WHITE (J.C.) With the author's compliments, ack

Extracted from the American Journal of the Medical Sciences for October, 1882.

THE QUESTION OF CONTAGION IN LEPROSY.

BY

JAMES C. WHITE, M. D.,

PROFESSOR OF DERMATOLOGY IN HARVARD UNIVERSITY.

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THE QUESTION OF CONTAGION IN LEPROSY.[1]

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Probably no disease has so excited the fears of mankind and the attention of physicians throughout all historic time as leprosy, for no other has produced such hideous deformity of the individual or protracted a termination so uniformly fatal through such prolonged periods of moral suffering; none has spread itself more widely at different epochs among all nations, or has left so marked an impression upon the record of their social and religious laws. Our knowledge of its etiology may with advantage, perhaps, be stated in the beginning, as follows:—

The origin of the disease is unknown, it is too remote for investigation.

There has been no apparent change in its type since the earliest intelligible records, either in relation to chronological or geographical distribution.

It has ravaged countries where it is now wholly absent, although it still survives about the outskirts of some of them.

It is endemic at present over large parts of the earth's surface, and prevails under the most diverse conditions of climate, soil, altitude, temperature, ethnic stock and customs.

Such diversity is a satisfactory demonstration that these extraneous conditions may possibly affect the predisposition to or course of the disease in individual or nation, that their etiological relations cannot be causative.

It is most prevalent among peoples not on the highest planes of hygiene or morals.

It occurs notably in families through several generations, it is claimed, although it fails in great proportion to affect the immediate descendants of lepers. It also affects great numbers of persons residing permanently or temporarily in leprous regions whose ancestry is free from the disease.

It occurs occasionally in sporadic form, that is, in persons who have never visited infected regions.

[1] Read at the meeting of the American Dermatological Association at Newport, August 30, 1882.

The period of incubation is without definitely known limits. It rarely appears in children below the age of five. The shortest time of development after residence in an infected region is one year. It has appeared as late as fourteen years after such residence or recognized contact with lepers.

The question in etiology which I propose to discuss has been satisfactorily settled apparently more than once, although in contradictory ways, and so conclusively in modern times in the general opinion of the medical profession that until within a year or two any attempt to re-open it would have appeared almost ridiculous. Some peculiar events in its history of late occurrence, however, would seem to make this not only a legitimate agitation at present, but imperative in the interests of science and national economy.

In the earliest medical records, as well as in biblical accounts of the disease, although it may have been confounded with other affections, it was considered contagious, and the leper was declared unclean. In mediæval centuries he was segregated, regarded as a moral monster, forbidden to marry, or to pass through public ways without a bell or in open daylight. When in later times by the practice of seclusion, then universally enforced, the disease had nearly died out in Europe, driven into the outskirts of the continent where it has since lingered, men outgrew their dread of it, and physicians their knowledge of it, and grew ready to accept any positive doctrine concerning its etiology put forth by individual observers or scientific bodies. Thus it has happened that in the present century, chiefly through the conclusions of Boeck and Danielsson, founded upon their study of the disease in Norway, and through the reports of physicians from many parts of the world, chiefly of a negative character, collected by Virchow and the English College of Physicians, the opinion has been almost universally adopted by the medical profession that leprosy is not contagious, and that it is endemic mostly because it is hereditary. This has become the unquestioned doctrine in the great centres of civilization where books of medicine are made and students of medicine are taught, although popular belief in contagion has persisted to a greater or less extent in the vast peripheric regions of the globe where the disease still prevails. There have not been wanting, however, observers in the midst of the disease who deny the universality of the facts upon which the dogma of heredity has been based, and who claim that those which point to its contagious character have been neglected or misinterpreted. The many other causes, of extraneous origin mostly, which have been assigned from time to time and in various regions, as peculiarities of climate, soil, diet, social customs, etc., need not be considered; they are so diverse and contradictory as to disprove all claim to such relationship.

It is evident, however, that the proper field for the study of this question of heredity is not that in which its chief advocates have laboured to

establish it, restricted geographical regions, namely, where the disease has prevailed for centuries among certain classes, and in small districts where affected families have intermarried for many generations. It is manifest that although the disease continues to appear in the descendants of such families this proves nothing *a priori*, for the same continuance among relations may be used, as well, as the best evidence of its communicability by contagion. The theory of heredity will not hold good in any instance without the absolute demonstration that inoculation has been impossible. The theories of heredity and contagion are not incompatible, however, they support each other. We have an illustration of such an etiological relationship in syphilis. The important point to be determined is the proof of the latter, not the disproval of the former. Fortunately for the solution of this question we have in the recent introduction of leprosy into an insular nation, and in several freshly developed foci of the disease upon our own continent, that virgin field for observation so essential for the proper study of this subject.

Hawaiian Islands.—It is impossible to fix the exact date of its first appearance in the Hawaiian Islands. Isolated cases may, as has been claimed, have occurred as far back as 1830, but it attained no noticeable development until towards the year 1860, when its increase became so rapid and universal, that government took stringent measures to control it. Nor has the mode of its introduction been positively determined. The islands have been the resort for many years of whaling ships manned by sailors coming from leprous regions. The natives have shipped as seamen, and after visiting such infected ports have returned home. The absence of any restraint in the intercourse of native women and strangers is well known. That under such favourable conditions syphilis has run an exceptionally endemic course in these islands has never been considered strange. Whether Chinese immigration has played an important role in the introduction of leprosy there, as has been sometimes stated, is doubtful; at all events there have been very few cases of the disease discovered among them. In 1866 the government opened the so-called "leper segregation" upon Molokai, an island from which there is no escape, since which time some two thousand cases have been received there, and the number at the asylum at present varies from seven to eight hundred. This, however, is not believed to represent the real amount of the disease prevalent in the islands, for many cases are concealed, and some, especially the white residents, emigrate when affected before the disease is discovered. It affects, however, almost exclusively the natives and half-breeds, there being in the asylum three years ago, in addition to these, but one American, one Englishman, and five or six Chinese. As the indigenous population by the last census was only 44,000 the proportion affected is very large. This unwonted rapidity of spread and general prevalence over the islands within the period of twenty-five years cannot possibly be

