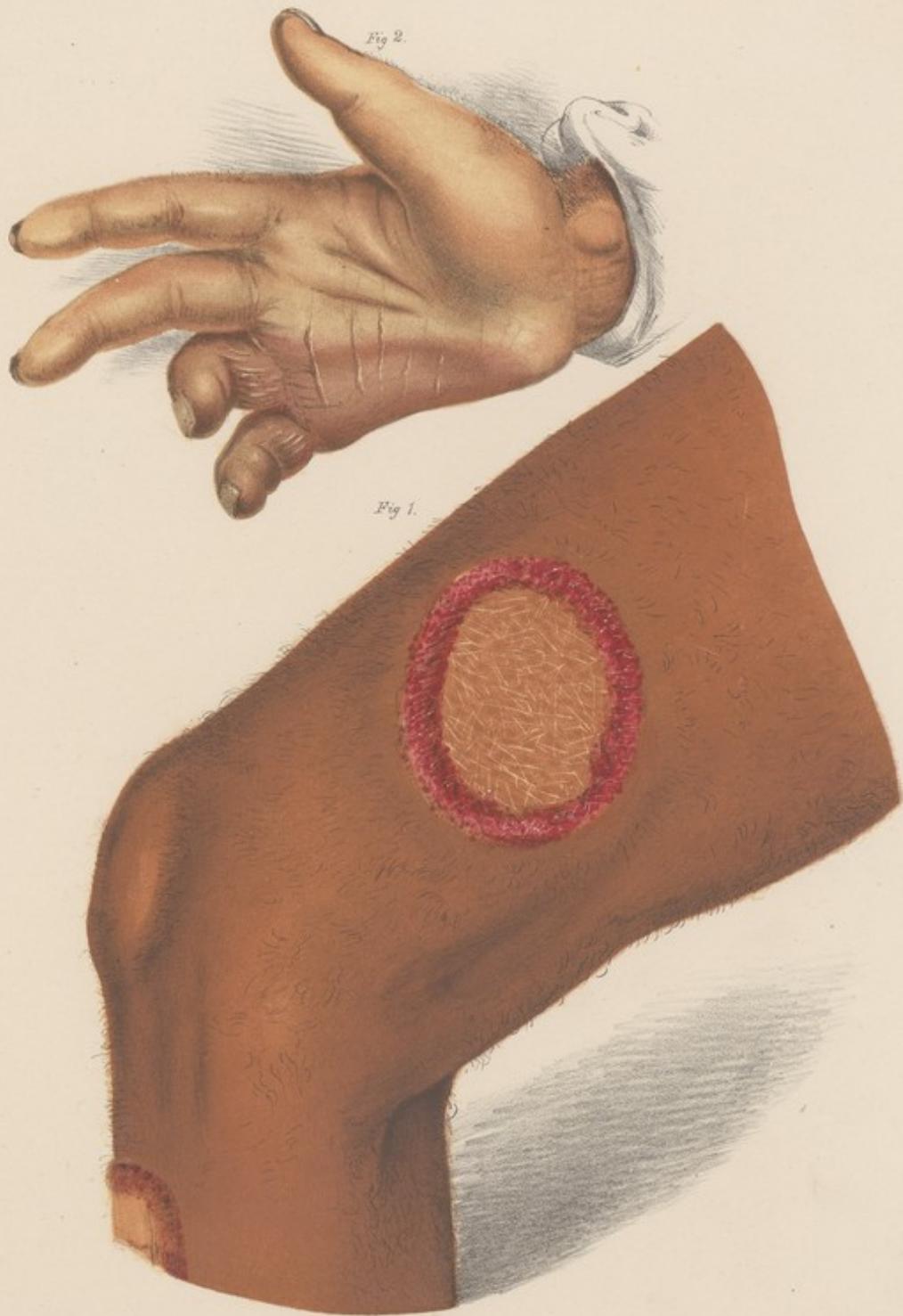


Plate. 1.



*Leprous Eruption and Nerve-disease.*

*Fig 1. The leper-spot Fig 2. The leper-hand*

*H. V. Carter, M.D. ad. nat. del. March 1862.*

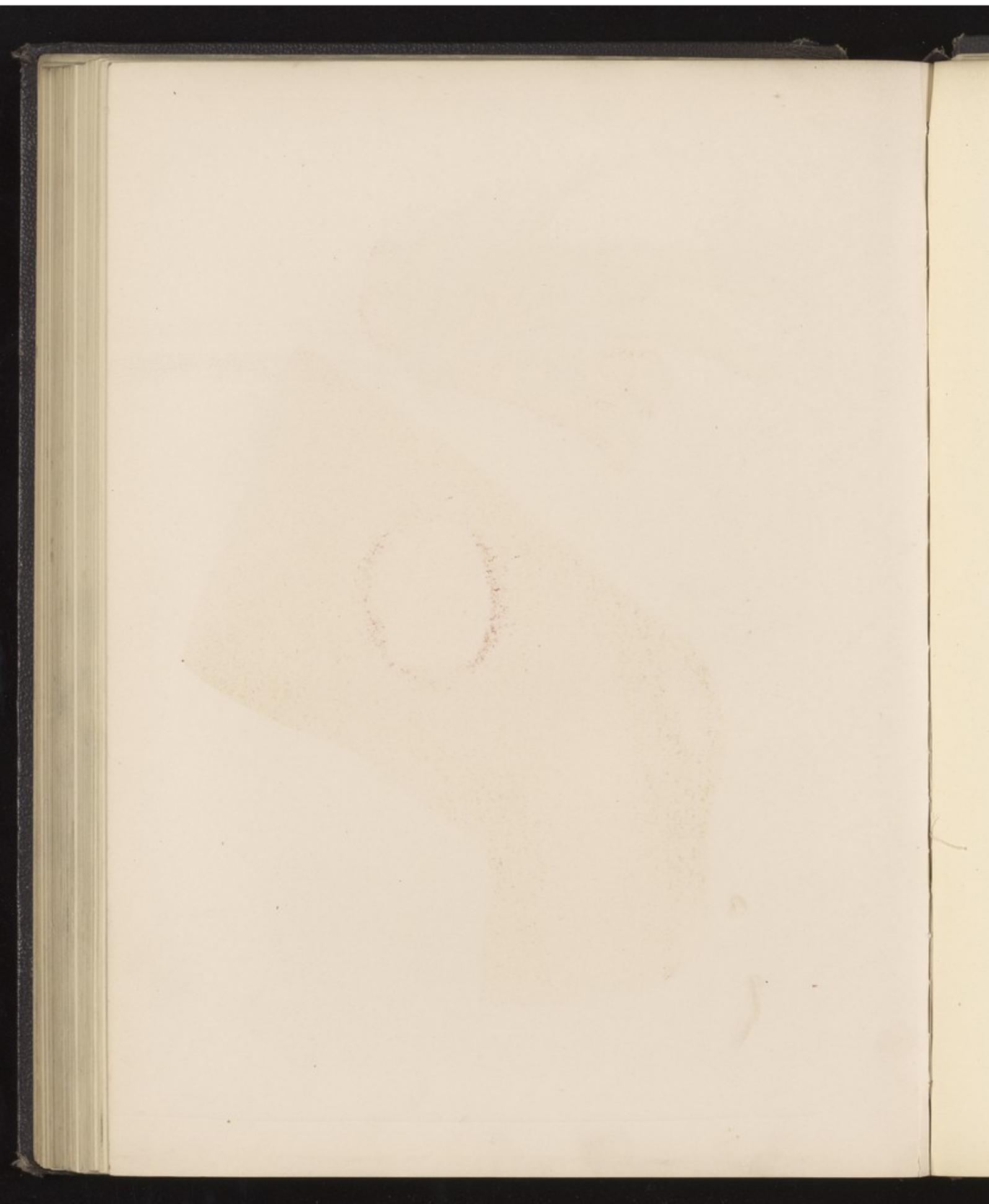


PLATE II.

The eruption of leprosy (*Lepra leprosa* auct.) at a comparatively early stage: see the case detailed as No. 1, at page 7.

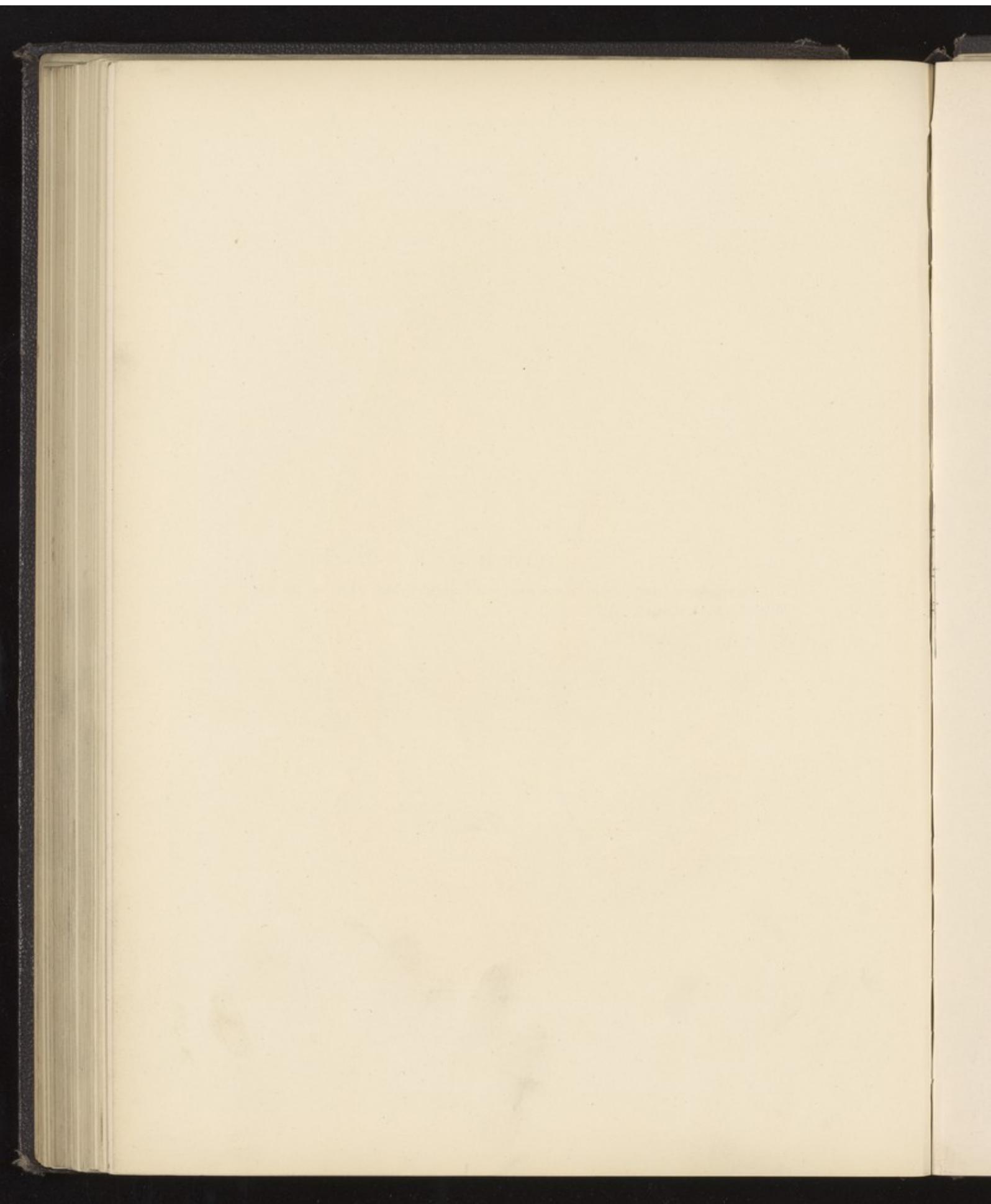
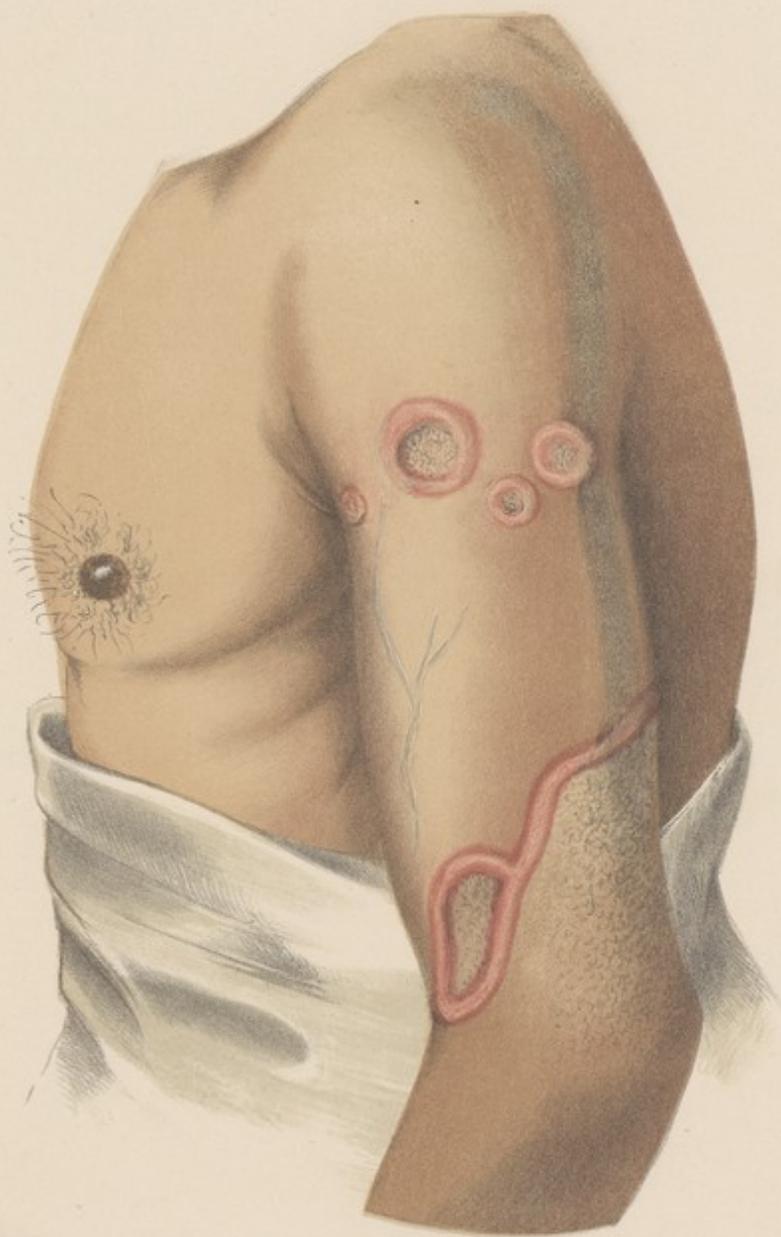
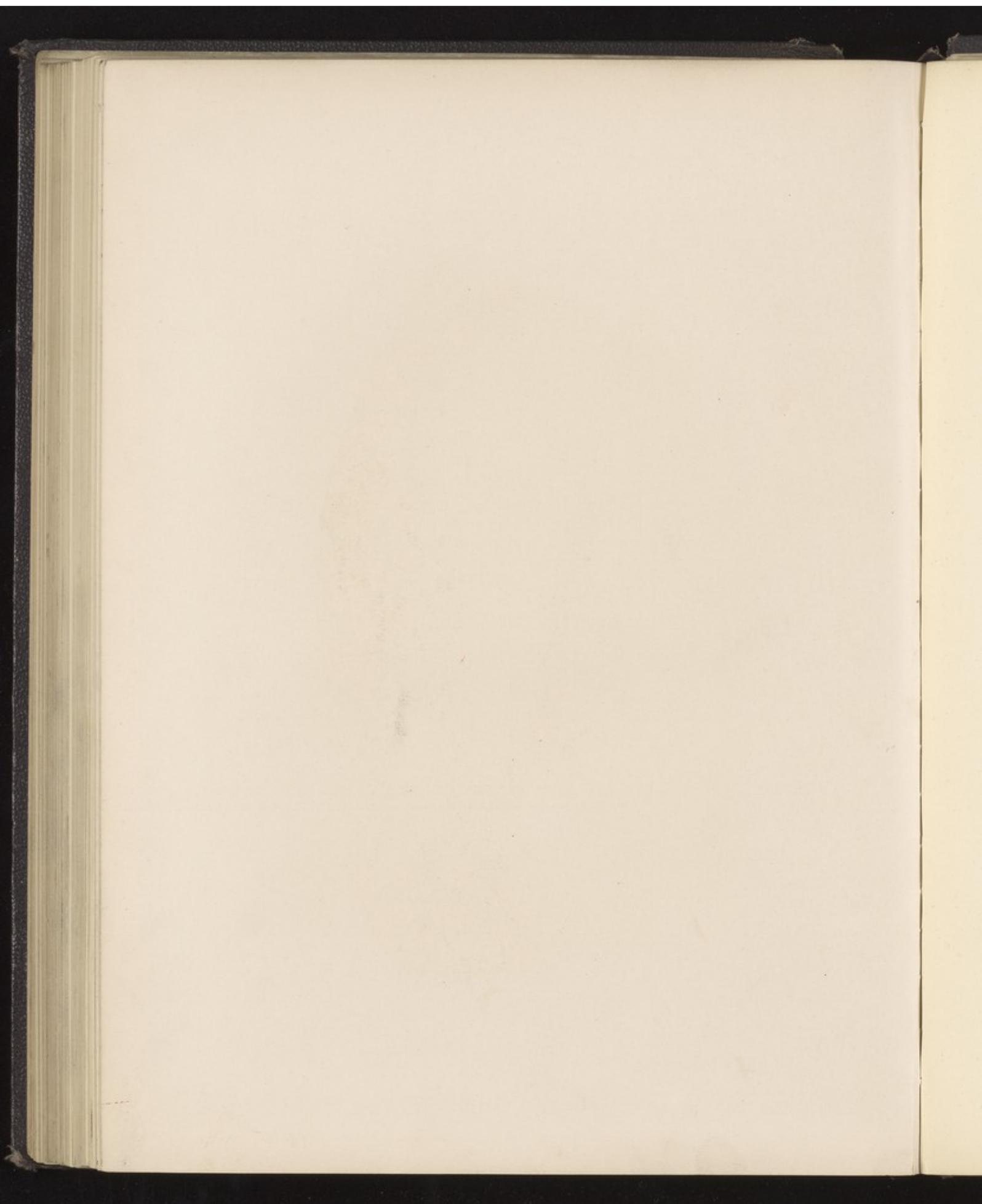


Plate II.



The Eruption in Leprosy - 'Lepra leprosa' auct.

J. V. Carleu sc. D., ad ins del Bombay 9<sup>th</sup> 10<sup>th</sup> 1802



### PLATE III.

The appearances presented by the arm of a young male leper, seen at Bergen in September, 1873. I noted that the edges of the large patch are slightly branny when exposed to air, from desiccation and the appearance of a few minute scales. There are spots on the face—cheek and chin—of the same kind, only somewhat more uniform; and on the eyebrows there are small spots which look a little like nodules ("tubercles"). The ear is slightly swollen. Duration of the large patch six months; of the smaller ones, 14 days; at their onset he had some fever. Complains of aching, smarting pains in the arm. No family taint: he comes from a leper-district.

This figure shows a remarkable similarity in the appearance of the eruption to the preceding, which is believed to be characteristic; and comparison of this Plate with Plate VIII. should also be made. The eruption in both European and Asiatic leprosy is alike in stage, form, seat and duration; and this Plate, like Plate II., displays both early and late characters of the skin-affection herein designated *Lepra leprosa*.



Plate. III.



