

RAVENEL (M. P.)

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ETIOLOGY OF MEMBRANOUS
RHINITIS.

BY

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From the Laboratory of Hygiene, University of Pennsylvania.

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ETIOLOGY OF MEMBRANOUS RHINITIS.**

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From the Laboratory of Hygiene, University of Pennsylvania.

It is only within the past few years that the disease known as membranous rhinitis, or *rhinitis fibrinosa*, has attracted the attention of bacteriologists and its true nature has been demonstrated. The course of the ailment is almost invariably benign, though tending to be chronic, and the constitutional symptoms are so slight that the patient is usually allowed to go for weeks without medical attention; relief sought finally for the local trouble rather than for any apparent illness.

The disease is comparatively rare, and has not been accorded a place in the text-books for a great length of time. Of the cases on record but few have been studied bacteriologically. In America Park¹ and Abbott² only, as far as I have been able to discover, have reported such cases, and in Europe the number of observers is almost as small. One important and interesting fact has, however, been clearly demonstrated, viz., that in the great majority of cases the Klebs-Loeffler bacillus is present in the membrane in



the nose, and undoubtedly also exists in the nasal discharges, as has been proved in one of the cases reported later (Case II); and it has furthermore been shown that the organism often possesses a high degree of virulence. Heretofore it has not usually been thought necessary to isolate patients suffering with membranous rhinitis, and most of the cases of which I have been able to obtain histories were treated at some dispensary and allowed to mingle freely with the other patients in the waiting-room.

I have tried particularly to obtain histories of infection from cases of membranous rhinitis resulting in faucial or laryngeal diphtheria, but without much success. The few instances in which this has been observed, however, warrant the assertion that such patients are always a possible source of contagion, and should be isolated as carefully as are those affected with the more common types of diphtheria. In short, many, probably the majority, of cases of membranous rhinitis are really forms of nasal diphtheria, and should be regarded as such.

It cannot be doubted that a condition is met clinically identical with membranous rhinitis, in which the Klebs-Loeffler bacillus cannot be demonstrated, and which seems to depend on the presence of some other organism. Thus Abel³ has reported one case in which the *micrococcus lanceolatus* was found, and other observers, including myself, have found staphylococci in some instances, among which, in my cases, the staphylococcus aureus was largely predominant.

An interesting question naturally presents itself: Why is it that patients carrying about a virulent type of the Klebs-Loeffler bacillus do not oftener

transmit diphtheria to those with whom they come in contact? The answer is not easy, and is largely theoretic. In every case observed by Park¹ and by Abbott,² and in all but one of my own, the organism obtained from the nose was possessed of very feeble vitality, even when highly virulent; and though kept under the most favorable conditions on Loeffler's blood-serum, the cultures died in from three to four weeks, with the one exception noted. This culture is still alive at the end of six weeks. In several of the cases observed by me the cultures were renewed every ten days, but in spite of this they ceased to grow inside of a month. It seems most probable that the apparent lack of infecting power is due to this feeble vitality. The literature on the subject is, however, very scant, and it is not unlikely that contagion has taken place much more often than is shown by the records.

The number of cases collected is, of course, too small to form the basis of any positive conclusions, except such as have already been noted. It is interesting to observe, however, that when infection does occur the resulting disease is membranous rhinitis rather than the ordinary form of diphtheria. It is not easy to explain why this should be the case, and more extended observations may prove the contrary to be true. This view is borne out by two cases reported by Seifert,⁴ two by Abbott,² two by Chapin,⁵ and four detailed in this paper. On the other hand, I have been able to find only three instances in which faucial diphtheria has followed infection from membranous rhinitis, one reported by Concetti,⁶ one by Scheineman,⁷ and one by myself. (See

Cases XI and XII.) In the last case there is an element of doubt, so that only two positive instances can be given. It will be noted that Case XI apparently communicated the same disease to Case XII. More than a month after the latter child had been discharged as cured of the nasal trouble she returned to the dispensary suffering from faucial diphtheria; and of the two other children in the same house, who were taken ill later, both had the disease confined to the fauces. As it had been impossible to examine Case XII thoroughly when first sick, it seems not unlikely that the disease persisted in some part of the naso-pharynx, and that finally the fauces became infected. The length of time which elapsed, however, before the second illness, afforded abundant opportunity for a fresh exposure, though no such history could be obtained.