accounted for, it seems to me, on the ground of heredity. Allowing this all admissible action, transference from individual to individual by inoculation seems to be the only possible explanation of all the facts which have been recorded, and nearly all resident physicians believe that the disease is contagious in this sense. Dr. Hillebrand, who has been at Honolulu since 1851, reports several instances where it has spread in isolated villages from a single imported case. Dr. Enders, who reported in his paper read at the Dermatological Section of the International Medical Congress in Philadelphia at the time of the foundation of this society that he had had four hundred cases under his observation, states his belief that it is "often conveyed by 'direct contact' through sexual intercourse or inoculation by other means." He gives several instances where whole families and those intimately associated with them have become diseased. He had seen four cases among Europeans who had been living entirely with the natives and following their customs closely. He believes that where prostitution is most rife there the most cases arise. Dr. Bemiss of Maui, H. I. (*New Orleans Med. and Surg. Journ.*, April, 1880), reports several cases where neither parent had the disease, and gives details of a case, cited by the legislative committee of the islands, of an American, æt. 55, both of whose parents were healthy, who acted as assistant at the hospital on Lahaina for several years, and in whom the disease appeared after taking some lepers to live with him. Dr. Saxe, President of the California State Medical Society, in an account of his recent visit to Hawaii states that there is no doubt as to its inoculability, and that although not infectious "it is inoculable in every way by which disease can be inoculated." He relates the case of the son of a physician who acquired the disease after inserting a pin into his leg which a little native leper had just previously run into an anæsthetic patch on his own leg. As another instance of the disease appearing in persons resident upon the islands in which there could have been no possible hereditary influence may be noted the case reported by Dr. Regensberger, of San Francisco, in Vol. IV. of our *Transactions*, of a young English girl brought to California from there. Dr. Wood, U. S. N., states in his account of a visit to Molokai that the great majority of lepers point to some association with others as the source of their infection, saying "I married a leper woman;" "my nurse was a leper;" "I lived in the house with a brother-in-law who was a leper;" "I was a prostitute and cohabited with lepers;" "I lived five months in the house with a leper;" "I used to visit, and both eat and smoke with lepers."

Among the thousands of cases which have occurred it may be demanded that those who would account for the spread of the disease in this rapid manner on the theory of contagion should be able to present many and much more positive instances than those just cited in evidence. It may be objected that the cases of the son of the physician, and of the hospital

attendant are, even if satisfactorily established as examples of inoculation, hardly enough to warrant the wholesale conclusion that the entire native population has become affected in the same way. It cannot be denied, however, that if we admit this possibility in a single instance, as in that of the boy pricked with the pin just previously thrust into the leper's leg, we must admit also that with the customs and loose morality of this people there can be no reasonable objection to the acceptance of this explanation of the rapid course of the disease in Hawaii. Indeed any other hypothesis seems wholly inadequate and inconsistent with our knowledge of its ordinary course. Either the external conditions of nature must have been extraordinarily favourable to the development of the germs or essence of leprosy, awaiting only the chance arrival of the specific seed to transform this the slowest of all known affections into a rapidly spreading epidemic disease, or the race itself must have been exceptionally receptive, in some mysterious way, of its influence. There is not the slightest ground for either supposition. The islands were natural sanitaria; the people, before syphilization, as perfect a race of beings physically as has been produced. Heredity, as the only or an important factor, is entirely out of the question; it would have required several generations to have accomplished such results. We must look then to the customs of the race as exceptionally favourable to inoculation as the only possible explanation, such as the crowding together of large families in small huts, sharing the same mats and blankets, eating poi with the fingers from the same calabash, drinking of *ava* from the same vessel, passing the pipe from mouth to mouth, their licentious habits, the absence of all fear or disgust of the disease as a bar to ordinary association, cohabitation, or marriage.[1] The history of syphilis since its introduction into the islands illustrates very forcibly the comparative action of these respective elements in its spread, inoculability and heredity. No one would question the influence of the former in the almost universal spread of the disease among the native population, and yet there is probably not one case in a hundred in which it could be stated in what way and from what source did inoculation take place, provided the period of incubation were extended from months to years as in leprosy. That syphilitic parents may beget children free from the disease, and that syphilitic patients may live for years amidst their family and relatives and friends, and yet not inoculate them, is as strong proof of the non-contagiousness of syphilis as similar negative facts, so often cited with regard to leprosy, are acceptable evidence of the non-inoculability of the latter affection. The wide spread of syphilis, too, among the natives and consequent cachexia have no doubt contributed to establish a national lack of resistance to the ravages of the disease; nor can we overlook the proclivity of all endemic diseases to extraordinary

[1] See account by Dr. G. Wood, U. S. N., in vol. iv., Med. Reports of Navy Dept.

manifestations of virulence in insular nations not previously protected by a gradually inoculated ancestry.

New Brunswick.—Since 1815 leprosy has prevailed among the poor French settlements in a district twenty miles or more in extent, bordering upon the Miramichi River near the bay of Chaleur in the Gulf of St. Lawrence, representing a population of four thousand. Another account refers the introduction of the disease back to the year 1758, through a vessel arrived from the Levant. The first authentic case was that of a woman named Benoit, in the first-named year, whose mother came from St. Malo, in Normandy, and of whose antecedents nothing is known. No measures were taken to control the disease at first, and it gradually spread from family to family, mostly in the descendants of the latter woman whose name was Bredeau. In 1844 the first hospital was built, and during the next five years thirty-two patients were admitted to it. In 1849 the present lazaretto was established at Tracadie, since when it has received more than one hundred patients, making the total number of cases treated in the two institutions nearly one hundred and fifty. Dr. A. C. Smith, of Newcastle, who has been appointed by the Canadian Government to make an annual report upon the condition of the lazaretto, writes to me under date of May 23d, this year, that it contains at present twenty-four inmates, and that he can learn of but four suspected cases outside of its walls. Seven new cases have been admitted during the past year. The most stringent means were at first taken to compel diseased persons to enter the hospital, and they were held as prisoners by an inclosure twenty feet high. There have been, however, many desertions, and in 1875 fifteen lepers were reported as living in neighbouring districts. Since 1868 the institution has been under the charge of the Sisters of Hôtel Dieu, of Montreal, and no police measures are observed to compel residence. According to Dr. Smith lepers are shunned by their relations, and are glad to go to the lazaretto. They do not try to escape, although the doors are open day and night. Affected persons may settle in any part of the province, but they rarely do so, and the disease seems to be confined mainly to a district within seven miles of Tracadie. Lepers are permitted to intermarry freely.