*Leprosy Leprosa. auct.*  
(from a Norwegian Subject)

*H. V. Carter, M.D. ad. nat. del. Bergen, August 1873.*

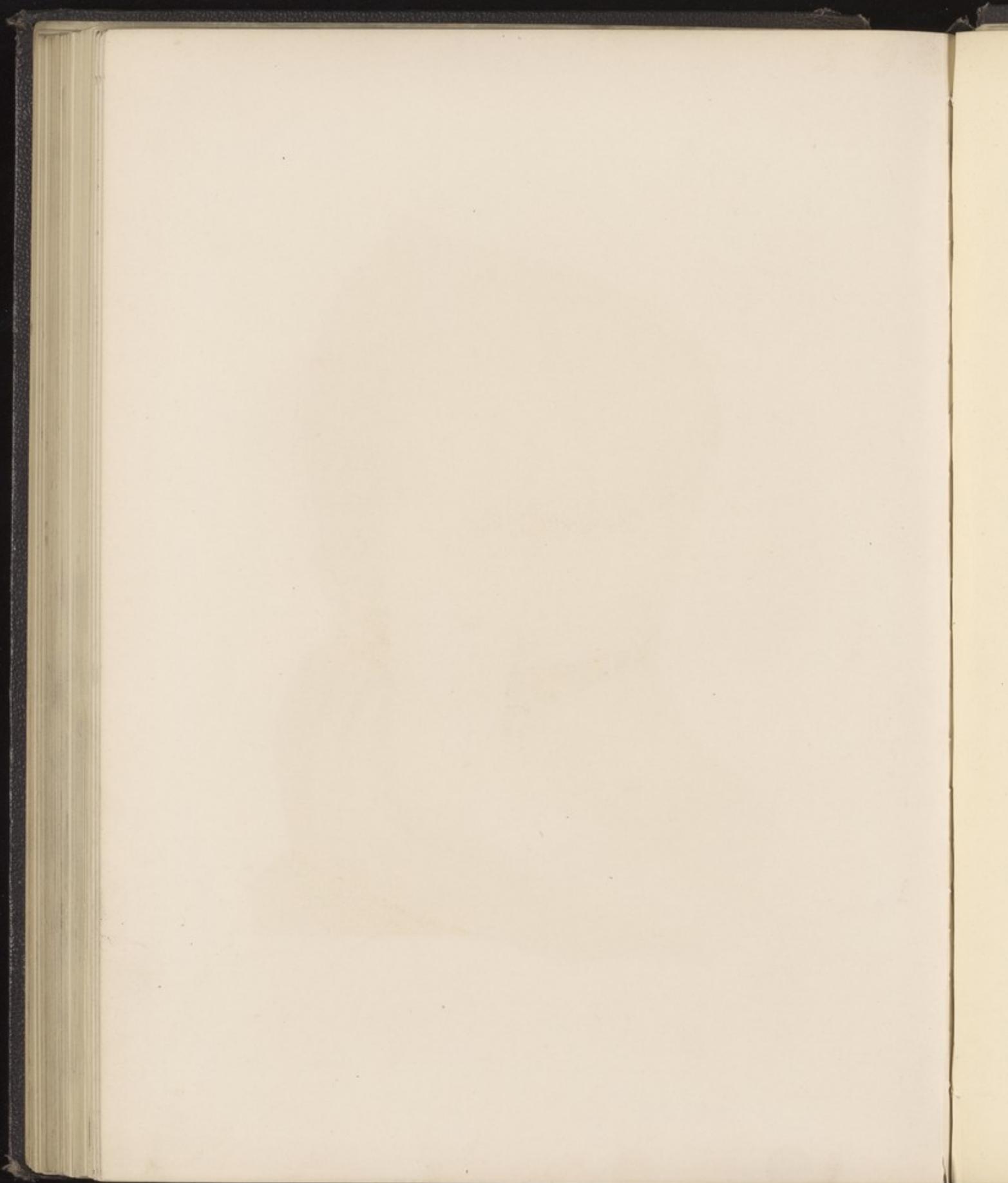


PLATE IV.

A more advanced stage of the eruption : see the case detailed at No. 4, at page 8.

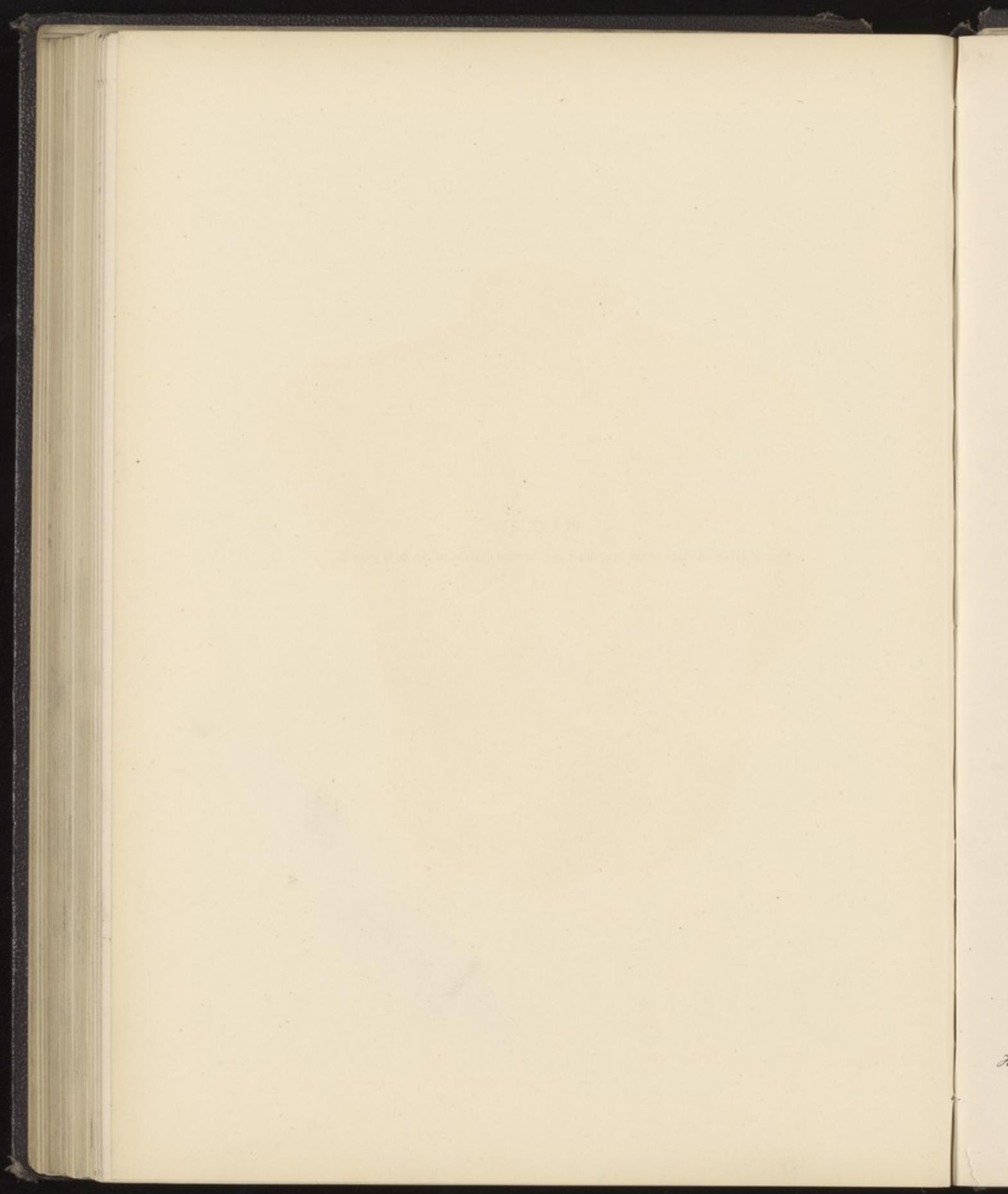


Plate. IV.



*Lepros Leprosa auct. (2<sup>nd</sup> firmi)*

*H. V. Carter, M.D. ad nat. del April 1862.*

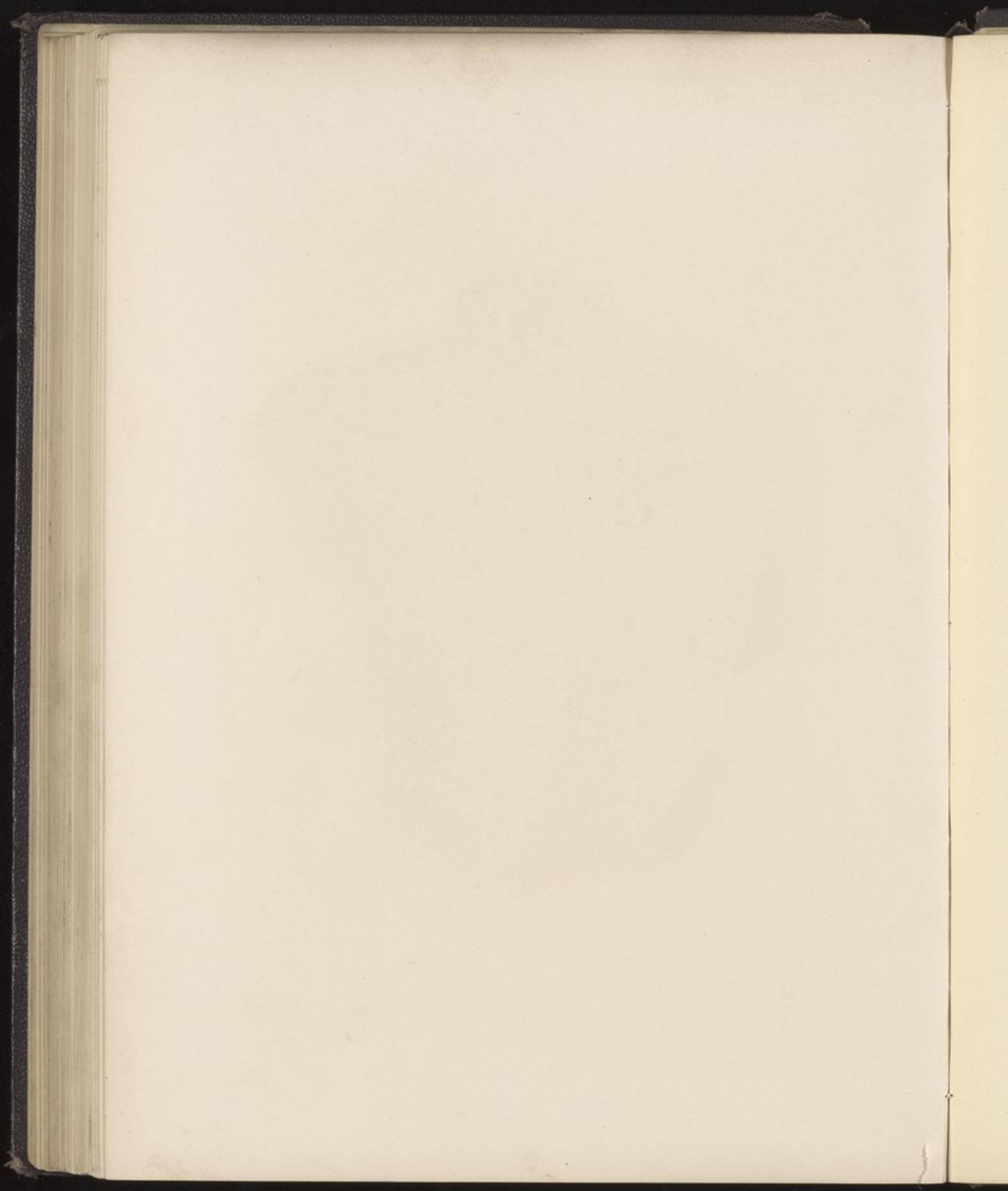


PLATE V.

Another variety of *Lepra leprosa*, as seen in the patient whose case is described as No. 5; at page 8.

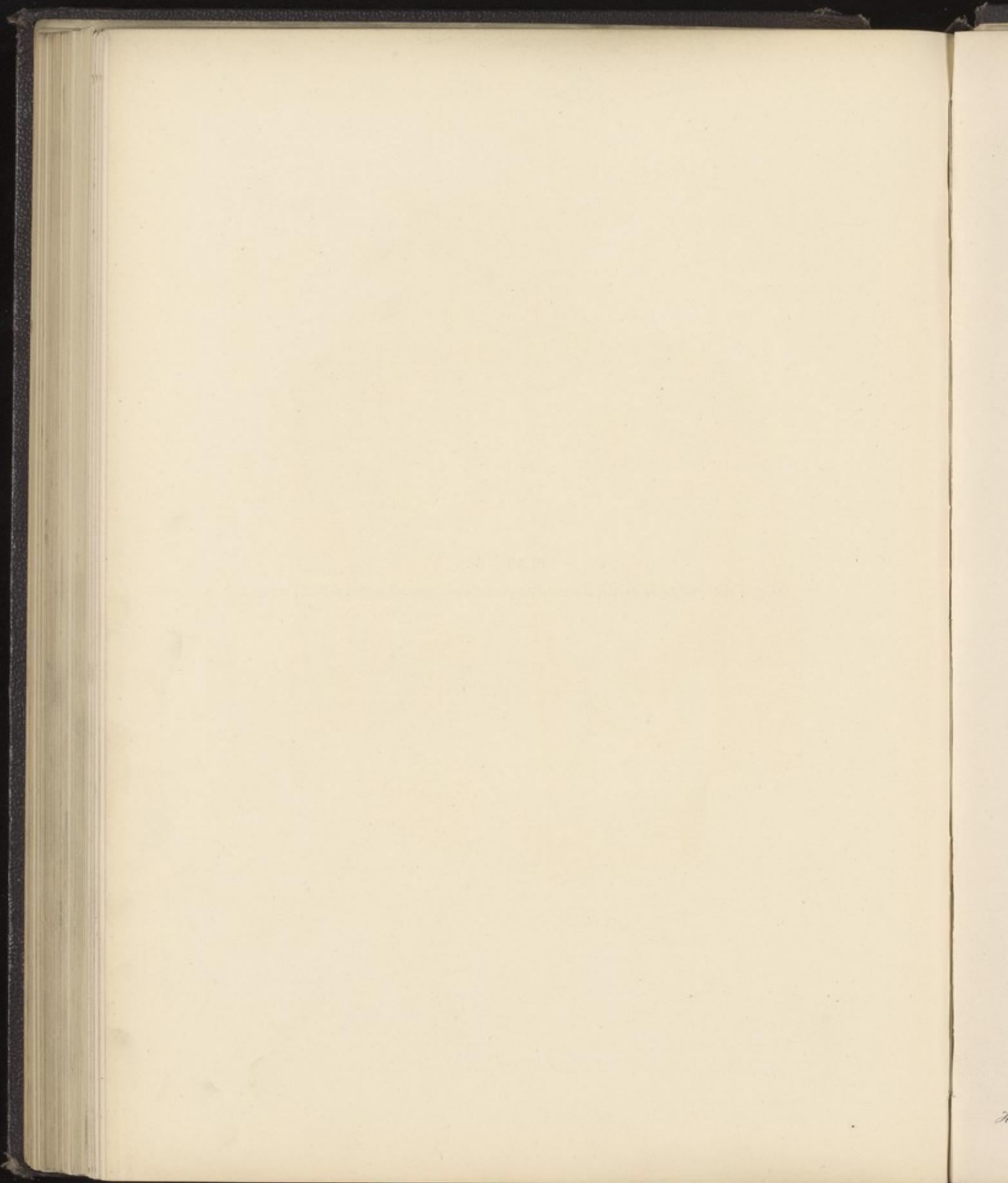


Plate. V.



*Leprosia Leprosa auct (2<sup>nd</sup> form)*

*H. V. Carter, M.D. ad. nat. del. 1862.*

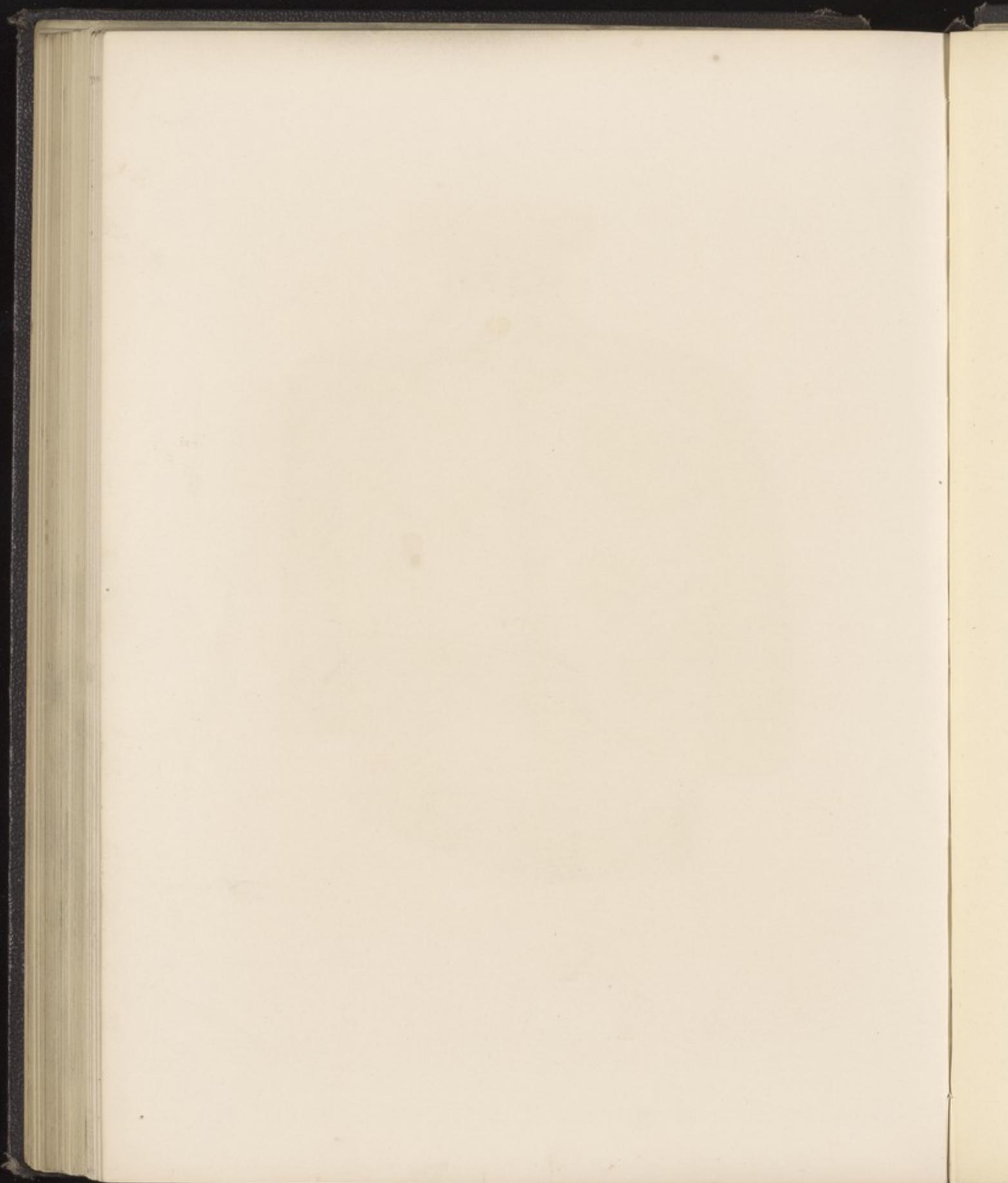


PLATE VI.

A view of the spots seen on the back of a confirmed leper. See the case No. 15; page 12.