In his last memoir on the subject, Bretonneau pointed out the disease known to the French at that time as "coryza couenneux" as an especially dangerous condition from which many grave diphtheric affections took rise. In all of the cases related by him in support of this opinion the angina followed the nasal symptoms, and they appear to have been instances of a more or less common type of diphtheria, in which the earliest symptoms are referable to the nose. Schlichter⁸ has reported a series of cases of this character occurring in infants. It is a matter of not uncommon observation that a discharge from the nostrils persists for some time after the throat-symptoms have subsided in ordinary cases of diphtheria, and it seems not improbable that the Klebs-Loeffler bacillus may remain alive in the more

inaccessible parts of the nose for some time, and give rise to trouble.

The question as to whether or not the organism found in these cases of membranous rhinitis, which resembles the Klebs-Loeffler bacillus so closely in every way except in pathogenic power, is a pseudo-diphtheric bacillus or the genuine Klebs-Loeffler, has been already ably discussed by Abbott,² who some time before had made a study of the relation existing between the pseudo-diphtheria-bacilli and the diphtheria-bacilli. Park¹ and Koplik⁹ have also made a study of the same subject, and the conclusions of the former agree substantially with those of Abbott, while Koplik has reached no definite conclusions.

Briefly stated, Abbott's conclusions are that the Klebs-Loeffler bacillus is found of varying degrees of virulence, and even devoid of virulence entirely, and that all bacilli that possess the morphologic and cultural peculiarities of the diphtheria-bacillus should be considered as such, irrespective of their pathogenic power. The name "pseudo-diphtheric" should be applied only to "that organism or group of organisms (for there are probably several) that are enough like the diphtheria-bacillus to attract attention, but are distinguishable from it by certain morphologic and cultural peculiarities aside from the question of virulence."

During the course of this work the pseudo-diphtheria-bacillus has been constantly borne in mind, and I am convinced that in every case the organism found was the true Klebs-Loeffler bacillus, which had in some way become modified as to virulence and vitality.

As mentioned, the literature of the disease is not extensive, and the number of cases on record is small, while in a large proportion of these no bacteriologic examination was made. The disease has been regarded as a benign, non-contagious malady until recently, and is so considered in many textbooks. Concetti⁶ was the first, I believe, to call attention to the danger of contagion, and in a paper published in 1892 he urges the importance of disinfection, isolation, and individual prophylaxis.

I have reviewed the literature of the disease as carefully as possible, and give here an abstract of the result.

The earliest report of cases that I have been able to find is by Isambert,¹⁰ who reports two instances under the name "Coryza Couenneux." He calls attention to the extreme rarity of this condition existing by itself and unaccompanied by any other manifestation of diphtheria, and does not question its relation to that disease. He says that he has seen but two cases of the kind, details of which are given at some length, as they differ from all others of which I have been able to obtain histories in their sudden onset and the severity of the constitutional symptoms.

In both cases the source of the contagion was evident, one being in an interne, the other in an externe of l'Hôpital des Enfants, where they see many children with diphtheria daily. In the first patient the attack was ushered in with high fever, intense headache and some soreness of the throat. On the next morning there was an acrid, corrosive, seropurulent discharge from the nostrils, abundant enough to require many napkins per day. The

throat-symptoms grew no worse, and were considered entirely "accessory." On the sixth day M. Roger found some deposit on the tonsils, but regarded this as a "secondary phenomenon," after the enormous false membranes that had come from the nose. These were thick, large, stratified, and represented moulds of the turbinated bones. The membrane disappeared from the tonsils in a few days, and the general symptoms ameliorated rapidly, while the formation of membrane in the nose persisted for ten months, though every known form of treatment was employed, and the patient travelled extensively, hoping that the change of climate would be of benefit.

The second case began in much the same way, but was preceded by several days of "malaise." There was at no time any formation of membrane except in the nose. This was thick and large, with an abundant sero-purulent discharge from the nostrils. The acute symptoms soon disappeared, but convalescence was slow.

It seems doubtful if the first of these two cases can properly be considered as an instance of membranous rhinitis, for some membrane formed on the tonsils later, though the disease was mainly confined to the nose, and persisted there for a very long time. I have quoted it, since Isambert has described it as one of the only two cases ever seen by him of "coryza coeunneux" unaccompanied by other symptoms of diphtheria.

It is of interest to note here that Schlichter,⁸ as already quoted, considers the nose as a frequent channel of invasion for diphtheria in sucklings, but he reports no instances in which the disease began in this manner in grown persons.