The disease was at first considered to be contagious by some of the physicians who observed it. In 1848 a medical commission was appointed by the government of New Brunswick, consisting of Drs. Bayard and Wilson, who reported that it was not contagious, but that it might be communicated by inoculation in particular cases, although they had met with no such instance. From the replies made by resident physicians to the leprosy committee of the English College of Physicians, it appears that only one believed that it was contagious, and he stated that individuals of different races living in the same house with lepers had become infected. In a report made to the House of Assembly thirty years ago, testimony was presented tending to show that the disease at the start was communicated by

inoculation. Dr. Smith states in his letter on the subject published in the second volume of our *Transactions*:—

"Apparently well-authenticated cases of contagion do exist. The third case that appeared in Tracadie was that of Francis Sonier, who helped to carry a Benoit woman's coffin in summer time. Matter oozed out of the bottom of the coffin through Somer's coat sleeve to his body. Within a year afterwards he was attacked by the disease." Another person attacked was Stewart, a Scotchman, who "had been in Tracadie in the company of two individuals on whose persons the disease was beginning to make its appearance. Two nephews of Stewart, by the name of Tingley, lived with Stewart, and afterwards died, lepers, in the lazaretto. A man by the name of McCombe, who lived one or two winters in Tracadie, lumbering, died of leprosy."

If these cases cited by Dr. Smith, viz., the Stewarts, Tingleys, and McCombe, be accepted as authentic, it establishes the fact that persons living in Tracadie and vicinity, not of French descent, and with no known inherited tendencies to the disease, are far more liable to leprosy than those living in other parts of that province. Such cases can hardly be accounted for by calling them sporadic; there can be no question that contagion, if a possible, is the most reasonable solution of such occurrence. A single case like Stewart's furnishes far more conclusive evidence of contagion than the confinement of the disease to descendants of the Benoit woman in several generations offers of heredity, unless it is also shown that there has been no opportunity of transference by contact from leper to leper through all these years. In order to get some light upon this question, as our only information concerning the disease is based upon reports of patients after admission to the lazaretto, I addressed a letter to Dr. Smith, asking him if the cases received there during the past year came from the households of those previously admitted, and if the seven cases last admitted did not inoculate before leaving their homes other seven cases to be received before long. Dr. Smith was kind enough to send my letter to the intelligent chaplain of the lazaretto, Father J. A. Babineau, who replies as follows: "The seven cases in question have sprung up within a district fifty miles in length. . . . As soon as a case of leprosy is known to exist outside, steps are taken to prevail on the party to enter the lazaretto, which they generally do without much delay. There have been few exceptions, but invariably, I think, the first case was followed by one or two more. A natural aversion to hospital life has made some remain longer at home than they should. Patients are not allowed to visit their homes except in very extraordinary cases. To my knowledge only two, I think, in eleven years have obtained that permission. People outside have access to the hospital grounds, but *never* enter within the walls of the lazaretto except when visiting the establishment. The people generally are under the impression (true or false) that the disease is infectious, and avoid all familiarity and contact." It will thus be seen that lepers are practically treated by the government as though the disease were infectious after they have become inmates of the lazaretto,

while no efficient means are taken to eradicate the disease by prevention of transference in family life by the early isolation of all cases. It is evident that under the present system the disease will not cease to exist, but that it will continue in a state of repressed activity, whether this be accounted for on the ground of heredity or inoculation. The weight of negative evidence is as strong against the former as the latter. In Dr. Bayard's report of the twenty-two cases in the lazaretto in 1848 eleven were married and had children:—

Case	1. Peter Savoy,	7	children,	none	diseased.
"	3. Israel Robicheau,	2	"	"	"
"	6. Margaret Sonier,	5	"	"	"
"	7. Julian Ferguson,	7	"	"	"
"	8. Mary Savoy,	5	"	"	"
"	13. Lewis Gould,	?	"	"	"
"	14. Fidele Brideau,	11	"	"	"
"	15. Fabian Gobreau,	7	"	"	"
"	16. Athenasius Sonier	2	"	"	"
"	19. Lawrence Comeau	13	"	"	"
"	22. Margaret Robicheau,	4	"	"	"

It will be noticed that of the sixty-three children not one is reported as diseased. This certainly shows that there was no strongly transmitted tendency to the affection, for a large proportion of them must have attained the age at which it is prone to develop. But are these facts as conclusive evidence of its non-inoculability? Not if there is a popular belief in its infectiousness which would insure precautions against contact, as the letter of Chaplain Babineau states.

Cape Breton.—It will be remembered that at the last meeting of the Association Dr. Duhring stated that he had received a communication from Mr. Fletcher a medical student, relating to the occurrence of cases of leprosy upon the island of Cape Breton. The results of the observations made by him have since been published by Dr. A. McPhedran, of Toronto, in the September (1881) number of the *Canadian Journal of Medical Sciences*. Mr. Fletcher, who unfortunately was drowned last autumn, is spoken of by our associate Dr. Graham, as a trustworthy student of more than ordinary ability. The history of the affection, as given by him after a most laborious investigation in this wild region, is as follows:—

1. Betsy McCarthy, of Prince Edward Island, a native of Lincolnshire, England, married in 1836. In 1852 became affected and died after twelve years (1864) of what a Tracadie priest called leprosy. She had children:

2. Richard died of same disease after 20 years' sickness.

3. John died of same disease after 12 years' sickness. He married the sister of James Cameron.

4. Mike died of same disease after 10 years' sickness. James Cameron used to sleep with him.

5. William died of the same disease at the age of twenty-one. He was washed and laid out by Joseph Brown.

6. Mary died of same disease after 20 years' sickness. She married John Doyle.

7. John Doyle died of same disease after 6 years' sickness.
8. Daughter of John Doyle and Mary, died of same disease.
9. Daughter of John Doyle and Mary, died of same disease.
10. Joseph Brown attended William McCarthy during his illness, and washed and laid him out after death; was shortly afterwards attacked by same disease and died.
11. James Cameron, of Inverness County, was born in Cape Breton of Scotch descent. Married in 1866 Susanna McCarthy, daughter of Betsy, who with two children is healthy. He used to sleep with Mike McCarthy. His disease began in 1870, and is now well advanced.