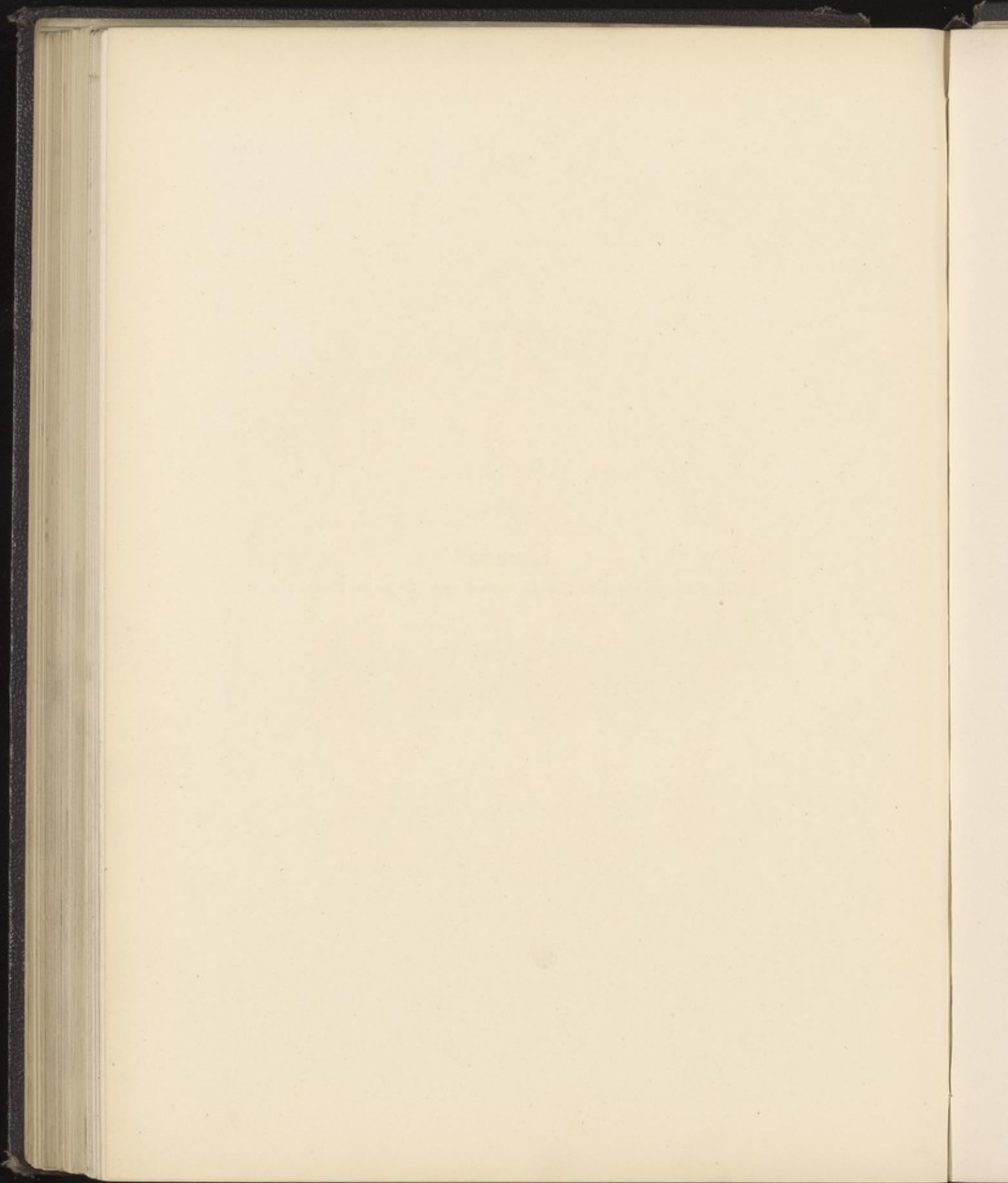
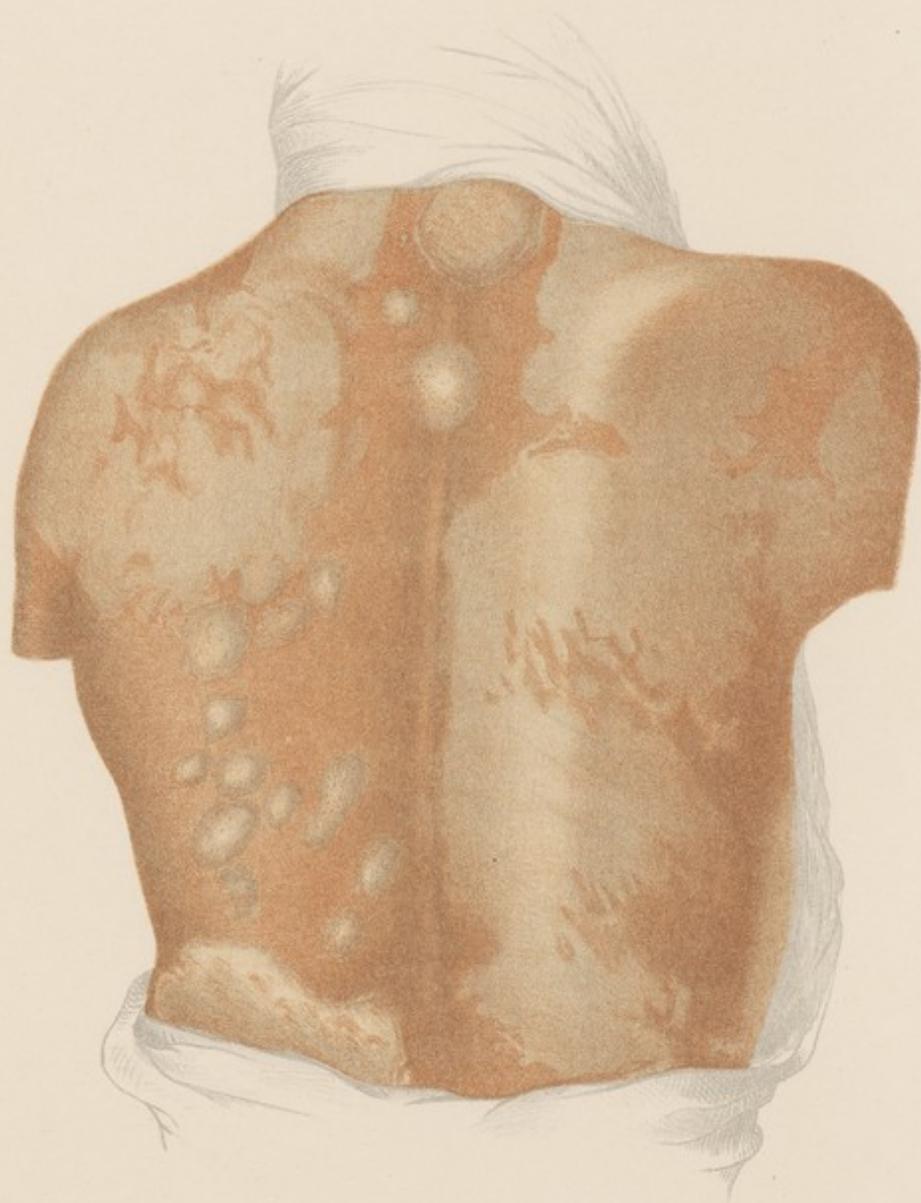


Plate VI.



*Lepros Leprosa auct. (4<sup>th</sup> form)*

*H. V. Carter, M.D. ad. nat. del. April 1862.*

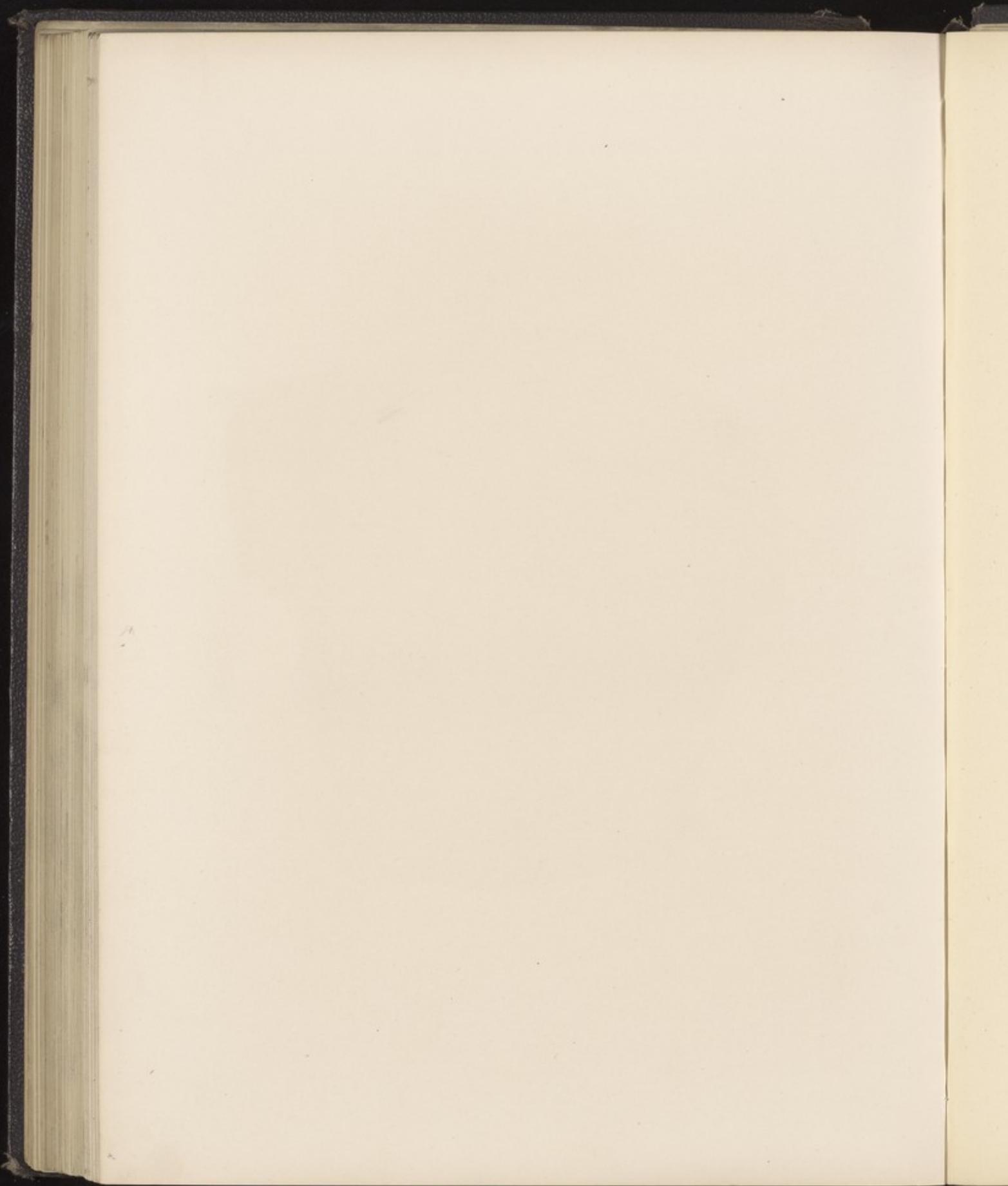


PLATE VII.

A reduced copy of Plate XII. of Boeck and Danielssen's *Samling af Iagttagelser om Hudens Sygdomme*, 3d Hefte or part, entitled "Traité de la forme anaesthétique de la Spédalskhed" (Elephantiasis Græcorum anæsthetos);" which is introduced in this place as an example of the chronic leprous eruptions, seen in Norway.

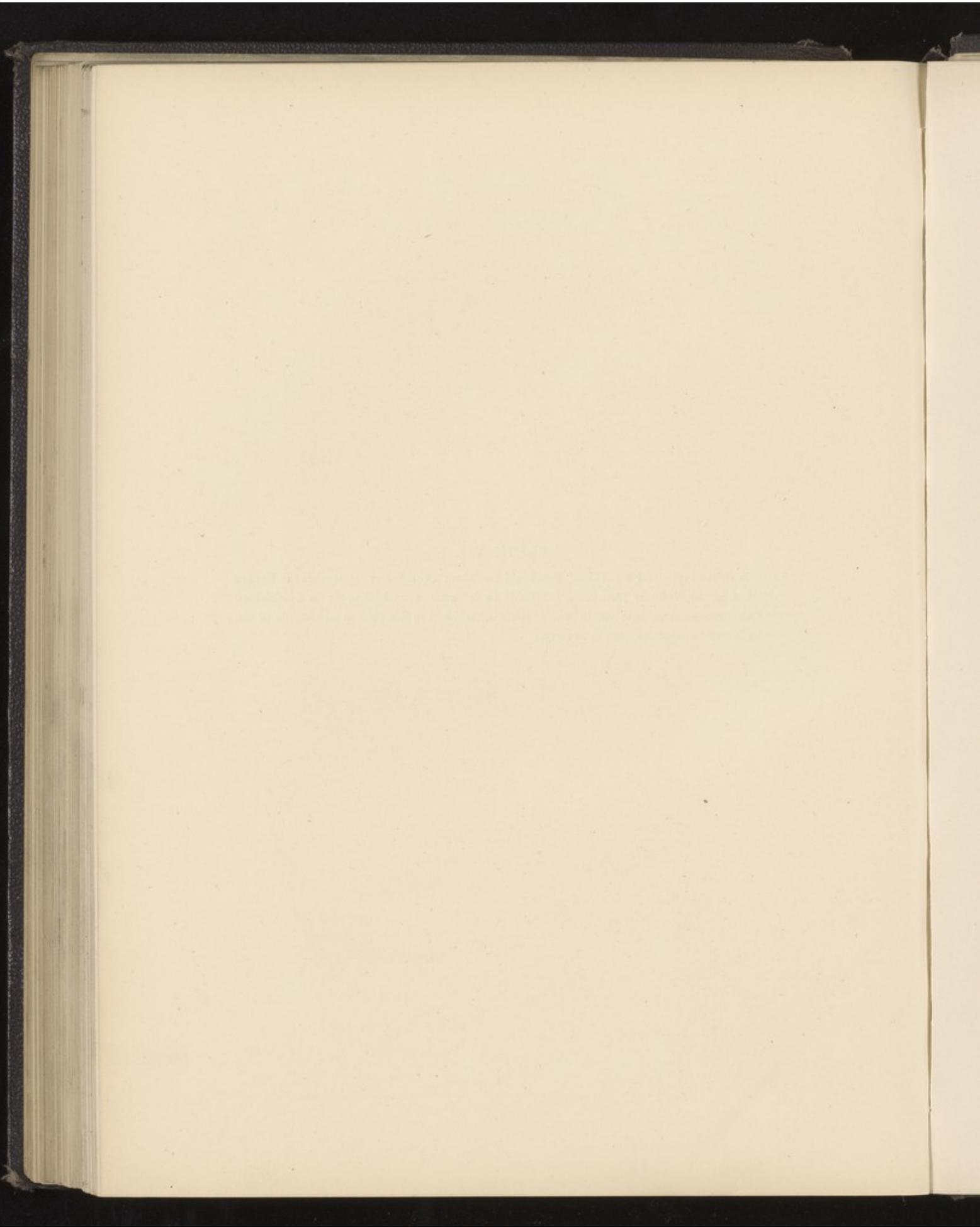
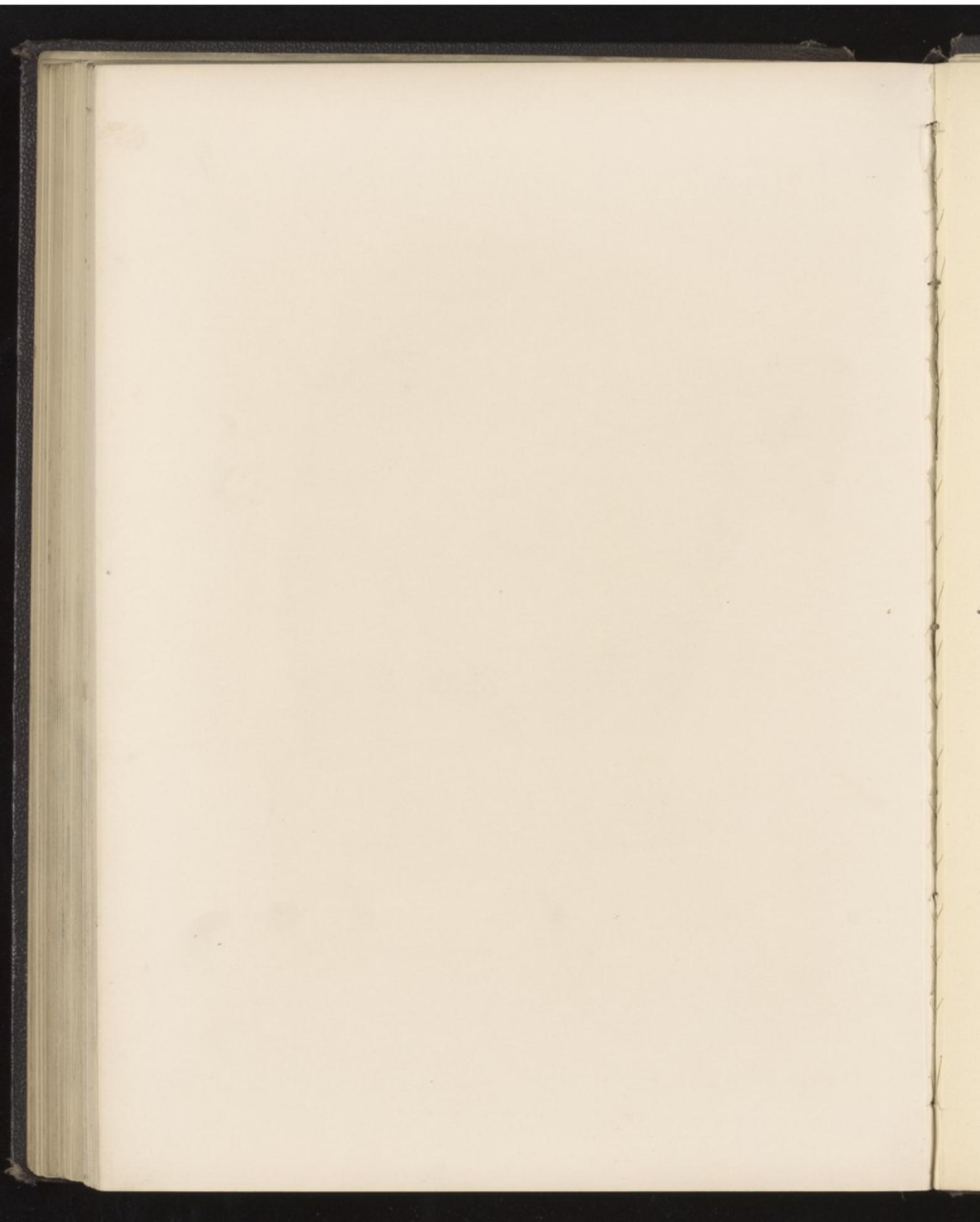


Plate VII.



*The Eruption in Leprosy.*  
(Copied from Dr. Danielsson's Memoir on Anæsthetic Leprosy.)



### PLATE VIII.

From a drawing made at Bergen, September 22, 1873. To show one form, at least, of the acute eruption which comes on in advanced stages of leprosy. The patient was a middle-aged man, greatly affected with nodular leprosy; his face being swollen and of livid hue, and his condition very cachectic. On account of his weakness, I limited the area sketched. The eruption was very abundant over the chest and arms; it consisted of red, raised patches, beginning with spots like pimples and finally attaining a diameter of 2 to 3 inches, of rounded contour, often blended; edges raised and pinkish, rather broad and free from scales; centre depressed, of light or greyish hue, dry and tolerably defined even in the smaller patches: of only a few days' duration, and attended with febrile symptoms. There was no reason to think this case peculiar amongst lepers in Norway, and I regard the eruption here depicted as one indicative of systematic infection from absorbed leprosy matter within the frame: it is possible that the spots commenced in an embolic process, which excites a uniform surrounding reaction and is only gradually overcome. The eruption would ordinarily be termed 'erythematous;' but it is not due to a mere functional derangement of the parts implicated.

This form of skin-affection is not like that commonly preceding the advent of leprosy 'nodules' (which rather resembles 'erythema nodosum'); but it is more similar to an ordinary phase of *lepra leprosa*.



Plate VIII.



*Leprosy Leprosa (acute form)*  
(from a Norwegian Subject)

H. V. Carter, M.D. ad nat. del. August 1873



PLATE IX.

Fig. 1. Dissection of the arm of a subject affected with 'nerve-lepra.' The part had been injected with an arsenical solution and the colour of the flesh had faded, but the appearances presented by the diseased nerves have been closely depicted.

Fig. 2. A smaller dissection—to show the abrupt change of appearance which the cutaneous nerves undergo, immediately after they pierce the deep fascia of the limbs, &c.

Fig. 3. A dissection of large nerve of compound function—to show the intimate meshes formed by its bundles (the *intra-neural plexuses*, as they may be called), and to illustrate the statement in the text, that of the main trunk one cutaneous or sensory segment, or sub-segment, may alone be affected; whence the varying appearances presented by the diseased nerves, and whence, too, the extremely various degrees of numbness, &c. perceived during life.

The illustration shows the front view of the  
specimen, which is a small, dark, oval-shaped  
object, possibly a seed or a fruit, with a  
slightly flattened top and a pointed bottom.  
The surface appears smooth and has a  
uniform dark color. The object is shown  
against a light background, and its  
shape is clearly defined. The illustration  
is a simple line drawing, capturing the  
essential features of the specimen.