Schüler¹¹ reports one case in a boy, five weeks old, before the discovery of the Klebs-Loeffler bacillus. The child died of an intercurrent erysipelas.

Henoch¹² details one case in his *Lehrbuch*.

Major¹³ reports one case in a lady of eighteen years. The membrane was examined under the microscope, but "no micrococci found." Cultures were not made. Treatment lasted for three months.

Seifert⁴ reports three cases, one in an adult, the other two being in children who were sisters. One was affected after the other—apparently an instance of direct infection. Both had follicular tonsillitis. The author considered the disease to be of a diphtheric nature. In a later communication he mentioned a fourth case, following pneumonia.

Moldenhauer¹⁴ reports four cases, one of which is doubtful, as there was a slight deposit on the tonsils, but unaccompanied by any febrile symptoms. At the time that these patients were seen diphtheria was more prevalent than usual in Leipsic. The author did not feel sure about the relation of the trouble to diphtheria, but was inclined to consider it as a distinct disease. The membrane was examined microscopically by Huber, and showed nothing by which it could be distinguished from that of diphtheria.

Hammond¹⁵ reports one instance of the disease in his own person. He had "a violent rhinitis, different in character and of far greater intensity than any that any rhinologist I have consulted has ever witnessed, and of a form not laid down in the books. There was great swelling of the nose and face, the discharge during the first stage of an exceedingly acrid and thin fluid, and the formation subsequently of a membraniform substance not very unlike that present in diphtheria, but very loosely attached to the membrane, and showing no disposition to extend beyond the nasal cavities."

Hortmann³⁴ has reported six cases in children of from three to nine years of age. He considered the disease as distinct from diphtheria.

Ryerson¹⁶ has reported one case in an adult. No bacteriologic examination is mentioned, and the author did not seem to suspect any diphtheric character.

Bischofswerder¹⁷ reports three cases observed at Baginsky's clinic. He was unable to establish any connection with diphtheria or other infectious disease, and considered the condition as the result of an increase in the symptoms of ordinary coryza depending largely on the severity of the weather.

Potter¹⁸ believes that the formation of membrane occurs in about 2 per cent. of all cases of acute rhinitis. He discusses the relation of the disease to diphtheria, and considers the questions involved as unsettled. He has seen but one case in which he could form any opinion as to the cause of the membrane. This patient had suffered from scarlet fever when a child, and the upper air-passages still showed the effect, and were very sensitive to changes of temperature.*

Gluck¹⁹ reports having observed a series of cases, but gives neither the details nor the results. He speaks of the affection as being entirely independent of diphtheria, and does not mention any bacteriologic examination in any of his cases.

Raulin²⁰ reports four cases observed by him. The membranes were examined under the microscope, and found to resemble those of diphtheria. They contained many cocci, but no cultures were made. The author did not consider the disease contagious.

* Potter is quoted by Abel³ and Raulin²⁰ as saying that membrane occurs in 20 per cent. of all cases of acute rhinitis, and the latter discredits the accuracy of the statement, contrasting it with the observations of other authors, all of whom agree that the disease is a rare one. I have studied the original paper of Potter, and take this opportunity of calling attention to the error into which Abel and Raulin have fallen. The figures should be 2 per cent. instead of 20 per cent.

Chapin²¹ reviews the literature of the disease and gives the details of two cases seen by him with Dr. Wright. The patients were sisters, aged two and three years, one affected after the other. The symptoms had appeared two weeks before relief was sought. Both children made a good recovery, and at no time did either show any constitutional disturbance worthy of note. In discussing the relation of the disease to diphtheria, and the diagnosis between the two the author says: "As far as the false membrane itself is concerned, both in structure and attachment, it does not appear to differ from diphtheria. This being the case, our diagnosis must rest upon its exclusive situation in the nose, together with the absence of sepsis and general constitutional symptoms. It appears to me, in the present state of our knowledge, that this negative, tentative diagnosis is all we are justified in making." He quotes Voltolini as saying that he had never seen dipththeria confined to the nose.

Newcomb²² reports two cases following measles. No cultures are mentioned, but examination of the membranes showed "a fibrous structure entangling a few epithelial and pus-cells, with here and there scanty rod-shaped and spherical bacteria." The author suggests that all such cases should be studied bacteriologically in order to discover their etiology.

Hunt²³ reports one case, in the wife of a physician. She had been examined by her husband and Dr. Campbell, of Liverpool, who said that "whatever else it might be it was not diphtheria." The disease ran a rather chronic course, without constitutional disturbance. There had been no diphtheria in the neighborhood, nor did a child living in the same house become infected. The membrane was examined microscopically, but not for bacteria.