It will be seen by this genealogical chart, very carefully traced by Mr. Fletcher under great difficulties, that the disease has been largely confined, as in the Tracadie cases, to the descendants of one woman. The proximity of Prince Edward's Island, her birthplace, to the leper settlements upon the opposite mainland is very suggestive of the possible source of origin of the disease in her case. These descendants, near relatives in a thinly populated district, of course offered the most liberal chances for the transference of contagion by contact, but it will be observed that three persons having no blood relationship, but all living in contact with the McCarthy family, John Doyle, Joseph Brown, and James Cameron, also became diseased. If these cases were acquired, and it would be difficult to explain them upon any other theory, why is it not much more likely that the McCarthy children also became infected by contagion, as the chances of inoculation must have been greater? Whilst James Cameron, the sole known representative of the disease now upon the island, lives in his condition of advanced tuberculous leprosy, it remains a probability that it will not become extinct with him, but that either his wife or children will continue it for future observation.

Northwestern States.—Leprosy has been known to exist for a considerable time among the Norwegian immigrants who have settled in the States of Minnesota, Wisconsin, Iowa, and Nebraska in large numbers. One hundred thousand Scandinavians are in Minnesota alone, and it is estimated that there are one million in the United States. Dr. Holmboe in 1863, and Prof. Boeck later made visits to these colonies while in this country, and published reports concerning them after their return to Norway. The former found quite a number of cases at that time among the Norwegians, most of which were leprous before emigration. In a few of them the first outbreak of the disease occurred after their arrival here. In no instance had it developed in a person born in America. The disease seemed to him to run a milder and longer course here than in their former home. Prof. Boeck found only eighteen cases of the disease among his people. In nine of them the disease was more or less advanced before leaving home; in the other half it developed after a longer or shorter residence here, in three of them as late as nine and a half, ten, and fourteen years respectively. It is not stated whether the latter half

were living in intimate relationship with the imported cases or not. He, too, found no case in which the disease had appeared in children born in America. It seemed to progress, however, in those affected uninfluenced to any marked degree by their change of residence. Within the last few years reports of several new cases in addition to the above have been collected by the efforts of Dr. Hyde from the Norwegian physicians practising among their countrymen in the northwestern States, which have been communicated to this Association at its annual meetings. One of them reported by Dr. Grönvold, of Norway, Minnesota, came to this country in 1869 when twenty years old. The disease first appeared in 1873; none of his relatives had been leprous. He thinks that he was infected while acting as a servant at the house of a leper during the year before his coming to America. Dr. Hyde gives, in his report of a case of a Swede from a leprous family, the interesting information of the probable occurrence of the disease in one of his children born since the arrival of the parents here in 1868. This is the first record of a case born of Scandinavian parentage in this country, and is of especial importance as a child of a leper of the tubercular form in open ulceration. In reply to inquiry concerning the customs of Norwegian immigrants here, Dr. Bendeke, of Minneapolis, has been kind enough to write to me: "Immigrants and the peasantry in the leprous districts of Norway do not believe the disease to be contagious, nor do they shun the disease. I never observed a case in this country where it was transmitted by inoculation. . . . . It occurs in much less proportion here amongst the emigrants than in Norway, and I ascribe this only to the better hygienic situation of the people as to food, clothing, exposure, etc. My friend Dr. Hansen, of Bergen, late surgeon to the hospital for the leprous there, has published cases where inoculation has taken place; before that time the disease has been considered non-contagious." We have yet much to learn concerning the disease in this portion of our population.

South Carolina.—In 1876 I learned through our former associate, Dr. W. H. Geddings, of Aiken, S. C., that cases of leprosy had been observed by his brother, Dr. J. F. M. Geddings, in Charleston, and brief notes of this occurrence were published in the *Transactions of the International Medical Congress* which was held in Philadelphia in that year. The latter gentleman has kindly sent me a tabulated statement of these cases, as follows:—

Tabulated Statement of Cases of Elephantiasis Græcorum observed in Charleston, S. C., from 1847–82.

Name.	Race.	Nativity.	Sex.	Result.
1. Nathans	White	Native Jew	Male	Died.
2. Cohen, M.	"	" "	Female	"
3. Cohen, D.	"	" "	"	"
4. Lopez	"	" "	Male	"
5. Lazarus	Mulatto	"	"	"
6. Dereef	"	" ?	"	"
7. McGuire	"	" ?	"	"
8. No name	Black	Unknown	"	Unknown.
9. Harral	White	Native American	"	Died.
10. Walker, F.	"	" "	"	"
11. Walker, S.	"	" "	"	Unknown.
12. Moran	"	Irish parents	"	Died.
13. Pritchard	Mulatto	Native	Female	"
14. Moultrie	White	"	Male	"
15. Gaillard	"	"	"	"
16. Jeffords	"	"	"	"

Of these, 11 were whites, 4 mulattoes, and 1 black; 4 were Jews, 1 Irish, 11 natives, 2 mulattoes of possibly Jewish extraction, 1 mulatto of Irish extraction. In answer to my inquiry he states: "I can form no opinion as to when the disease first made its appearance in South Carolina. The case marked 1 was the first which came under my notice about 1846–7. The first cases could not be in any way connected with the old cases of the past century in the Gulf States. Both of the first cases were Jews from families coming to this country early in this century. Nor could any of the cases have had any connection with the recently imported occurrence in Louisiana, or from African descent through slaves." With regard to the origin of these Jews he says: "Of the three Jewish families the descent can be very clearly traced: Nathans, mother and father German; Cohens (mother and daughter), father Polish, mother English; Lopez, father Portuguese, mother English. In reply to your second question" (whether the persons affected had lived in intimate association with one another?) "I fear that an answer is impossible. The mulatto named Lazarus is said to be the son of a Jew; the others are of uncertain descent. With the exception of this case there was no special association." No new cases have been observed since Dr. Geddings's first report in 1876.