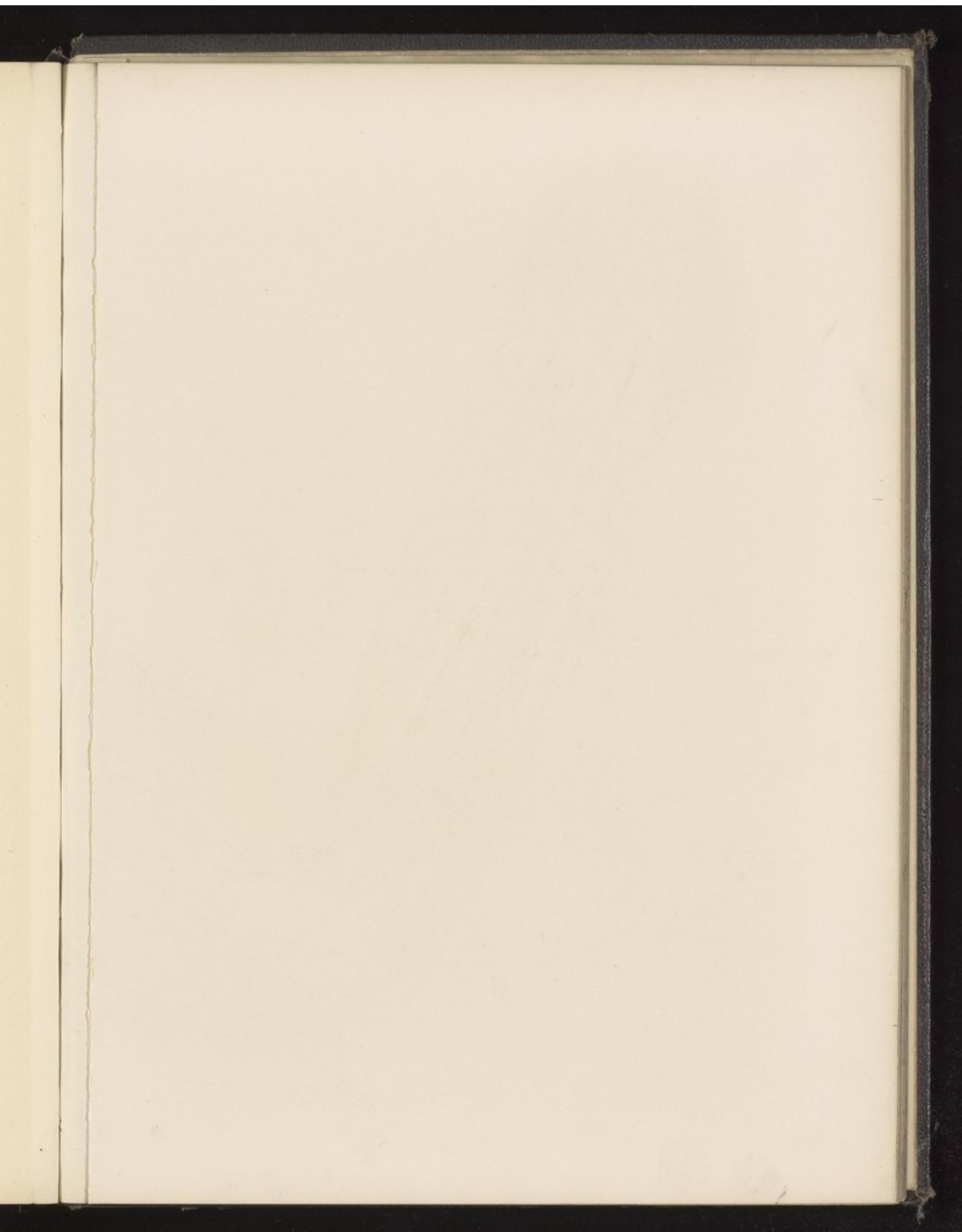
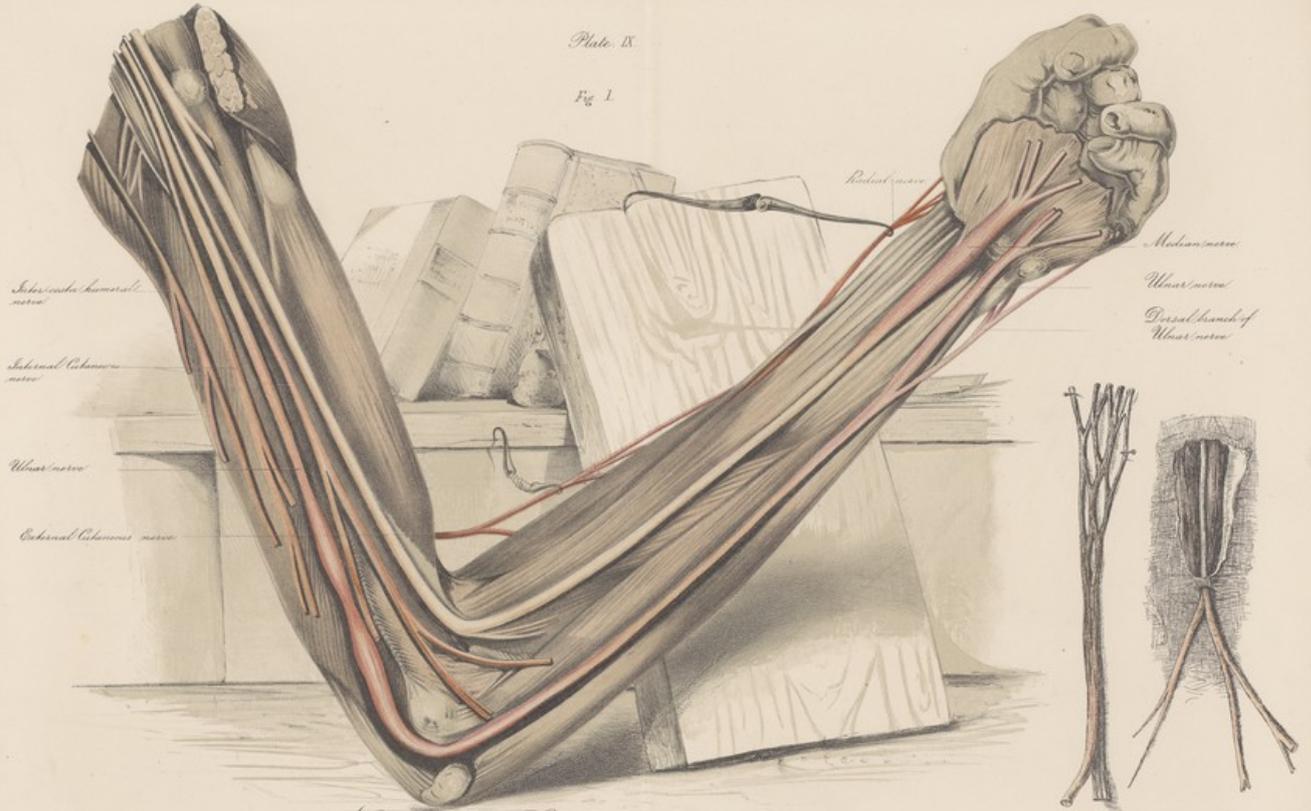


Plate. IX.

Fig. 1.



J. T. Cooper, M.D. and nat. del. March 1862

The Nerve-affection in Leprosy. Dissection of the Upper Extremity, natural size.

Fig. 3.

Fig. 2.



## PLATE X.

Fig. 1. Part of a healthy *Median nerve* at the wrist, natural size.

Fig. 2. A diseased *Median nerve*, from the same part, natural size. This figure shows an unusually abrupt form of swelling.

Fig. 3. Part of a diseased *Ulnar nerve*, at the elbow; it measured  $\frac{7}{16}$  in. diameter.

Fig. 4. A portion of a healthy *Ulnar nerve* from the same part: it measured  $\frac{1}{2}$  in. diameter.

Fig. 5. Transverse section of the healthy *Ulnar nerve*, made where the line is seen in fig. 4. 2 in. objective. The section was flattened and soft; and the component nerve-bundles were of opaque aspect.

Fig. 6. Transverse section of the diseased *Ulnar nerve*, made where the line is seen in fig. 3. Equally magnified. The character of the enlargement is here shown: the funiculi being chiefly affected. The section is rounded and firm; and the component nerve-bundles are of translucent aspect: the whole nerve is much enlarged.

Fig. 7. Nerve-tubes from a healthy nerve, as seen under a higher magnifying power; they are of uniform diameter and in close opposition: they are of characteristic aspect and they fall apart, when compressed.

Fig. 8. A portion of fig. 6 highly magnified ( $\frac{1}{4}$  in. objective). The neurilemma is studded with large granule-cells, masses, and granules; and the area of the nerve-fasciculus is greatly encroached upon by the same new materials, so that the nerve-tubes are compressed or even destroyed, and the whole tissue rendered firm and translucent. The new material is of dark brown colour, and apt to accumulate on the inner surface of the neurilemma: it contains besides granules, round or oval cells ( $\frac{1}{1000}$  —  $\frac{1}{2000}$  in. diam.), and it seems as if branching, granular, nucleated fibres were forming between the individual tubes: in one instance, a number of large clear bodies, apparently cells, were seen, having double the size of the above. The nerve-tubes appeared to be distended with a transparent, firm substance; but frequently their section is obscured by the quantity of the new formation, which presents the characters of copious cell-growth.

Fig. 9. A portion of the above more highly magnified.

Fig. 10. Transverse section of a nerve-strand from the *great sciatic nerve*. There was no disease apparent to the eye, and none on microscopic examination. On manipulation the appearances here shown were observed, and the most noteworthy are the varying size of the several nerve-tubes.

Fig. 11. A nerve-strand from an affected *Ulnar nerve*, which to the naked eye appeared to be somewhat diseased. The tubes are here not separately seen, all the parts being blended in a new formation, which has a gelatinous aspect, and is marked by large granular bodies. Hence the contrast with fig. 10. 1 in. objective.

Fig. 12. Section of a *diseased nerve-strand*, with a smaller one by its side, and opposite to this a blood-vessel: +acetic acid. The general aspect of an affected nerve is here shown; there is the almost unaffected nerve-sheath, the accumulation of granular matter just within it, and the more internal deposits which seem to follow the course of the small blood-vessels.

Fig. 13. Vertical section of part of a diseased *Posterior tibial nerve*; showing some of the varied appearances presented by the altered nerve-tubes.

Fig. 14. The stump of an atrophied thumb (Anæsthetic leprosy), dissected to show the number and arrangement of the clustered *Pacinian bodies*, in connexion with the digital nerves.

Figs. 15, 16, and 17 are views of such *Pacinian bodies*. 1 in. object. Their average length was  $\frac{1}{4}$ — $\frac{1}{2}$  in. They are also rounder and more opaque than natural. Similar changes are noticed in the Pacinian corpuscles found in the mesentery: but nowhere are they quite as variable. Fig. 15 shows vessels on the capsule. Fig. 16 shows the characteristic opaque cellular deposit in the interior, and also an enlarged and tortuous nerve-filament—as it appeared to be. Fig. 17 shows vessels in the interior of the corpuscle, when filled with injection.

Fig. 18. The *Bones of the digits* in 'lepra nervorum,' natural size. *a.* A view of the Bones of the right foot. The segments of the *tarsus* are light and delicate in texture: the *metatarsal* row is greatly affected, each bone being attenuated towards the anterior extremity, so as to become more or less pointed; the head of the bone is wanting, but its base is unchanged. The *first phalangeal* row is also altered in a characteristic manner; the shafts of the bones being converted into slender columns, upon which the head is seated like a small expanded capital. The *second phalangeal* row in this specimen, was less changed; in the *terminal* row, the expanded horseshoe-shaped ends of these little bones was wanting, their basal part being little changed. *b.* The bones of a finger, showing the simultaneous occurrence of interstitial absorption (at the tip), and necrosis (between first and second phalanx). *c.* A similar specimen to the last. The changes in the terminal phalanx are characteristic of absorption, whilst the joint between the first and second phalanx has been the seat of inflammation, followed by necrosis of the adjoining bones, abscess and sinus of the dorsum of the finger, where the small necrosed fragments were extruded. *d.* The bones of a shortened and bent middle finger: the remains of the wasted second phalanx are ankylosed to the altered head of the first phalangeal bone. *e.* A separate metatarsal bone from a leper's foot, seen from the dorsal aspect. It shows the tapering, pointed form of the partly absorbed shaft, the anterior part and the head being wholly deficient, while the base is unaffected. *f.* A side view of a first metatarsal bone, showing the characteristic shape of the still more altered fragment: here absorption has proceeded so far as to leave only the basal end of the bone, surmounted by a conical remnant of the shaft. Another specimen is mislaid, which had a still more regular conical shape, exactly resembling a limpet-shell. *g.* A view from above, of another wasted metatarsal bone belonging to the great toe: here similar changes have occurred to those described in the last specimen. *h.* The remains of the second phalangeal row (finger). Here absorption has proceeded to an extreme degree, but still after the same manner as is usual in these cases.

Fig. 19. One of several small *bony growths* in the Spinal arachnoid membrane of an anæsthetic leper. See A. L. Table II. Case No. 1. Natural size two  $\frac{1}{16}$  in. diam.

Fig. 20. Two of the same somewhat magnified—to show their form.

Fig. 21. Transverse section of a small growth, viewed with 1 in. objective. Its formation of true bone is seen: this had taken place in fibrous tissue, and not in cartilage.



Plate X



H. V. Carter. del.

The Nerves, Pacinian Corpuscles, Bones &c. in Leprosy.



## PLATE XI.

Fig. 1. Transverse section of a single funiculus, taken from the *median nerve* in the lower part of the fore-arm (other nerve-bundles were similar to this), + acetic acid and glycerine: 1 in. objective. It shows the irregular distribution of the leprous neoplasm amongst the nerve-tubules. The whole diameter of the funiculus is about  $\frac{1}{2}$  in. The neurilemma is not greatly thickened, but it and its septa are darkened by deposit: the light part of the general area is that which is yet normal; the darker parts are those where disease exists, and large, dark globular bodies are seen, which are the characteristic leprous elements, some of them were  $\frac{1}{3}$  in. in diameter. Specimen taken from the subject marked as A. L., No. 3, in my Tables of Autopsies.

Fig. 2. Transverse section of a portion of the *posterior tibial nerve*, as seen after preparation: 1 in. objective. Several funiculi of different sizes are present; they are seen to fit loosely in their neurilemmar sheaths, and the vacant interspace seems to correspond with lymph-spaces or canals. The peculiar dotted and darkened appearance of the funiculi, most evident at their circumference, is marked; also the opaque septa; and the lamellated neurilemma, of a yellowish tint, is not much changed. Adipose tissue and blood-vessels are also shown.

Fig. 3. A portion of the above more highly magnified (250 diameters), + acetic acid and ether: in glycerine. The mapping out of the nerve-area, and the coarsely nucleated investment, the atrophied nerve-tubules and the thick-walled blood-vessels, are here shown.

Fig. 4. A vertical section of a similar diseased nerve-bundle, prepared as above; here the tubules, compressed, atrophied, and even partly obliterated are seen passing longitudinally. On the left-hand side they are less affected.

Fig. 5. A portion of the same, more highly magnified. Two of the nerve-tubes are seen imbedded in the new formation, which has here acquired a fibroid structure, containing some nuclei. An isolated tube is shown, to represent the folded and collapsed sheath, which is sometimes to be seen. I note that the appearances are probably not artificial.

Fig. 6. Vertical section of a *median nerve*: + acetic acid:  $\frac{1}{4}$  in. objective. Four nerve-tubes are seen imbedded in the new formation, and much altered thereby: the intertubular substance contains granule cells and dark masses.

Fig. 7. Vertical section of part of a *supra-orbital nerve*: + acetic acid:  $\frac{1}{4}$  in. objective. The nerve-tubes are widely separated by a growth, which here presents a cellular character. My notes remark "the nerve-tubes are frequently small, irregular, granular, and their contents firm or escaping in very small quantity at the end of the bundles. Intermixed with them and seen often on the outer side of the bundle are numerous, small, clear corpuscles imbedded in a scanty homogeneous substance: these are readily seen after the addition of acetic acid, as well as before, and resemble blood-corpuscles in their regular size and form; but they are granular and not at all regularly imposed, and sometimes are very small."

Fig. 8. Vertical section of part of a fine digital branch of the *ulnar nerve* much diseased: + liquor potassae:  $\frac{1}{4}$  in. objective. There were no traces of nerve-tubes; but "delicate, finely granular nuclei (cells), mostly of a rounded form, arranged in elongated groups running in the course of the tubes: very little granular matter, except in the form of long, narrow streaks: not a trace of nerve-tubes, and the intervening tissue is clear and like fibrous tissue, with parallel straight lines in it."

Fig. 9. Transverse section of a diseased *ulnar nerve* (anæsthetic leprosy), as seen after the prolonged action of acetic acid:  $\frac{1}{4}$  in. objective. The neurilemma is seen to contain numerous "large, fusiform, granular accumulations;" the septa proceeding from it, are narrow and nucleated at intervals; the spaces inclosed by them seem to contain a clear, refractile material, surrounding the nerve-tubes—these spaces measure  $\frac{1}{10}$  to  $\frac{1}{15}$  in. diameter. Sometimes the nerves are greatly reduced in size, as if from compression, and sometimes they are wholly destroyed.

Fig. 10. Transverse section of part of an *ulnar nerve*, taken from near the elbow-joint: + acetic acid:  $\frac{1}{4}$  in. objective. None of the usual coarse, granular cells or masses were seen, but in their place, countless numbers of clear, or slightly granular, round or oval, irregularly-sized corpuscles; never branching into fibres . . . they are exceedingly abundant in the outer coats of the nerve-strands, but may also be seen in collections in the interior and amongst the nerve-tubes themselves: the relation of these corpuscles to the material and network between the tubes is not clear, the latter are not very apparent, even after the action of acetic acid. It would seem as if this was an early stage, yet some of the nerve-tubes in the strands, must have been completely destroyed, for not a trace of them is seen in other sections."

Fig. 11. A small portion of the clearer part of Fig. 1 magnified  $\frac{1}{4}$  in. objective, to show the minute structure of the nucleated septa. "There is some difficulty in distinguishing the nuclei (cells) from the granular ends of the shrivelled nerve-tubes or their axis-cylinders, but the latter are generally tinged yellow, are sometimes quite clear and refractile, and often of larger size, when no mistake could be made."

Fig. 12. Transverse section of a *median nerve*: + dilute acetic acid:  $\frac{1}{4}$  in. objective. The nerve-tubes have a coagulated appearance, and there is no distinction of sheath and contents: they are imbedded in a clear, refractile, and homogeneous substance; and they are separated by bands or septa passing inward from the neurilemma, and composed of a delicate, nucleated fibrous-tissue. The projecting ends of the nerves (their axis-cylinders?) measured in diameter,  $\frac{1}{10}$  to  $\frac{1}{15}$  in.; the spaces inclosed by the septa about  $\frac{1}{10}$  in. across; the neurilemma was here  $\frac{1}{15}$  in. thick.

Fig. 13. Part of a *supra-orbital nerve*: the branches of which outside the orbit seemed to be healthy; within the orbit, the trunk had rather a firm and round aspect, and on examination, a small quantity of deposit seemed to have taken place between the nerve-tubes, which was furnished with small oval or round, clear nuclei (+ acetic acid) or cells.

Faint, illegible text covering the majority of the page, likely bleed-through from the reverse side.

Plate. XI

Fig. 2.



Fig. 1.

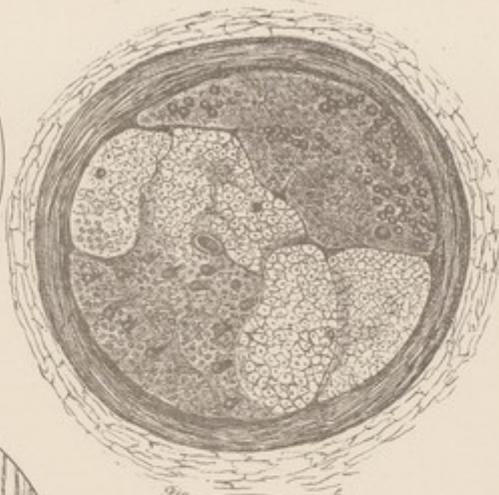


Fig. 3.



Fig. 4.



Fig. 5.



Fig. 6.

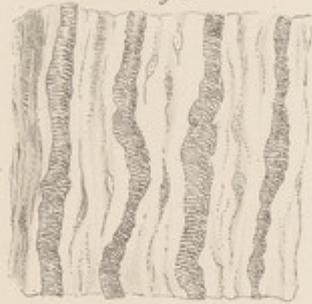


Fig. 7.



Fig. 8.



Fig. 9.

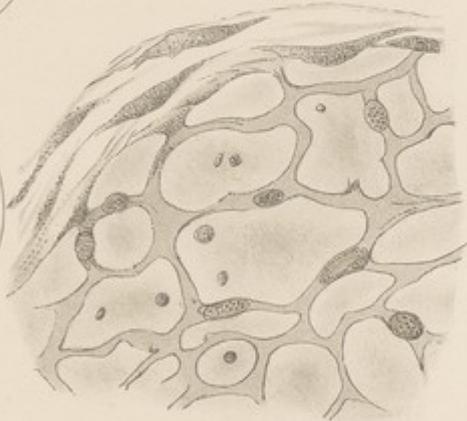


Fig. 10.



Fig. 11.



Fig. 12.