This isolated focus of disease springing up in a community where leprosy had not previously prevailed, and affecting within a few years persons of different nationalities, cannot, of course, be explained upon the theory of heredity, and the cases were too many (sixteen) to be accounted for by the application of that most unsatisfactory term *sporadic*. The most reasonable basis for the explanation of such an occurrence is that of the importation of the disease either through the person of some one of

those attacked in a state of incubation possibly, or of undeveloped hereditary inception, or through some transient leprous visitor to Charleston, and the infection of the others from such source of contagion. Such an explanation is perfectly consistent with our knowledge of the laws of those affections of a contagious nature most nearly resembling leprosy, and any other seems impossible. There is nothing known of the circumstances of this limited endemic inconsistent with such a supposition, and the cases occurred at a time when the possibility of contagion was not entertained by those in charge of them, so that any facts pointing to such a conclusion would naturally pass unnoticed. We must expect the data for the full establisnment of the truth of this theory to be collected hereafter, when the attention of observers shall have been sufficiently and impartially directed to it.

Louisiana.—It is not known at what period leprosy was introduced into the French and Spanish colonies in the Gulf States, although it is recorded as existing in the West Indies in the latter part of the seventeenth century. Accounts are given of its occurrence in Florida more than a century ago, and it prevailed in Louisiana at that time so extensively that a special hospital was founded for it in 1785. Professor Jones, of New Orleans, in an article on the occurrence of leprosy in the Southern States (*N. O. Med. and Surg. Journal*, March, 1878), quotes from Gayarré's *History of Louisiana* the account there given of the disease at that time. The historian says:—

"It is remarkable that leprosy, which is now so rare a disease, was then not an uncommon affection in Louisiana. Those who were attacked with this loathsome infirmity generally congregated about New Orleans, where they obtained more abundant alms than in any other part of the colony. They naturally were objects of disgust and fear, and the unrestrained intercourse which they were permitted to have with the rest of the population was calculated to propagate the distemper. Ulloa had attempted to stop this evil by confining some of the lepers at the Balize, but this measure had created great discontent, and had been abandoned. . . . The council caused a hospital to be erected for the reception of these unfortunate beings in the rear of the city. The ground they occupied was long known under the appellation of La terre des Lépreux. In the course of a few years the number of these patients gradually diminished, either by death or transportation, the disease disappeared almost entirely, and the hospital went into decay."

No account exists of the occurrence of the disease during the present century until the year 1866, when it appeared in Vermilion parish, in a woman whose father came from southern France. Her husband, recognizing the disease, being also a native of France, separated himself from her, fearing contagion. She died in 1870, leaving children:—

Sons	1.	Leprosy appeared in 1872.
	2.	" " " 1871.
	3.	
	4.	" " " 1872.
Daughters	1.	Died of acute disease.
	2.	Reported to have leprosy.

These children all lived in Abbeville where their mother resided. In 1875 the disease appeared also in a nephew living eight miles from this place. It has also affected a young woman, who is not a relative of this family, but who constantly nursed Madam Ourblanc, the original case, during her last illness. The disease developed in her in 1873. It has appeared, too, in a young man living a few miles from Abbeville, in no way related to any of the above, but who frequently slept with the fourth Ourblanc son during the year 1875, while the latter was peddling through the parish. In 1877 the case was sufficiently advanced to be recognized as leprosy. Dr. Jones states that other cases are reported to be (1878) in the parish.

The history of these cases, which could have had no connection with those of the past century, is very interesting. The origin of the disease in the first case is obscure. It seems improbable that this woman should have borne through a long life the inherited germs or elements of the affection from some remote ancestry in France, to assume in 1873 for the first time such activity; yet such is consistent with the commonly accepted laws of heredity as applied to this disease. But however inexplicable it may be, with our limited acquaintance with all the circumstances of Mad. Ourblanc's life, the original case, those which follow can certainly not be explained upon such a theory of transmission. They developed all too rapidly, and well nigh simultaneously after it, to make any such supposition at all plausible. How much more reasonable to regard these five cases, the three sons, one daughter, and the nephew, living in a small town, and of course in frequent communication, more or less intimate, with the original case, which was one of extensive ulceration, as the result of infection. In the case of the nurse in constant attendance upon her in her last illness, and in that of C., the frequent bed-companion of the youngest son diseased, no other explanation is possible. It seems to me that they establish the fact of the contagious nature of the disease beyond dispute. Since the development of this outbreak in Vermilion parish the disease has appeared in several other districts in the State, particularly in that of Plaquesmines, and in the city of New Orleans. It would be interesting to learn into what parishes the affected sons of Madam Ourblanc had extended their travels.

California.—It is not surprising that with a population of 20,000 Chinese in this State not a few cases of leprosy should have appeared among them. An excellent account of it, as observed in the hospital for lepers in San Francisco by Dr. J. W. Foy, was contributed by him to the last number of our *Transactions*, by which it appears that fifty-two cases had been admitted up to that date, during the preceding ten years. These, with a single exception, were Mongolians. This number represents no doubt the majority of the cases in the State, so that as all the lepers are shipped back to China there can be no great number present in California. After

the last shipment, however, fourteen new cases were admitted to the hospital within the following year. The cases must leave home in the incubative stage, for it is not to the advantage of the shipping companies to send over diseased workmen. The Chinese believe that the disease is contagious, and will not work in the same room with a leper. Thus far no case has been reported of a native citizen of California acquiring the disease. To what extent the Chinese may have communicated it to each other while here, there are no means of ascertaining; but, from their peculiar customs of herding together, favourable opportunities of such transference cannot be wanting.

Oregon.—In this State the disease has likewise appeared among the Chinese, but the recent laws adopted by the National Government will, for the present at least, check its fresh importation upon the Pacific Coast, although cases will no doubt continue to develop and be discovered among Mongolians already resident.

But how shall we explain the occurrence of the cases which have been reported by competent observers, from time to time, outside these modern centres or foci of disease, the so-called sporadic instances? Is it possible that a disease so typically endemic in its geographical distribution and historic course is capable of originating, *de novo*, in regions where it has not prevailed for a century or never existed before? Can there occur now and then and anywhere such an exceptional combination of favourable conditions independently of the influences of heredity or contagion, that the spontaneous evolution of the disease necessarily follows? How is it possible for the strict upholders of the theory to exclude the former even on this virgin soil of America in dealing with such cases considering the mixed ancestry of our population, for as they trace back such etiological influences to grandparents and great-grandparents at times, how can they limit its activity to two and three generations, why not grant it to the tenth even? And then how can it be positively determined that cases to which the title sporadic seems legitimately applicable, *i. e.*, those recorded by competent observers, so that the diagnosis is unimpeachable, and which have never visited any country where the disease prevails, which have not even left their native districts of New England or the Middle States for instance, have not come in contact with lepers without their knowledge, and thus have acquired the disease? Such a supposition is not only credible; facts abundantly give support to it. Take my own single experience as an instance. One of the Tracadie cases escaped from the lazaretto twenty-five years ago and was for a considerable time a resident of Boston under an assumed name. He was under my charge for months at the Massachusetts General Hospital. Who can now trace his wanderings in New England at that time, or know that no one was infected by contact with him then? There has died during the past year under my care one of the Louisiana lepers from the Plaquesmines district. He, too, was

living under a feigned name in the vicinity of Boston. Such cases are of course not limited to the observation of one individual. Another Tracadie case has been known in Boston, and one lately discovered in Providence and taken back to the lazaretto. Yet it was not generally known that such concealed foci of the disease were existing in the midst of such thickly populated districts even at the time, and the outbreak of leprosy in any individual there after the lapse of years, it may be as the result of unknown contact and infection, would be regarded by patient and physician as necessarily "sporadic." I cannot but regard this term with great mistrust. If a lie is a natural feature for elimination in the history of a kindred disease, unconscious deception is to be considered as an element not to be disregarded in the patient's history in every case of leprosy.

This brief account of the geographical distribution of the disease in North America suggests a mention at least of the sources from which it has been derived, and the dangers to which we are still exposed through immigration from them. Spain, at the time of her colonization of the southern portion of North America, had many lepers within the home kingdom through whom in Mexico and the Gulf States the seeds of the disease were planted. Her island colonies in the Spanish main also served, as at the present day, for distributing foci in their intimate commercial relations with our continent. Of this implantation, however, no traces, save those of historical record, remain along our shores, although it survives in a state of no inconsiderable activity in the West Indies and the maritime countries south of Texas.

Portugal, too, scattered her leprous settlements over many of the islands of the Atlantic, with which our sailor population has kept up constant intercourse through our various fleets. It is from these two sources that the occasional cases among our native stock, those known to have been acquired out of the country, have been derived.

From Africa also we drew a supply of the disease in connection with our importation of negroes, and the instances observed among the blacks in the Southern States, up to a very recent period, were no doubt largely of this origin. With the cessation of the slave trade we were relieved from this source of danger.

France, as we have already seen, peopled her North American colonies in the gulf with numerous lepers, so that old world and old time means were employed in dealing with the disease, so successfully that it was eradicated before Louisiana became one of the United States. But the home country remained leprous in some of her districts, and has succeeded in re-establishing, through her emigrants, the modern outbreak of the disease in Louisiana we have just been studying, although its immediate origin is so completely a mystery at present. In Tracadie, too, the disease originated in and has continued to affect mainly the residents of

French origin, although in neither instance were those first attacked direct immigrants from their mother country.

From the infected regions of Norway and Sweden immigrants are constantly pouring into our land and forming a new Scandinavia in our northwestern States, with a not inconsiderable number of lepers at least in the incubative stage among them.

And upon our Pacific shore, both in California and Oregon, the much feared invasion from China was certainly not without its tangible elements of evil in the victims of leprosy already developed amongst us. Thus both at the extreme north, and south, and west of our boundaries, and directly in the heart of the country have been planted centres of the disease, from which under favourable conditions it may spread in all directions.

If from this brief study of the course of the disease in our midst and in our own time we find evidence that it is communicable from man to man by direct transference, or facts which can be interpreted in no other reasonable way, and this conclusion I, after due consideration, must accept, how far is this supported by the general history of the affection in past times as related by medical chroniclers? There was a period when leprosy was one of the most common diseases of civilized Europe, when the lazaretto was as universal as the modern lunatic asylum. If not imported directly by the Crusaders returning from its early home in eastern lands, it was certainly far more prevalent and widely distributed after these events. Belief in its contagious qualities was then universal, because observers then possessed the same opportunities of witnessing its progression over a virgin soil and among unaffected nations that we are just beginning to study amongst ourselves. The leper was shunned, his personal belongings were avoided as unclean. He became the object of relentless laws and lost almost a claim to humanity. No disease has ever met such vigorous quarantine enactments. The result of all this moral isolation and enforced lazaretto life was the gradual extermination of the disease in the centres of population and its expulsion to certain corners and border lines where, at first in concealment and later in neglect, it has lingered down to the present day. Without a revival of the strictest enforcement of these same laws it will still hold its ground in these lurking places scattered over most of the European States, or will increase yet to a more terrible magnitude, as in Norway. Under the seemingly more humane but dangerous theories of Boeck and Danielsson respecting its nature, which allows the leper to associate safely with his fellow-men, we should expect the disease to flourish as it does and to affect the many, who, as is well known, can plead excuse for its presence under this fallacious doctrine of heredity. The sterner judgment of the middle ages, which made the leper individually the responsible agent of communication rather than the progenitor, must again be adopted before the affection will be subdued in Scandinavia.