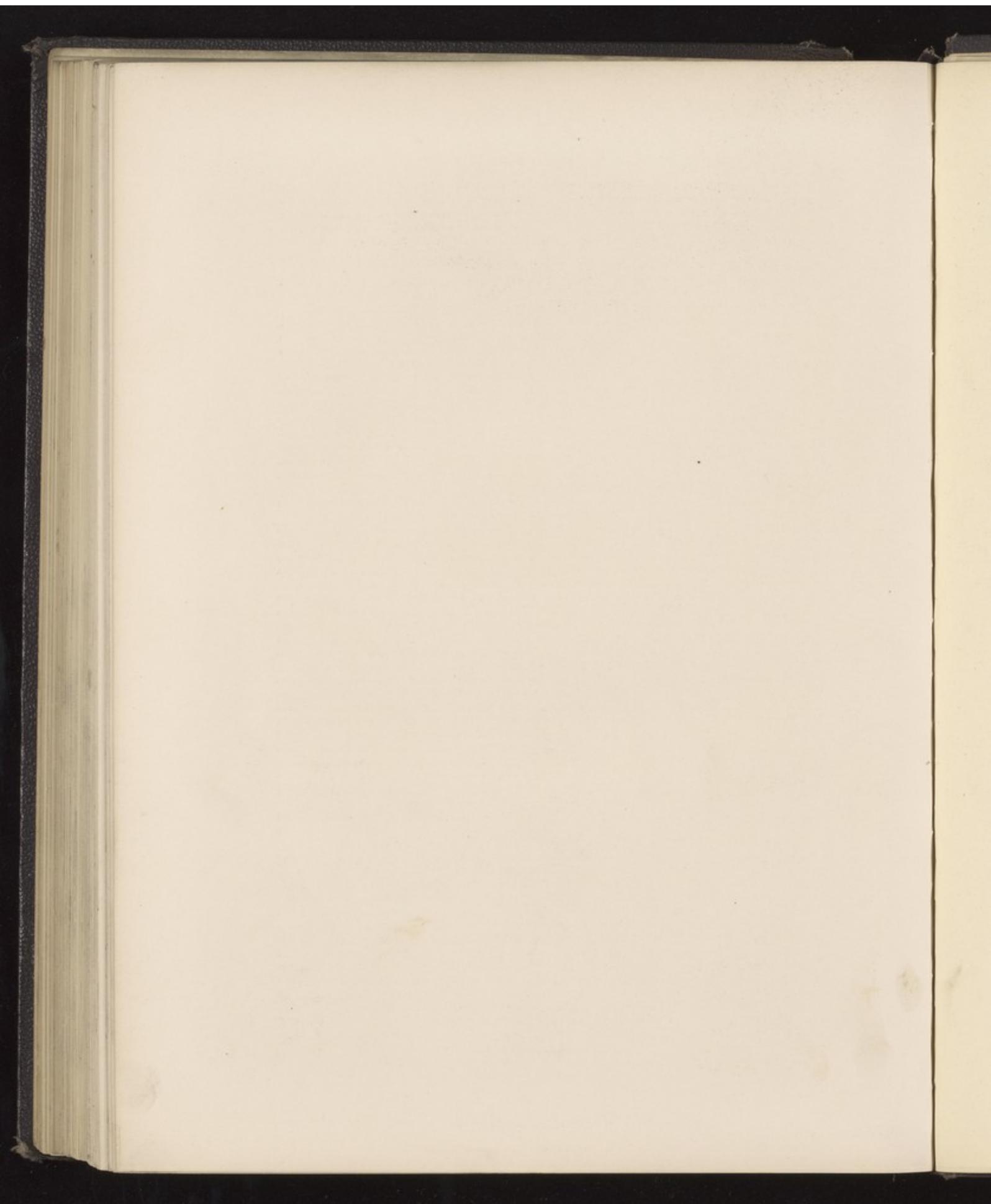


Fig. 13.



H. V. Carter, M.D. del.

Minute Structure of Leprous Nerve-disease.



## PLATE XII.

### DESCRIPTION OF THE FIGURES.

Fig. 1. *a.* Vertical section of *healthy skin* (Hindoo); slightly magnified. As compared with the figure below (*b.*) it is noted that the section is more opaque, presents opaque wavy masses leaving lighter clear meshes; there are no large clear spots: the whole is much thinner; the edges more wavy; hair-follicles not so distinctly marked out; hairs thicker, and their colour sometimes darker.

*b.* Section of *skin of cheek somewhat tumefied by leprous deposit*; equally magnified. The depth of the section is increased by the new material to  $2\frac{1}{2}$  times the normal; the whole is less densely opaque and presents a more uniform appearance; there are large, lobated sections, tolerably well defined and of yellowish-brown translucent hue; in these the compressed hair-follicles and atrophied sebaceous glands are imbedded, the latter being reduced to mere lines. The upper edge of the section is even and somewhat convex; apertures of the hair-follicles very distinct.

Fig. 2. Section and contents of a *small tubercle* the size of a split-pea, taken from the back of the hand. *a.* The nodule is sub-cutaneous; it consists of a firm yellowish material disposed in lobes, tough though readily torn with a needle, and vascular. *b.* The mass consists of cells having the appearances depicted; mostly large in size, very irregular in form, furnished with one or more nuclei having nucleoli, and sometimes seeming to pass into distinct fibres. The addition of acetic acid renders the nuclei more clear. Diameter of the latter  $\frac{1}{1000}$  to  $\frac{1}{2000}$  in.; they may be seen dividing or themselves passing into a fibre: most fibres, however, are not regularly formed, but seem to be rather irregular fragments torn off the general mass. Few oil globules and little granular matter.

Fig. 3. *a.* Section of the *skin of the left cheek*, which was reddened, thickened, lighter in colour, coarser in appearance than the rest; also smooth and shining. The new deposit is in vertical oblong patches, which seem generally to be prolonged in the course of the ducts of glands and hair-follicles, which are invested in their exterior and suffer compression by it. This is often apparent in the lobes of the glands around which the deposit may be seen (e.g. in the sweat glands) in isolated patches; as viewed with a low power, the deposit has a granular, yellowish, and characteristic aspect. The cuticle is unaffected; the pores of follicles and ducts are enlarged, and the hairs appear compressed; the papillae of the skin are effaced. The depth of the deposit varies from  $\frac{1}{2}$  to  $\frac{1}{4}$  in.; within the substance of the new material are to be seen groups of sebaceous glands, apparently distended and opaque; the character of the deposit is the same in all parts, and the granules it contains are laid parallel with the surface invested, so that a stunted appearance is produced or concentric lines. *b.* Microscopic characters of the neoplasm. Acetic acid has been added. Ordinary fibrous tissue is rendered transparent, but the new formation becomes more distinct. It appears to consist of a homogeneous material, rendered clear by the acid, disposed in layers as would seem by the position of the nuclei or granules: these are of yellowish colour, granular aspect, and of very irregular form and size. In some parts it appears as distinct cells or masses without any indications of nuclei; commonly this is not the case. Ether has but little effect on the cells, sometimes, however, it seems to render clearer the appearance of a nucleus in the interior of these large masses; and there are some other indications of the presence of these bodies in the new formation, in the elongated granular processes almost like fibres communicating with others. The contents of the ducts of the glands are not changed. Some of the larger masses here depicted are as large as the  $\frac{1}{10}$  in.; the smaller and more regularly round or ovoid ones no larger than  $\frac{1}{20}$  in. in diameter. *c.* Cells and granular masses from a *tubercle on the leg*; this was a large flattened nodule over which the skin was smooth; it is composed, I write, of a deposit of a reddish colour; tolerably defined; it involves the true skin which is blended with it; the papillae are absent in the smooth part, while in normal skin around they are very clear, and have in them looped and dilated capillaries; no nerve-fibres were seen; sections of blood-vessels surrounded by deposits were not unfrequent. The new material is of semi-granular character, like that of true leprosy; there is a homogeneous, tolerably clear matrix, on which are imbedded numerous cells, nuclei, and granular masses; the former are more numerous and often seen forming into fibres; the latter have the characters of leprous material, only having a more defined wall and being commonly of a more regular form; none of the greater leprous masses were seen, but in this case the deposit was probably not so advanced as in that shown in fig. 2.

Fig. 4. *a.* Contents of a *leprous tubercle situated in the palate*. "The nodule was composed of a dense, brownish deposit, not cleared by acetic acid, and consisting mostly of large, irregular, but defined granular masses, in form ovoid, stellate or branching, of coarse aspect, and not showing any trace of a nucleus. The edge of the tubercle was defined, presenting small papillae covered with thick epithelium; blood-vessels very numerous. The same deposit extended along the surface of the mucous membrane for some distance and also to some depth. Some of the granular masses depicted were so large as to resemble true myeloid cells; others were of elongated and branching form, and the smaller masses were rounded or oval. The addition of ether produced very little change in their appearance; no nuclei in their interior were seen." These are the characteristic structure-elements;  $\frac{1}{4}$  in. objective.

*b.* Cells and granular masses from an *inguinal gland* which was somewhat enlarged; it did not contain a firm deposit; the external part of the gland was opaque and streaked, the internal grey and vascular. "A portion of the former showed aggregations of cells, with very little connecting substance; some of these are represented in the figure. Of the rounded granular masses which had a dark brown colour, several were seen, and occasionally a nucleus within them; there were nuclei and fibres belonging to the connective tissue it would seem; there were several large clumps or masses of granular aspect which gave the impression of endogenous growth proceeding within them." Also were noticed numerous smaller and delicate cells, which were probably proper gland-cells and on the addition of acetic acid showed granular contents.

Fig. 5. *Leprous deposit in the skin*; acetic acid has been added. The lower end of a sweat-duct is seen emerging from the mass of deposit. The neoplasm resembles in external characters the deposit found in the nerve-

fibres; when acetic acid is added the same coarse cells appear, often rather elongated granular masses than actual cells; frequent large pigment-cells of a deep reddish or orange colour, and some coloured particles may be sometimes seen in the granular masses. The deposit has a tendency to accumulate around the hair-follicles and sweat-ducts, both of which, as well as the sebaceous glands, it finally compresses. The hair-follicles are frequently filled with an irregular dark deposit, the contour of the hair being swollen and bulging; the sebaceous glands are generally small.

Fig. 6. *a.* A small hair in its follicle, from the skin of a leper. The sheath of the follicle is seen to be distended at intervals, probably from hypertrophy of the lining epithelium, and the result would be extrusion of the hair itself, as commonly occurs.

*b.* Section of two blood-vessels (?) imbedded in thickened skin; acetic acid and ether have been added. The same enormous granule masses, as well as incipient stages of the like, are seen here as elsewhere; in some of the detached cells vacant spaces of regular form are seen, the nature of which is doubtful, and the great masses seem to contain particles looking like oil globules. From the same preparation as Fig. 3 *a.*

Fig. 7. Portion of a sweat-gland from the skin of the forehead. The patient had a 'leonine' aspect; the forehead was most affected; hairs very scanty, though under the microscope many smaller ones became visible, whose follicles, I note, are not furnished with sebaceous glands. The deposit is indicated, at first, by a reddish grey appearance in and beneath the cutis; it is arranged as above described, but hardly so distinct or isolated; it follows the vessels, ducts and glands. Seen around a sweat-gland, it had not the usual decided brown colour; acetic acid and glycerine being added, its characters were seen as shown in the figure; the matrix is clear and homogeneous; scanty: cells very numerous, of more or less oval shape, tolerably uniform in size and general appearance, small, being  $\frac{1}{2000}$  to  $\frac{1}{4000}$  in. in diameter, clear, devoid of nuclei, defined; they differ from the cells of areolar tissue in their closer aggregation, irregular disposition, clear and more refractile appearance; they do not form fibres; they have some resemblance to red blood corpuscles, but are devoid of colour even in mass. In this case the deposit was different from usual.

Fig. 8. Non-striped muscular fibre from the skin of the cheek of a leper, + ac. acid + glyc. In the section examined, several bands of a clear substance provided with very long nuclei and resembling involuntary muscular fibre were seen. These nuclei were frequently in a state of fatty degeneration. The bands mostly run in a very oblique direction, and could sometimes be traced as far as the epidermis; at their opposite extremity they were apparently in connexion with glands, follicles, &c. Nothing like nerve-tubules were seen in the bands.

Fig. 9. *a.* Vertical section of the skin at the wrist of an aged leper where an ulcer existed. This is seen to the right of \* which marks the elevated edge magnified at *b.* A white patch is indicated to the left of \* by absence of dark tint in the superficial layer representing the cuticle; *b.* shows the structure of the new material added at \*; the cuticle (*c*) is much thickened; there are enormous papillae (*d*), containing capillary loops, which are sometimes varicose and seem to burst from over-distension here and there; the loops may form a small network at top sometimes; at (*e*) the cutis and new layer blend together.

Fig. 10. Structures taken from the semi-lunar ganglion, seemingly enlarged: subject, a leper. *a.* Two ganglion-cells; these had a normal appearance; they were surrounded by numerous nucleated fibres, upon the preponderance of which any supposed peculiarity in this specimen (*i.e.* the enlargement) would seem to depend; blood-vessels numerous and healthy; few fat-granules or free nuclei; the colouring matter in the nerve-cells is abundant. *b.* A piece of a grey nerve in which two of the medullated tubules are seen; these have undergone considerable change, there being no trace of double contour, &c., the preparation had, however, been preserved in spirit + acetic acid. *c.* Other grey fibres, in one piece, having fine tubules intermixed.

Fig. 11. Deposit in the urine of a leper (a Portuguese). There are casts of two kinds and numerous varieties of cell-growth; the former either transparent or granular, with cells imbedded; the latter showing cells delicately granular or more coarsely granular and of yellowish tinge: no oil-globules were seen.

Fig. 12. Fatty degeneration of the kidneys in a leper. Two of the uriniferous tubes are seen, that to the right being most diseased; also an isolated epithelial cell loaded with fat. Below is part of a Malpighian tuft, showing also a state of fatty degeneration; and amyloid changes were also present.

Fig. 13. Urinary tubules from the kidney of a leper; various stages of disease are shown. Some of the tubes become enormously enlarged and filled with granular contents; the lining epithelium is greatly hypertrophied, as shown to the left; but the nuclei of individual cells remain. I remark, there is no evidence in this specimen of a deposit similar to that found in the nerves: none between the uriniferous tubules was ever seen.

Fig. 14. Microscopic appearances of the osseous tissue in a metatarsal bone from the foot of a leper, which had become much shortened by interstitial absorption. The ordinary appearance of the atrophied bones is shown in Plate X. fig. 18. *a.* Transverse section of Haversian canal from one side of which are seen proceeding two narrow channels: diameter of the Haversian canal  $\frac{1}{32}$  in.; of the channels about  $\frac{1}{128}$  in. The latter here pass off in a radiating direction right through the osseous tissue towards other canals or other channels; in the text they have been compared to the tracts of worms permeating the bony tissue; and they are supposed to be the commencement of morbid changes, shown at a more advanced stage in *b.* *b.* A large and irregular passage in the compact osseous tissue, which is the product of the wasting or absorption here termed 'interstitial.' Diameter of the passage  $\frac{1}{8}$  in. At \* is seen the remains of a Haversian canal, which has become involved in the widening Haversian space, as this and the like passages or cavities may perhaps be termed, in accordance with the definition given by Messrs. Tomes and De Morgan.

Fig 1  
a.

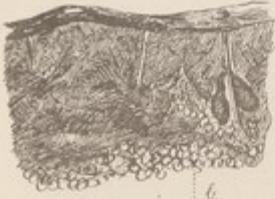


Fig 11



Plate. XII.

Fig 12



Fig 13



Fig 8



Fig 9  
a.



Fig 2.



Fig 3

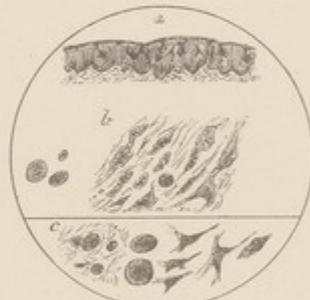


Fig 10



Fig 7



Fig 5



Fig 14

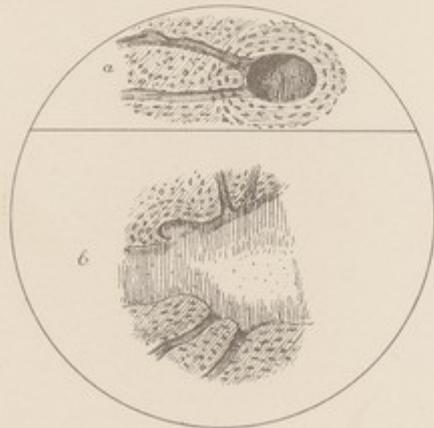


Fig 4

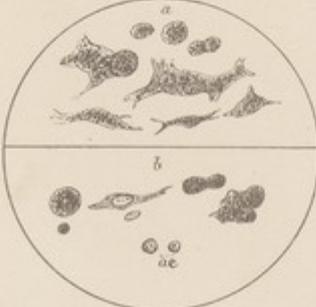


Fig 6



H. V. Carter, M.D. del

Minute anatomy of Leprous deposits &c.

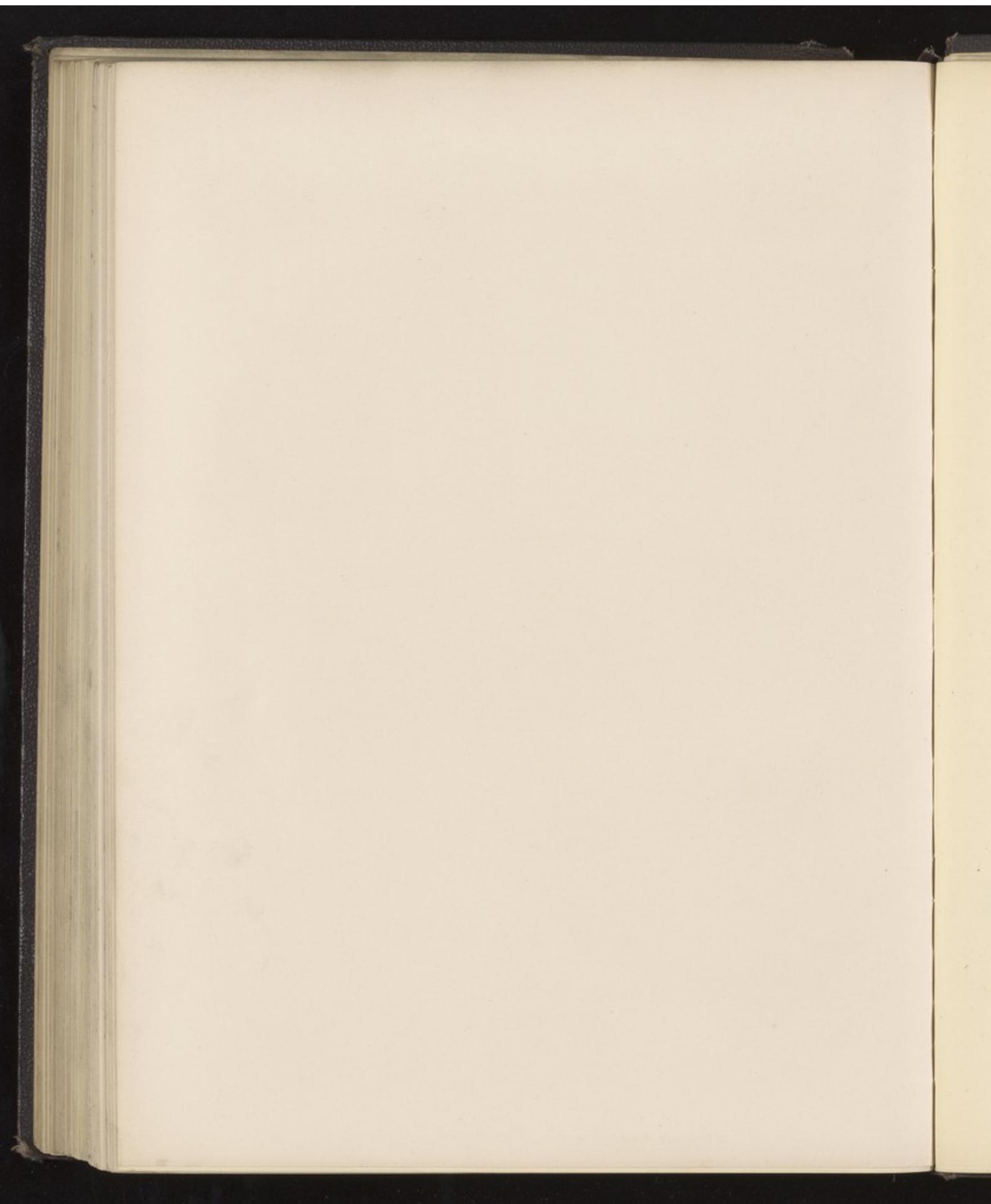


PLATE XIII.