History then seems to confirm the lessons to be drawn from modern observation regarding the communicability of the disease, so far as conclusions are warranted from the opinions then generally held, and the laws then in force. These lessons or deductions which, as it seems to me, we are forced to draw from the data I have thus presented (how imperfectly as a demonstration in any sense I am too well aware), justify in my opinion the following conclusions: Leprosy has spread under recent observation, when introduced into a previously unaffected stock, in so rapid and general a way as to prove that it may diffuse itself universally through a nation independently of the action of hereditary tendencies. There is no evidence to support the assumption that this wide and quick extension of the disease has been caused or aided by any peculiarities of soil, climate, diet, or other telluric agency in Hawaii. The history of the affection, on the other hand, leads to the strongest conviction (scientific proof is well-nigh out of the question) that it is communicated directly from person to person, while the peculiar customs offer a satisfactory explanation of its unparalleled spread. The history of the little centre of disease in Louisiana, watched fortunately from its very beginning, leads to the same conclusion that it affects persons not under any law of heredity but through the intimacy of personal relationship, the customs and morals determining largely the rapidity and universality of its spread. So, too, syphilis abstracted from its venereal relationships, could exist as a disease, and does communicate itself in no inconsiderable measure in various other ways. It is only through the assistance of the loose sexual customs of certain grades of the population everywhere that it has become such a world wide pestilence. Take away from it its characteristic initial lesion and give it a greatly prolonged incubative stage, and the difficulty of determining the circumstances of inoculation would be as great as in the disease we are considering.

It is probable that leprosy may, like syphilis, be communicated under all circumstances by which some of the fluids and other products of the infected foci of a diseased person come in contact with abraded or excoriated, possibly with the uninjured surface of a healthy person. Such favourable conditions might happen during coition, vaccination, kissing, in using the same utensils in eating, drinking, or smoking, in handling the diseased parts in hand-shaking or nursing, in sleeping with the patient, or in other ways. It would be necessary that the diseased products should be at the surface of the skin or mucous membrane, and this would generally be accomplished during the process of softening by which the impermeable epidermal layers were removed. Thus the nodular form in its ulcerative stage would necessarily be the most dangerous phase of disease, whereas the anæsthetic form might exist for years with little danger of communicating itself to its surroundings. In this sense we may conclude that leprosy is contagious, and in these ways do I believe that the disease

mostly spreads in a family, a community, a nation. I would not exclude hereditary transmission as a direct cause in individual cases, although how largely the disease originates in this way and how remotely such influences may extend our exact knowledge is very deficient. Positive information upon this point and upon the limits of incubation is yet to be almost wholly acquired.

That recent observers and those dermatologists who have lately studied the disease have become more and more inclined to regard the exclusive dogma of heredity as unsatisfactory, and to accept contagion as an important factor in etiology, the following opinions very strongly show. In the replies to Virchow's questions respecting the disease sent out in 1860, there were many which were in conflict with the conclusions of the committee of the English College of Physicians, "that the most skilled physicians in all parts of the world are entirely opposed to the belief that leprosy is contagious." Dr. McNamara in Bengal, who was seeing three thousand cases a year, believes that it is contagious, and mentions cases in confirmation. Dr. Lob, of Hong Kong, says: "It is contagious beyond a doubt." Dr. Friedel, of China, states that it is communicated by inoculation during sexual intercourse. Dr. Wolff, of Madeira, gives cases of contagion. Dr. Wucherer, of Brazil, gives cases also, but says that the anæsthetic form is not contagious. A missionary resident ten years in a large leper hospital in Trinidad, cites instances of contagion in his book (*La Lèpre, est Contagieuse*, Paris, 1879). Dr. Manson, in a report published by the Inspector-General of Customs, Shanghai, 1881, says:—

"In the face of certain well-known facts in the history of the disease, it is difficult to understand how its communicability can be denied. I can only explain the denial by the absolute ignorance which prevails as to the steps, etc., of the disease. . . . Leprosy is studied only in hospitals, rarely in its proper home, and genuine efforts to study there the history of its beginnings and the secret, perhaps, of its cause have been few."

Dr. Tillbury Fox, in his last book, said:—

"There is by no means a slight body of facts which seem to indicate that the inoculation with matter from a leprous sore, and this may occur in cohabitation and constant contact and in vaccination(?), may give rise to the disease." And again: "Leprosy is apparently spread by the free contact of the healthy with the leprous."

Neisser says: "Leprosy is probably an infectious disease, and its specific products are contagious." Köbner, in his recent paper (Virchow's *Archiv*, Bd. 88), on the inoculability of the disease, says, with regard to this question: "The isolation of the leper by confinement is the best means of overcoming leprosy as an endemic disease." Kaposi (*Path. und Thérap. der Hautkrankheiten*) says, upon the same point: "Freilich kommen da merkwurdige Fälle vor."

But if contagious, what is the contagious element in the disease? A constitutional virus peculiar to it, or a foreign organism, an entophyte,

which is the sole cause of the local tissue changes and indirectly of the subsequent systemic changes? I must confess that the latter theory is to me the most satisfactory explanation of the peculiar features of the affection, and that I am prepared to receive proof of the existence and etiological relations of such a specific being as the *bacillus leprœ*. Is this proof at hand?

Bacillus.—In 1873 Hansen first called attention to the presence of bacteria in leprous tissues, but the medical world was not ready to accept the announcement in its full signification; it had been over-credulous in receiving hastily made observations and inconsequent conclusions as established facts in this field of research. Since then it has become prepared, by better work and more critical and educated judgment, to estimate the value of such discoveries. The parasitic nature of certain so-called constitutional diseases has been established, giving reasonable ground for assuming that others may yet be proved to be of a similar character. There is nothing in the history or pathology of leprosy incompatible with the theory of its parasitic nature. Should a bacterium be constantly found in the disease, in the leprous tissue itself, most pronounced in that in process of development, presenting the same characteristic features in cases occurring in all parts of the world, and not found in human tissues in connection with other diseases or in their healthy condition, it would constitute strong presumptive evidence that this parasite was the specific cause of leprosy. The proof would be positive if its inoculation were found to reproduce the disease. What facts have we to support such a supposition? Within the last year or two Hansen's observations have been confirmed by several most reliable investigators, among whom may be mentioned Neisser, Koch, Köbner, Cornil and Souchard, and by Dr. Berman in this country. At our last meeting we had opportunity of seeing this so-called bacillus demonstrated by Dr. Atkinson, as prepared by the latter gentleman. There can be no doubt of the existence of this object in the various tissues of the disease in my opinion, and but little of its nature. The failure of some good observers to discover it in cases of the disease may be satisfactorily explained by their inexperience in conducting the complicated processes by which its presence is to be discovered. Others who have likewise failed at first have later learned to work more successfully. Nor can this complexity of manipulation be urged as ground for mistrust of the genuineness of the results obtained, for the same objection applies to proofs of the existence of several of the normal tissues of the human body. Of the specific character of these growths and of their etiological relations to the morbid tissues in which they occur, and to the disease as a whole, there is room at least for a suspension of judgment. *A priori*, there is no reason why the bacterium found may not satisfactorily explain all the local and general pathological processes characteristic of the disease, and it has been found in connection with