A view of the leg of a Parsee man, showing an early stage of *Elephantiasis*, and as well numerous papillary and vesicular prominences; which are believed to be due to dilatation of the cutaneous lymphatic vessels, and from whence issues a fluid having all the visible characters of lymph.

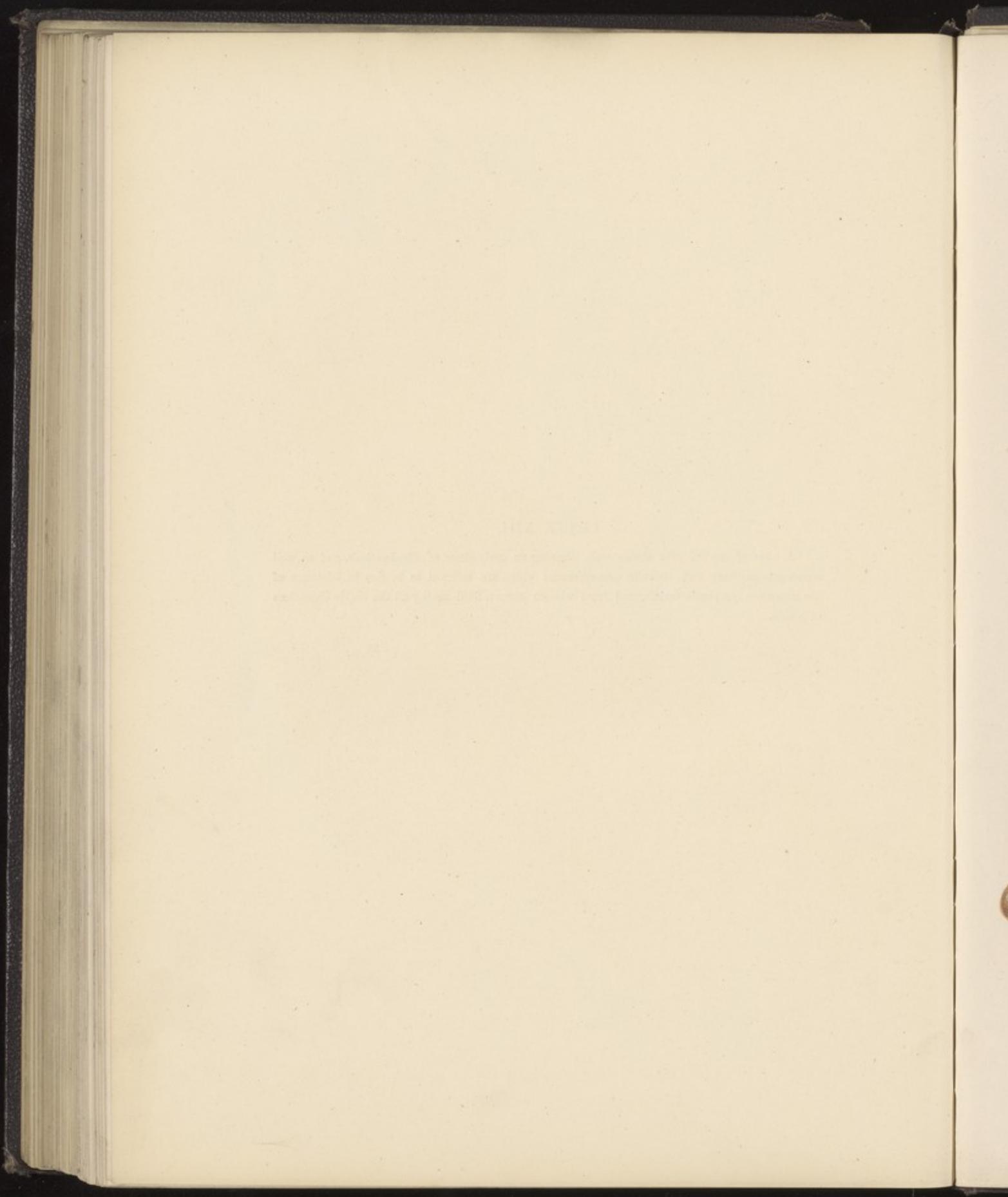
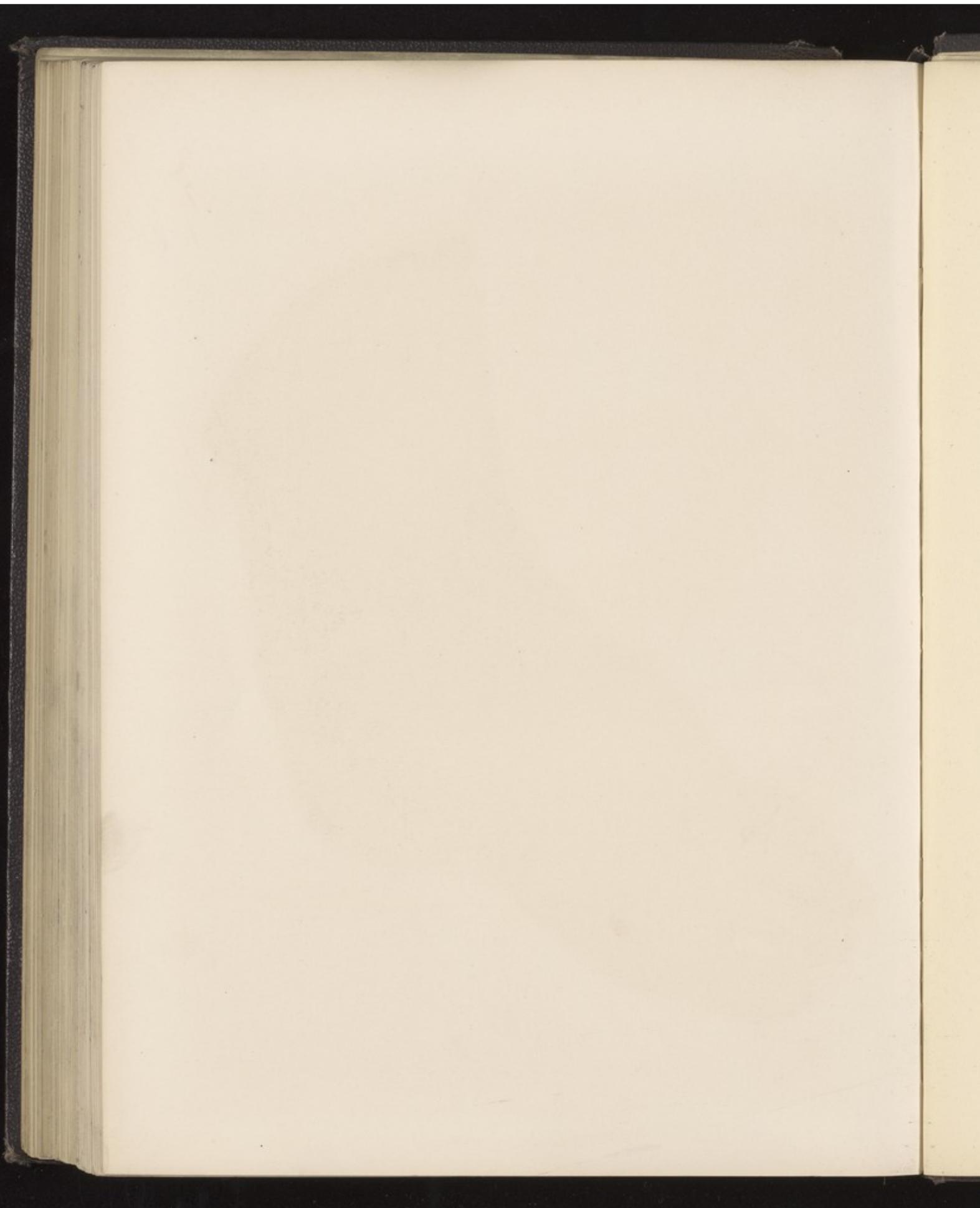


Plate. XIII.



*Elephantiasis (Arabum) of the Leg: early stage.*

*From the life. Bombay 1862. H.V.6*



## PLATE XIV.

Fig. 1. View of a *Scrotal tumour* taken immediately after its removal from the body. To show the appearance of the tissue which forms its mass, and which consists of thin and interlacing laminae, separated by a fluid resembling liquor sanguinis. Slightly below natural size. The gelatinous and reticular structure of Elephantoid tumors is difficult to display.

Fig. 2. Section of the prominent raphe of another tumour + 1 in. obj. The epidermis is not changed; the papillae are sometimes of considerable size; the cutis is made up of a uniform, dark tissue, with an occasional appearance of vessels. There are bands of pale muscular fibre, passing both horizontally and vertically; some may be traced close to the surface, and the ends of others are frequently seen on section. All are distinct as light bands amidst the more opaque connective tissue.

Fig. 3. View of the cutaneous papillae of another large scrotal tumour, as seen after removal of the cuticle; their enormous size and varying form is here shown, half-inch obj.; length of the papillae  $\frac{1}{10}$  to  $\frac{1}{8}$  in.; they are frequently club-shaped, and they contain vascular loops, better seen in fig. 4. Below is the cutis, consisting of a slightly reddish-grey layer,  $\frac{1}{2}$  to  $\frac{1}{4}$  in. thick, and marked with vertical lines or streaks, some of which of are here shown, passing to the papillae.

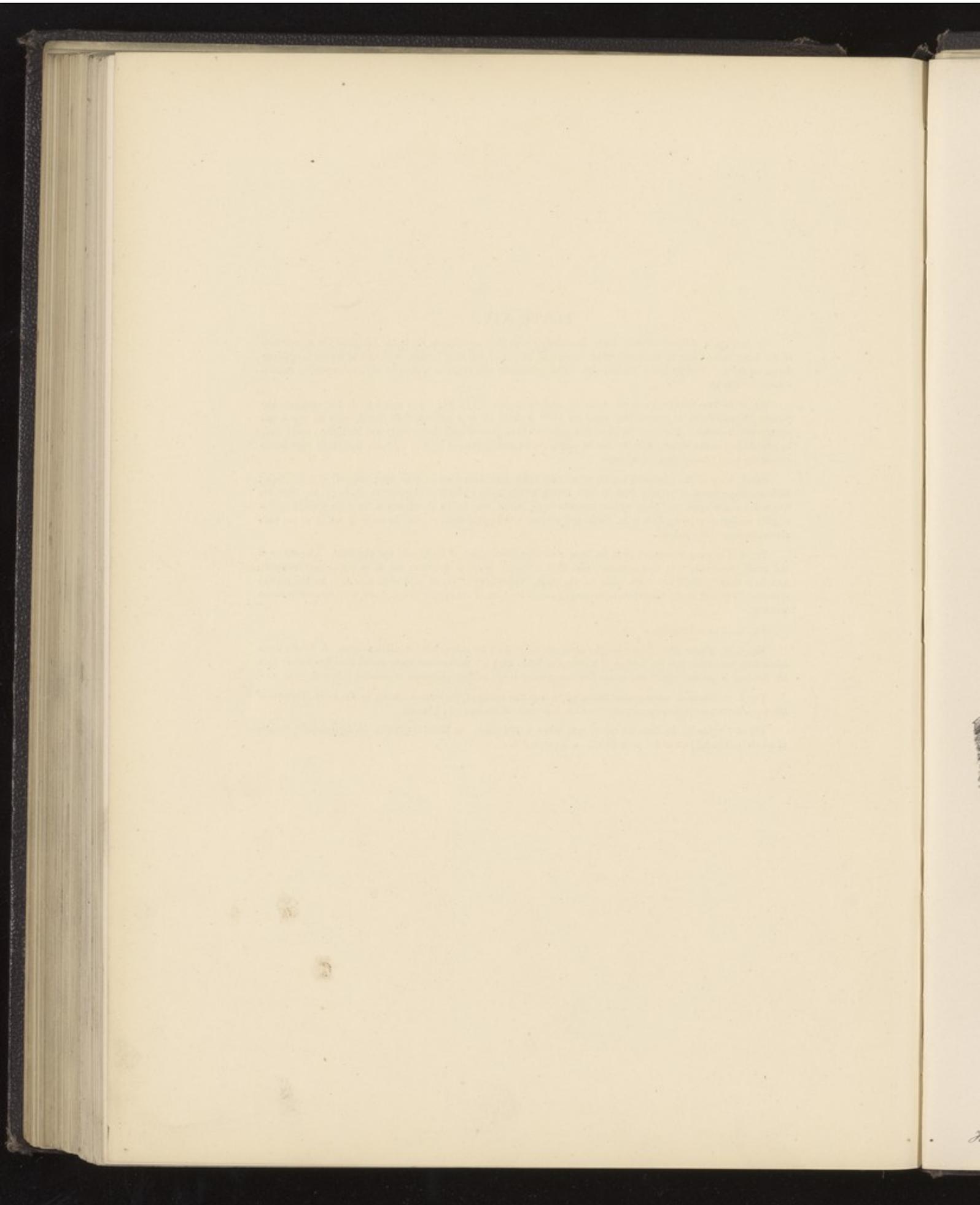
Fig. 4. The same structures as in fig. 3, as seen after the addition of acetic acid and glycerine. The course of the small blood-vessels is now apparent, also their irregular diameter granular and often pigmentary contents, and their greatly thickened walls while in the cutis. Collections of round cells were also seen in the papillae (lymph-cells?), and in the transverse layer passing across the base of the latter: deeper down, only connective tissue was seen.

Fig. 5. A looped papilla.

Fig. 6. *a.* Elastic fibres from a healthy scrotum; taken from the sub-cutaneous cellular tissue. *b.* Elastic fibres taken from one inch below the surface of a scrotal tumour: they are thicker and more curled than the above; they are disposed in parallel layers, and where this arrangement is not evident, elongated or rounded cells were seen.

Fig. 7. *a.* Bands of white fibrous tissue, taken from the centre of the tumour shown in fig. 1. *b.* Portions of the same, in course of development, and found in most parts of the tumour;  $\frac{1}{4}$  in. obj.

Fig. 8. Corpuscles, &c. from the scrotal lymphatics  $\times 300$  diams. *a.* Blood corpuscles. *b.* Lymph-cells, to some of which (on the left) water has been added. *c.* Lymph-clot.



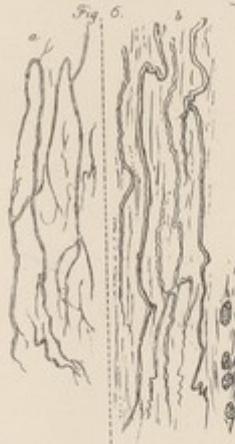
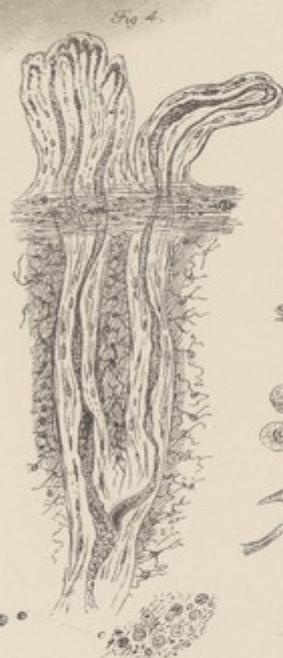


Fig. 1 - Elephantiasis (Arabum) of the Scrotum.

H. V. Carter, M.D. ad nat. del. Fig. 2 to 7. Minute structure of the Tumour.  
27 August. 1858

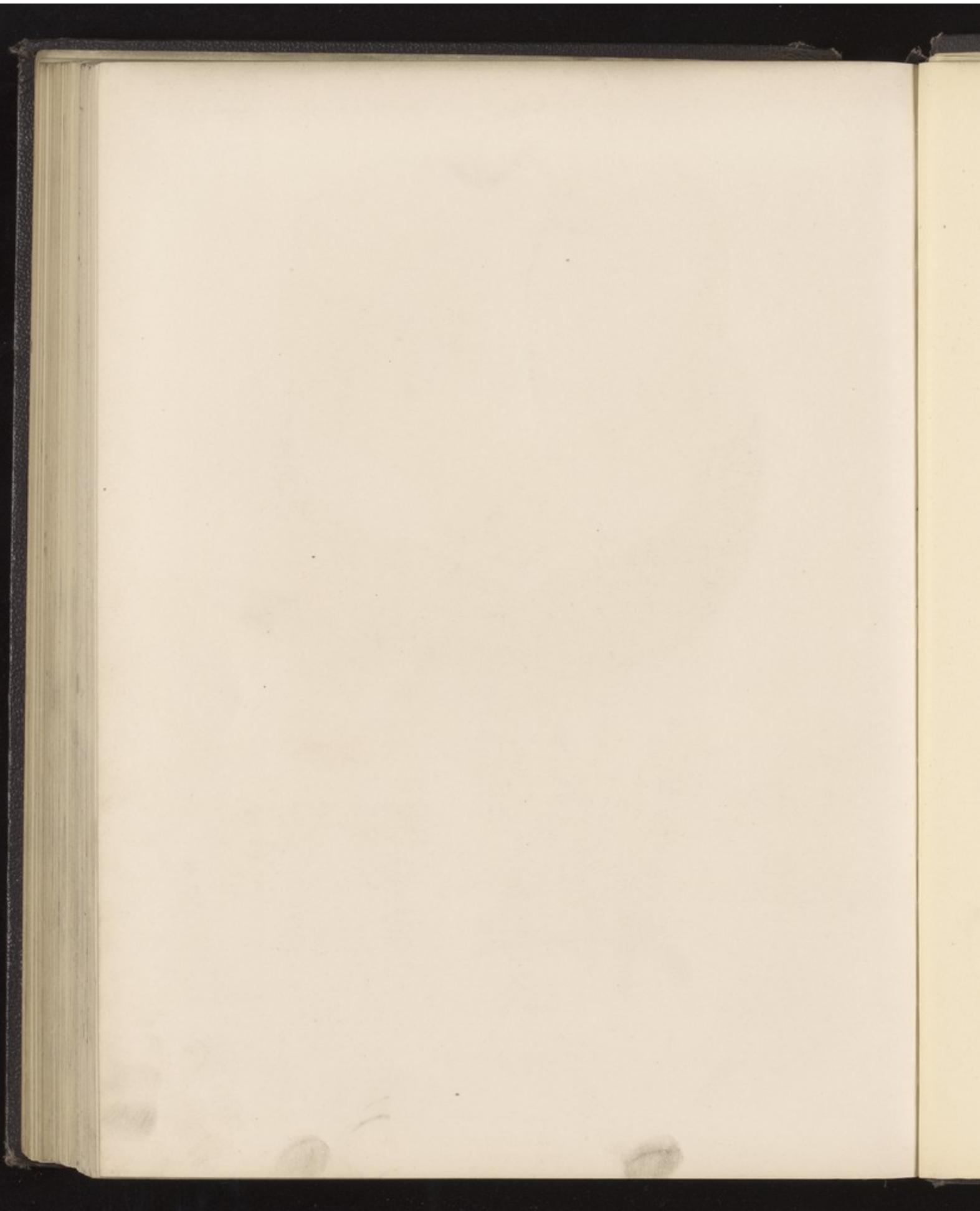


PLATE XV.