cases from so many parts of the world and by so many reliable and experienced observers, and has, under all circumstances, presented so uniformly identical appearances that the probability of such specific relationship grows stronger and stronger. The results of inoculation are as yet negative. The most recent attempts in this direction are the recent experiments of Prof. Köbner, of Berlin, carried on with the assistance of Koch. The results were negative. None of the animals inoculated lived long enough to fulfil the probable minimum period of incubation of the disease in man, and it may be that the bacillus is incapable of growth in the tissues of other animals. In some Utopian epoch let us hope that humanity may reserve her condemned criminals for such experiments. Until then this question may have to await its complete solution. I cannot forbear, in this connection, to recall one of Köbner's observations: The leprous nodule for his inoculations was excised on April 12th, and was found to contain an abundance of bacilli. The wound cicatrized, but in October became excoriated in the bath, forming an open sore. The granulations and pus removed from this were found to be filled with bacilli. Can any one doubt the dangerous character of this sore? Is there one of us so skeptical as to the possibilities of the experiment as to have been willing to apply it for a moment to an abraded surface upon his own skin? Such contact, I believe, to be the frequent cause of the spread and perpetuation of the disease.[1]

If then we are prepared to admit the contagious nature of leprosy, using the term with the meaning above defined, what measures should be taken for its exclusion from and repression within the country? Is isolation effective, or necessary, or justifiable? Should immigration from infected nations be prohibited? That the establishment of lazarettos and special laws for lepers were everywhere considered necessary, and that the disease disappeared almost wholly from civilized Europe thereafter in historic times there can be no doubt; nor of the fact, on the other hand, that the only place there where it holds in any degree its old importance as a national evil is Norway, where the necessity of such institutions is publicly and privately disbelieved in. In modern times the revival of enforced isolation on any large scale has been tested in the Hawaiian Islands alone, and here the necessity and effectiveness of the stringent government measures in this respect are admitted by all resident physicians as well as by lepers themselves. The resident Governor of Molokai, a talented lawyer who voluntarily exiled himself thither on discovering himself to be a leper, declares that all who doubt that the disease is contagious are dreamers, and that any one who would be willing to return to his home and spread the foul contagion among his friends and countrymen is worse than a traitor to the

[1] For recent observations on bacillus lepræ see Hewsen, Virchow's Archiv, 1880, Band 79; Neisser, Virchow's Archiv, 1881, Band 84; Cornil and Souchard, Annales de Derm. et Syph., 1881, No. 4; Köbner, Virchow's Archiv, 1882, Band 88.

Hawaiian nation. It is a pity that the system was not adopted before the seeds of the disease were so universally distributed. The experiment at Tracadie has never been carried out with sufficient stringency to fully test its efficiency, as is evident from the accounts above given. With the lazaretto unsupported, as has been the case, by proper compulsory laws, there is no doubt that the disease has been held only just within bounds, nor that under the present management it will continue to hold its own. Such half measures are mere trifling.

We have at present an unknown number of lepers in the United States —let us say fifty or a hundred; one centre in Louisiana, another in Minnesota, Wisconsin, and Nebraska, another in California and Oregon, affecting three entirely distinct nationalities, in different climates, and under quite diverse methods of living. It is evident that the disease may make more rapid advance in one part than in another. Any circumstance, for instance, which tends to soften or abrade nodules, as a hot climate possibly, would of course greatly increase the danger of infection, so that the necessity of interference by compulsory means might be more urgent in the former than in the latter. It is evident, however, that such measures should be undertaken by the national government, and that they should be made applicable to all parts of the country alike. We have a National Board of Health to which their execution might be entrusted. There can be little doubt of their necessity, or of their success in eventually exterminating the disease. When this necessity becomes more apparent this result will be immensely more difficult of accomplishment. These measures should be—the establishment of graded hospitals in possibly insular localities in various parts of the country, to which all access should be prevented excepting under restrictions determined by professional rules; the enactment of laws which should make residence compulsory and perpetual, and the concealment of the disease punishable by severe penalties. These rules should apply to so-called sporadic as well as to endemic and imported cases, but the latter might be given the option of returning to their native land. The immigration of lepers should be prohibited and arrested at ports of arrival by inspection so far as possible, as other contagious diseases now are by quarantine regulations. By the establishment of such national measures immigration from leprous countries would largely cease, lepers would no longer change their residence within the country to escape the action of local laws against their liberty; marriage with them would become abhorrent when the people had thus become aware of its dangers, and after a generation has passed the disease should be virtually eradicated.

But are such measures justifiable? it will be asked; why not so, as much as the national laws concerning yellow fever, and municipal regulations against smallpox? These kill their victims quickly and intermittingly, leprosy after years of frightful disfigurement and pauperism. If we cannot

prevent our country from becoming the refuge of the world's criminals, we may at least take such action that it shall not be made the asylum for its infectious diseases. If Draconian laws regarding marriage and intercourse could stamp out consumption and syphilis, as some day they will, who would feel that he had a right to oppose them? Lepers belong to the dangerous classes of the community which require perpetual confinement, and the sooner this remedy is applied the less seeming cruelty will attach to it.