A view of the scrotum, &c., of an adult Hindoo, presenting the signs of incipient 'Elephantiasis.' To show the number, size, and arrangement of the vesicles and dilated lymph-trunks as they are sometimes seen in this disease, at its commencement. The enlargement of the corresponding inguinal glands is also apparent. From the vesicles which are seen to be dotted over the true scrotal surface, lymph or even a milky (chylous) fluid may be obtained; and according as the varicose state of the lymphatics is superficial or deep-seated, will be the aspect of the tumour and glandular swelling. *See Trans. Med. and Phys. Soc. of Bombay, New Series, Vol. VII., 1861.*

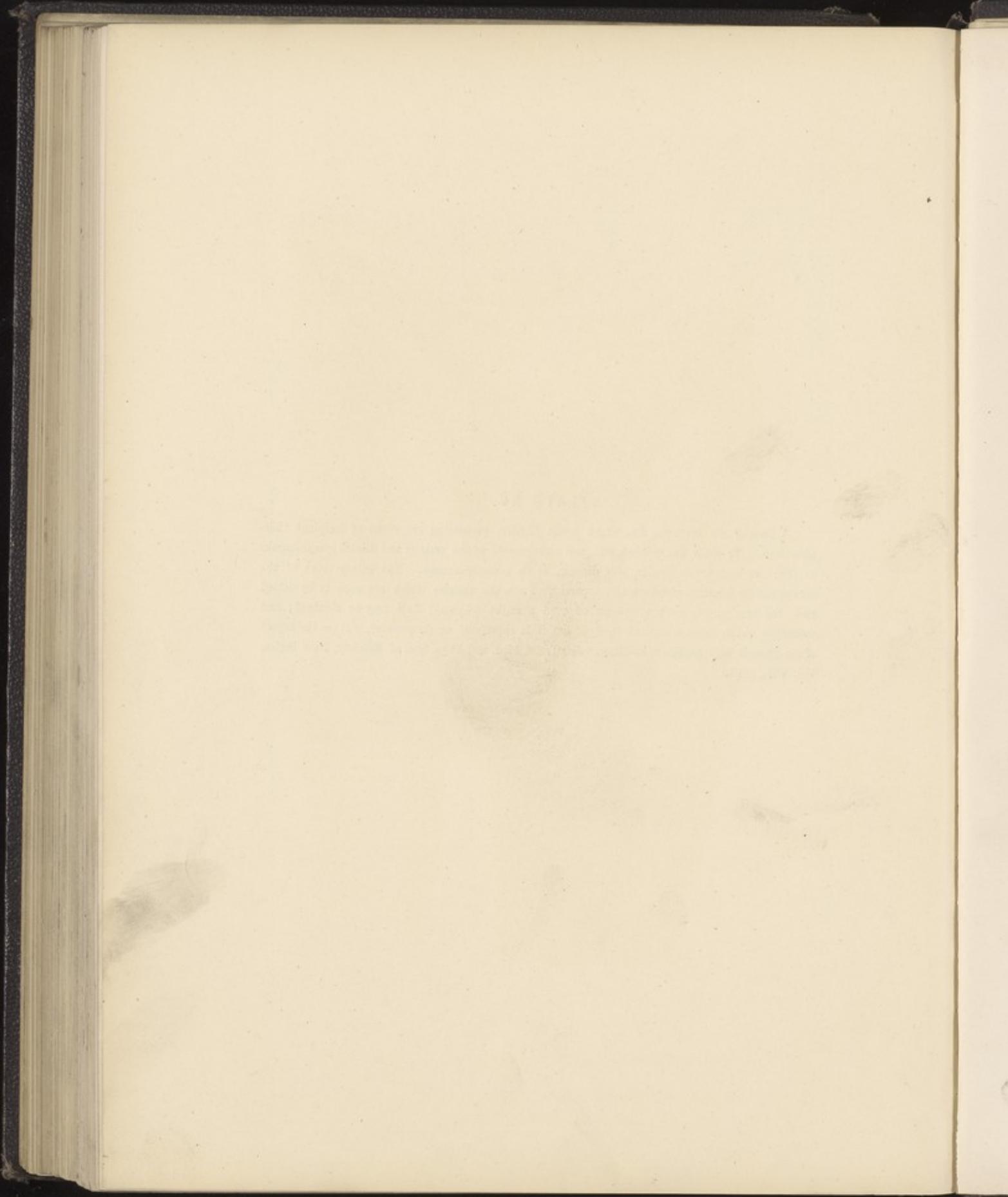
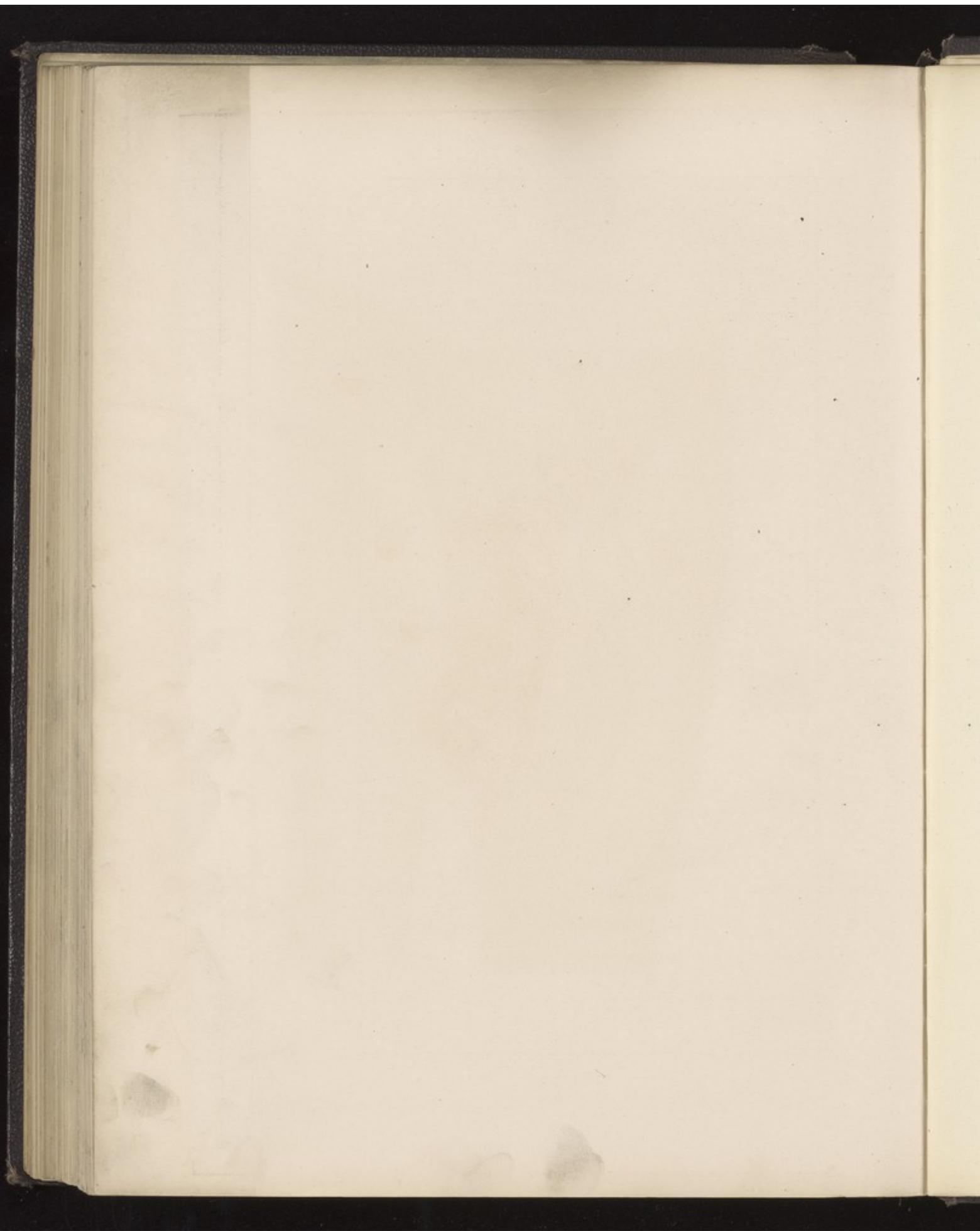


Plate XV.

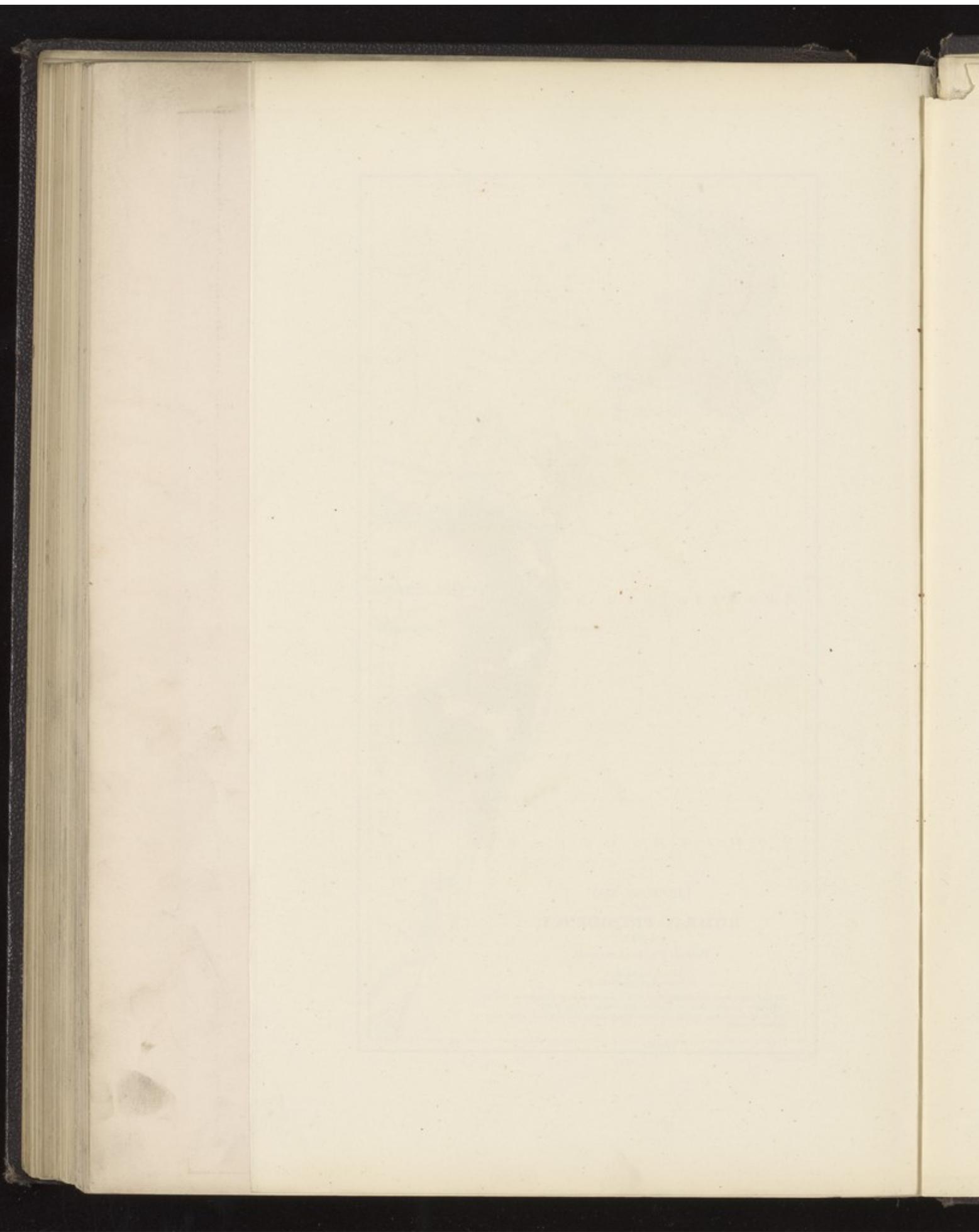


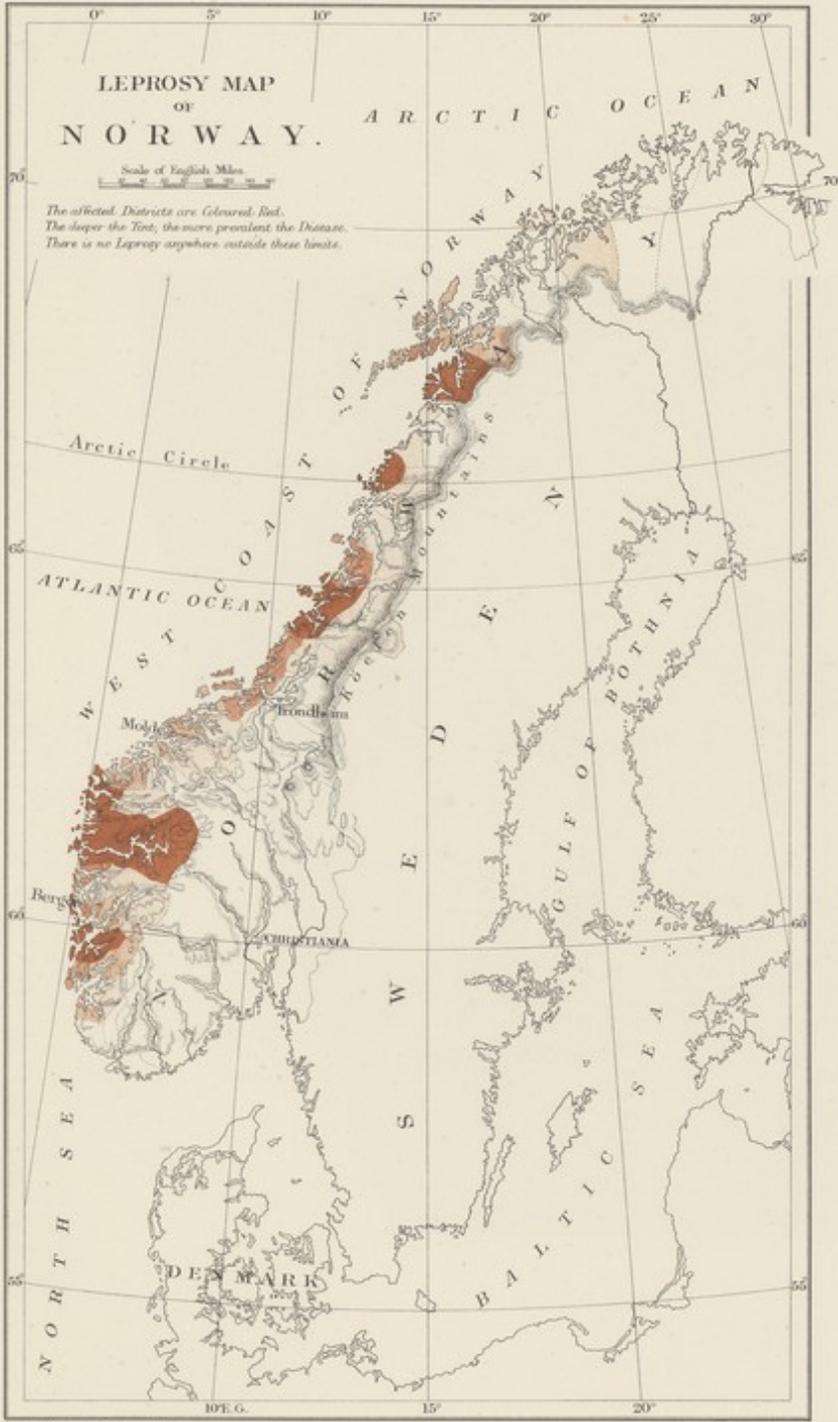
*Elephantiasis (Mabum) of the Scrotum; early stage.*

*J. V. Carter M.D., ad miss del Bombay April 1862*

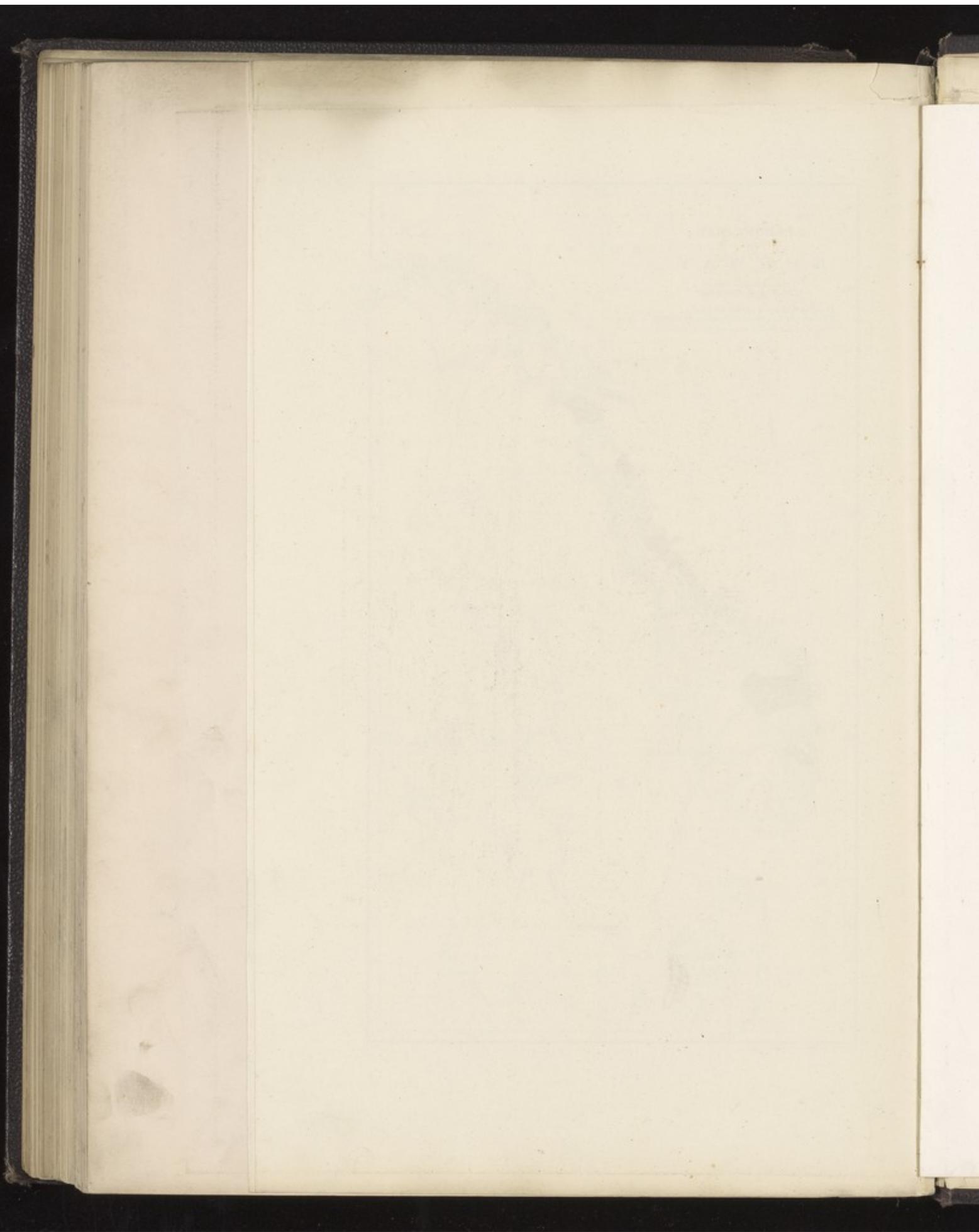








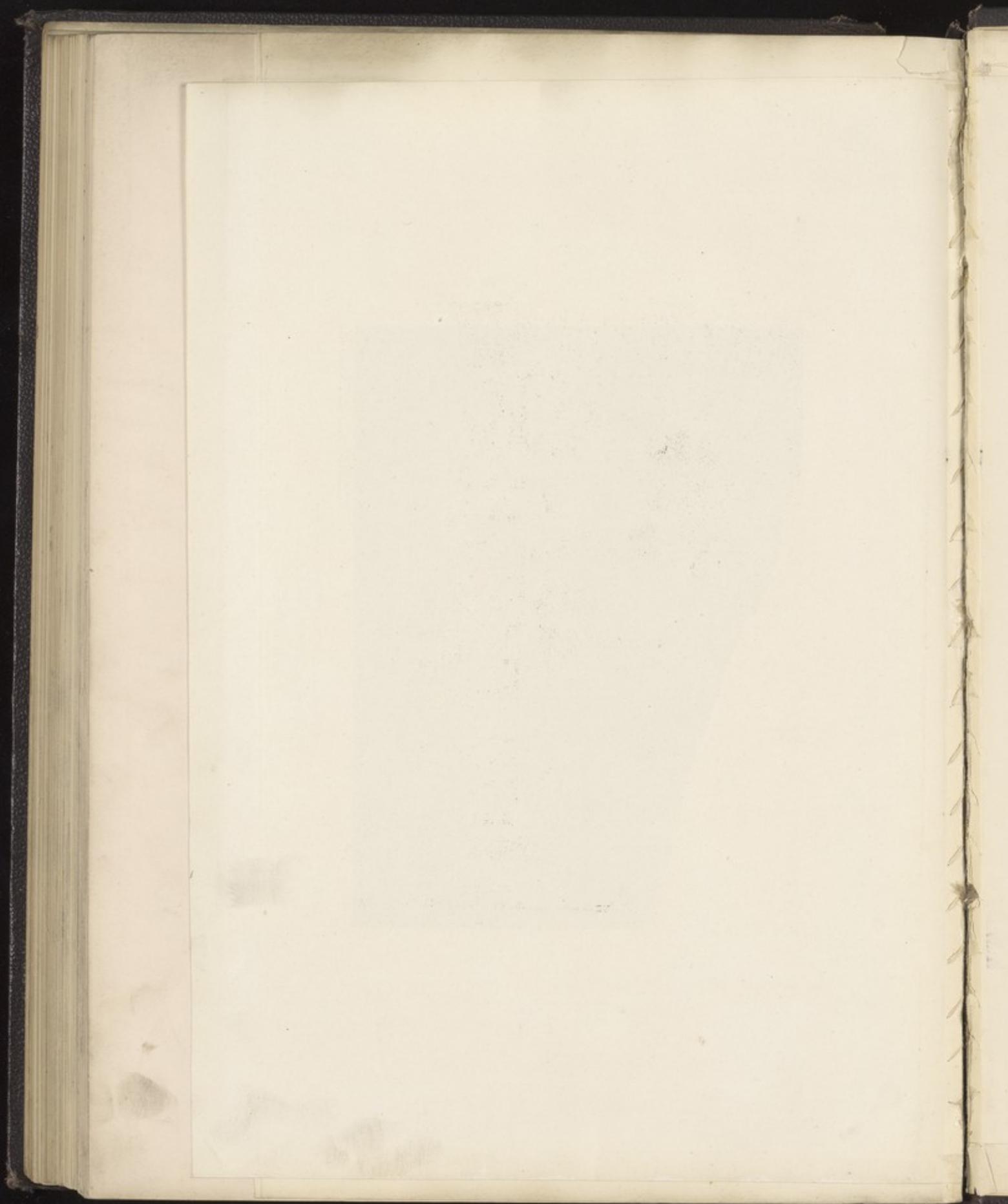
1870 Census. See. Adapted from Dr. Schickel.





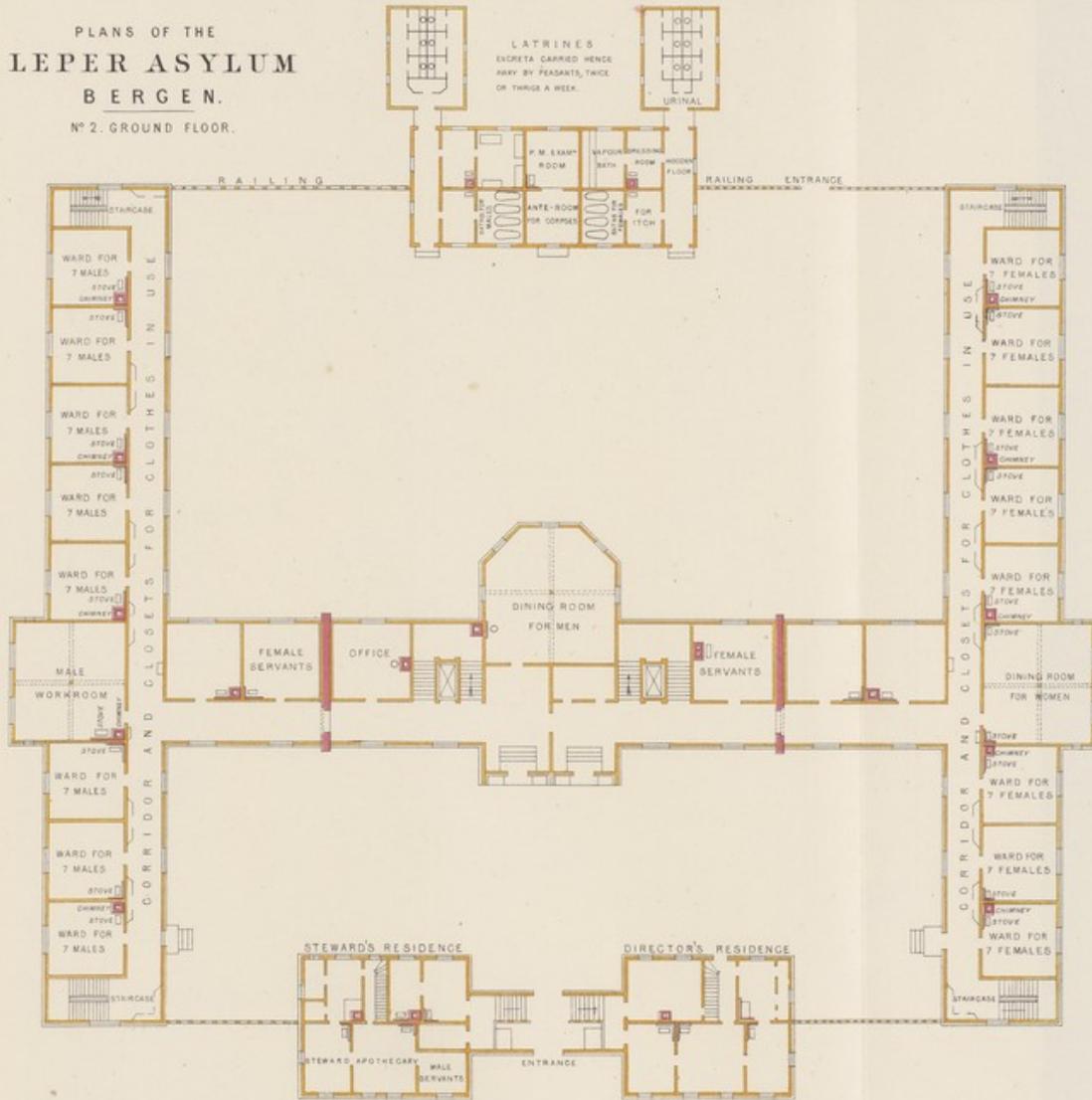
Photographed in Carbon from an original View.

NORWEGIAN LEPPER-ASYLUMS.  
PLEISTITRESEN, No. 1. SOUTHERN ASPECT.  
BERGEN.



# PLANS OF THE LEPER ASYLUM BERGEN.

N° 2. GROUND FLOOR.

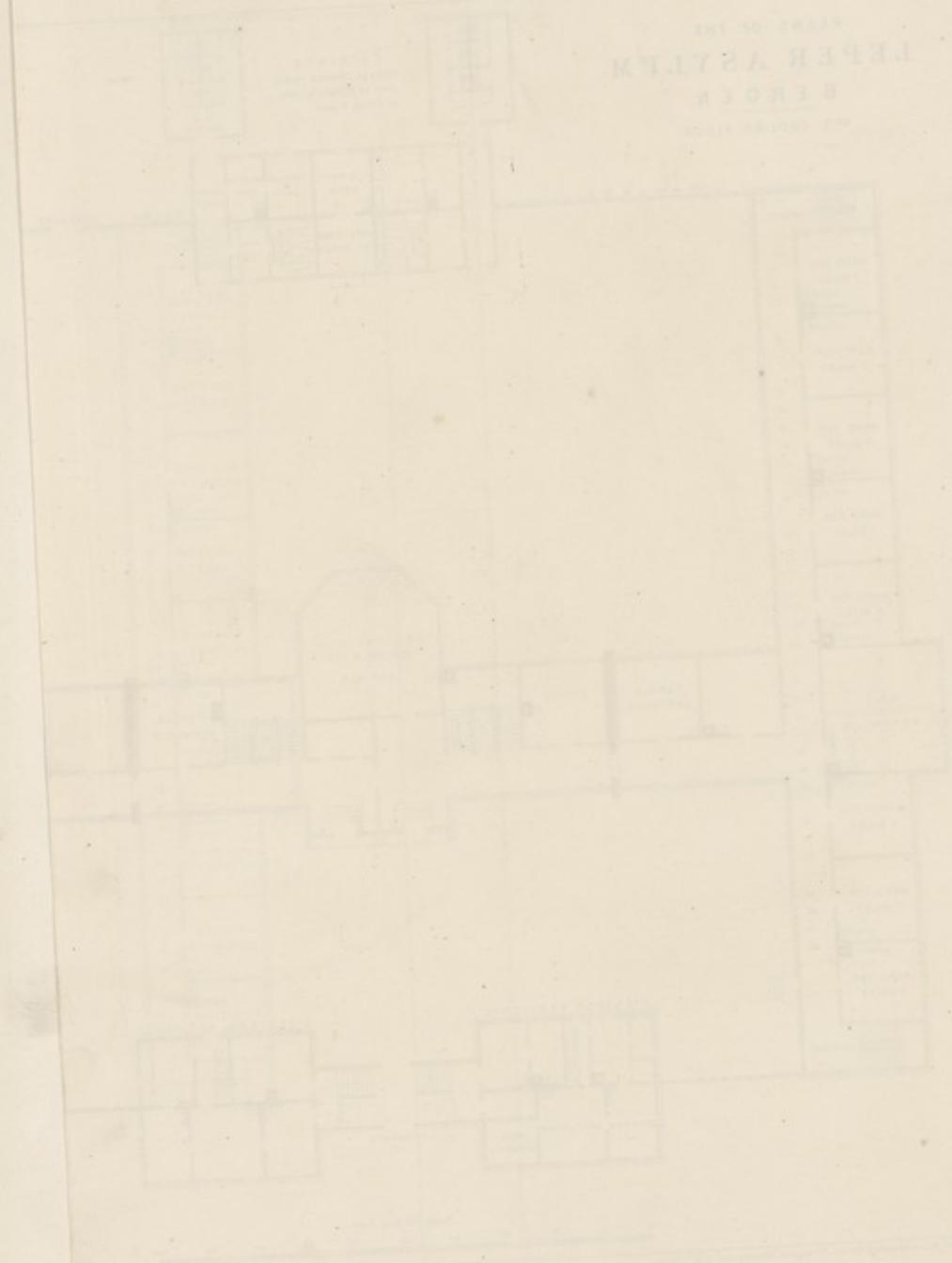


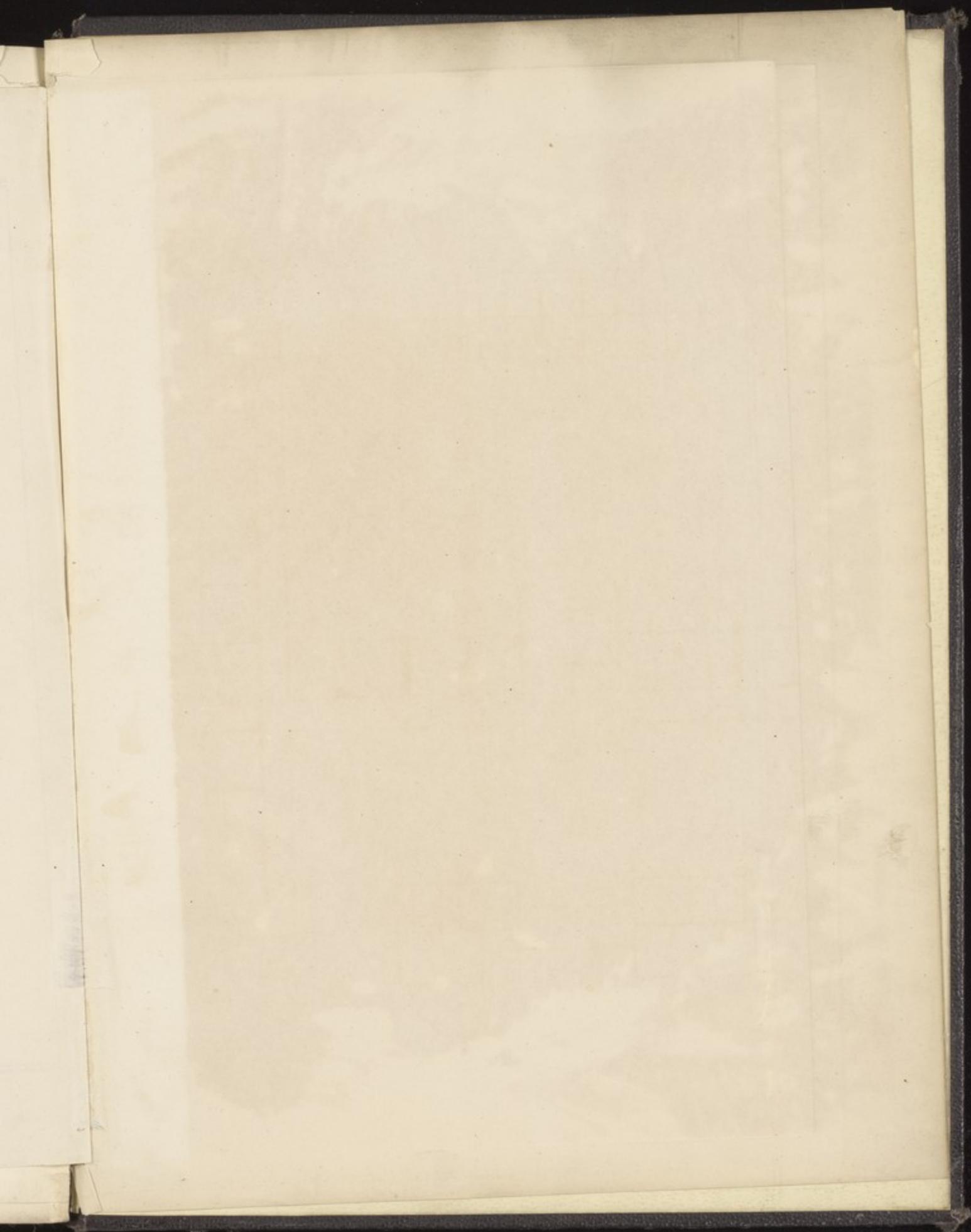
Scale of Eng Feet

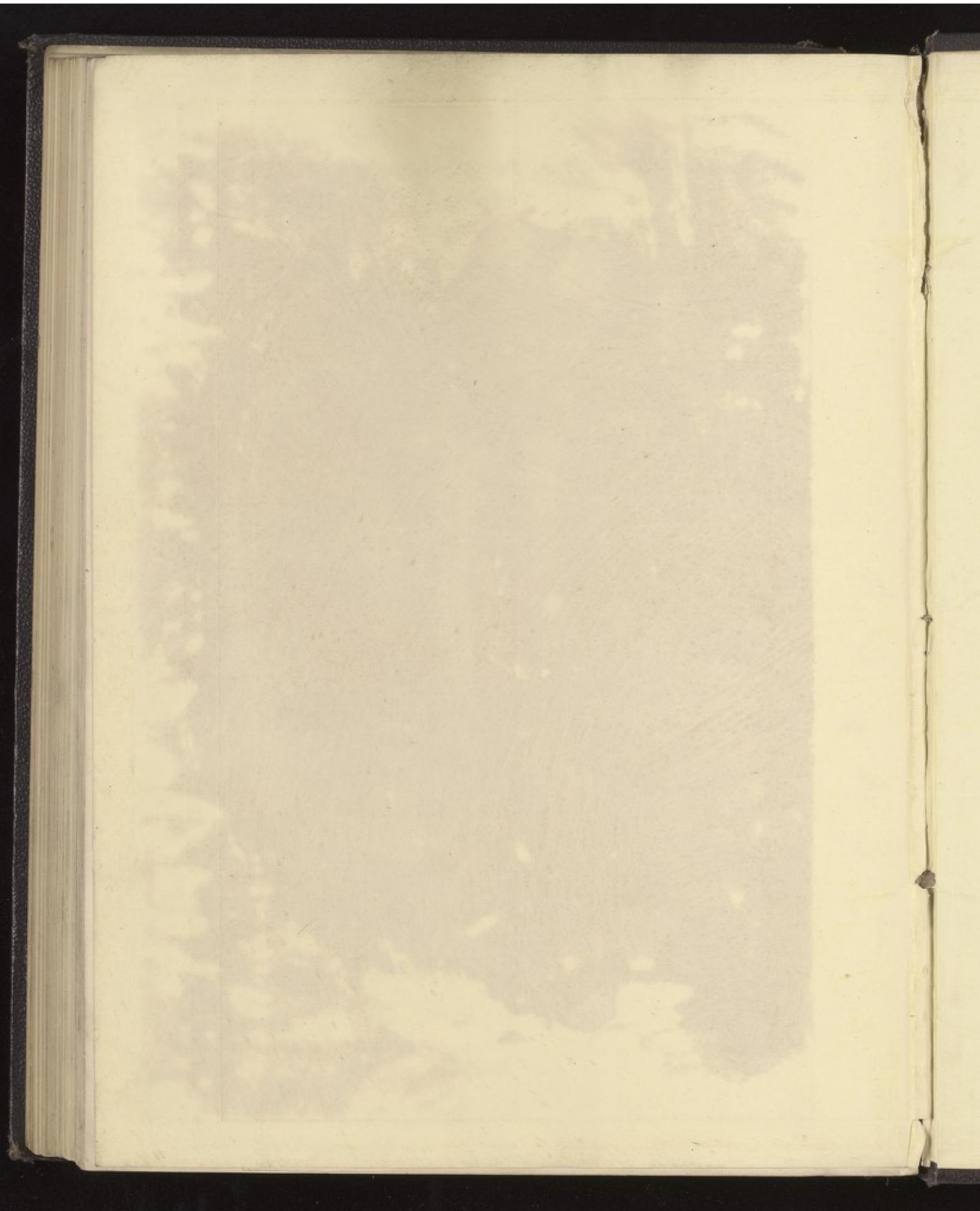


Photographed from original plans supplied by the Norwegian Government to H. Carter

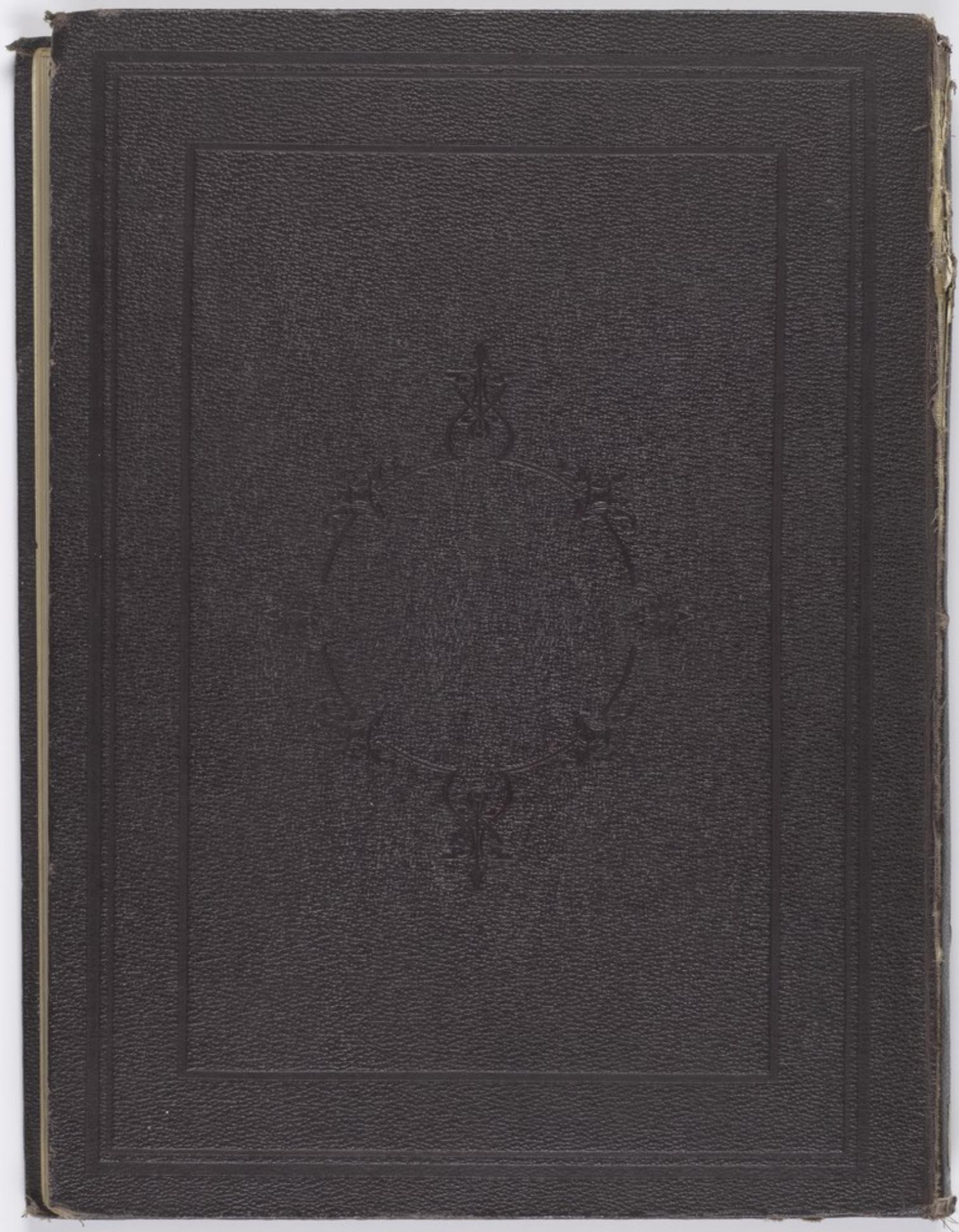
PLANS OF THE  
LEPER ASYLUM  
SINGAPORE  
NO. 10000











LEPROSY

AND

ELEPHANTIASIS

H. VANDYKE

CARTER