In commenting on this case Mr. Lennox Browne

said that so far as he was aware it was the only one of the kind ever reported in England.

Leemans²⁴ has reported two cases. In both there was a short febrile state, but almost entire absence of constitutional disturbance. The membranes were so thick and firm that when removed they represented moulds of the turbinated bones and meatus. The author's paper is commented on by a commission of the society before which it was read, as follows: "Dr. L. insists at length, too much so in our opinion, on the diagnostic difference between the disease seen in these two cases and diphtheritic rhinitis. It seems impossible that such a confusion could present itself."

Scheineman⁷ reports one case. The membrane was limited to one side of the nostril, which was completely occluded. The patient had a playmate who developed diphtheria. The author says that the disease has usually been considered non-contagious, but this case has led him to modify his views on the subject. The membrane was examined, but the presence of the Klebs-Loeffler bacillus was not proved. The bacteriologic examination also proved negative. In a subsequent communication the author reports a second case in which the Klebs-Loeffler bacillus and streptococci were found. He says that from a prophylactic point of view these cases should be regarded as a benign diphtheria.

Lieven²⁵ reports one case, from which he obtained an organism that when introduced into the noses of other children by means of tampons caused a similar condition in them.

Baginsky²⁶ says that he has found the Klebs-Loeffler bacillus in cases of "pseudo-membranous rhinitis," and speaks of them also as "chronic diphtheria." No details are given, nor is the number of cases mentioned. He considers the finding

of the Klebs-Loeffler bacillus to be of interest in view of the contagious nature of the disease. Later he mentions one case in which the Klebs-Loeffler bacillus was found and its identity proved by experiments on animals.

Park¹ has examined ten cases of typical membranous rhinitis, all of the usual benign character. In all he found the Klebs-Loeffler bacillus, of varying degrees of virulence. In nine the membrane was confined exclusively to the nose, while in one there was some exudate on the tonsils. Only six of these cases have been published in detail; the other four were reported to Welch²⁹ in a private communication. The virulence of the organism obtained was tested in five of the six cases published. From one case it killed a guinea-pig in four days; from two in five days, while in the remaining two the animals were made sick, but recovered.

Abel³ has reported one case in which he found the diplococcus of pneumonia.

Stamm²⁷ reports three cases observed by himself, all of which ran a benign course, though virulent cultures of the Klebs-Loeffler bacillus were obtained in each instance.

Concetti⁶ says that he has seen a total of five cases. In two of these the diphtheric nature was demonstrated by a bacteriologic examination; in two contagion followed, in one of which there was a subsequent paralysis; while in the fifth the larynx became involved later. The author points out the danger from such cases, and shows that however mild the symptoms may be, at any moment a grave form of the disease may supervene, or else be conveyed to others with whom the patient comes in contact. He says that they should be examined bacteriologically, and advises measures of disinfection, isolation, and individual prophylaxis.

Von Storck²⁸ reports three cases, in none of which

was the Klebs-Loeffler bacillus found. Two of the patients had been similarly affected before. The author says that even if the bacteriologic examination had not proved negative, neither of these cases would have been considered as diphtheria.

Abbott² reports three cases, in all of which the Klebs-Loeffler bacillus was found, in two of them of a virulent type. Two of the patients were sisters, and one was affected after the other, being an instance of direct infection. The organism obtained from the older sister, who was first seen, was fatal to guinea-pigs in less than forty hours, and the animals presented the characteristic lesions; while that from the second child did not cause death, producing only a slight local reaction, with temporary indisposition. The author says: "Except for the absence of pathogenic properties, the bacilli obtained from the latter case seen by me could not, by any of the means usually employed, be differentiated from the genuine virulent *bacillus diphtheriae*." Attention is called to the importance of isolating such cases. The clinical history of the first case is not complete, as the patient disappeared from the clinic; but in neither of the other two were there any constitutional symptoms of note.

The formation of membrane after operations on the nose, or the application of the galvano-cautery, appears to be not very uncommon. Baumgarten³⁰ has reported two cases following operation, one for an adenoid growth, the other for polypus; and Maggiora and Gradinego³¹ have reported one, which is especially noteworthy as having been probably the first in which a bacteriologic examination was made. The organism found was the staphylococcus aureus.

Bresgen³² asserts that he has frequently seen the formation of membrane follow the use of the galvano-cautery, and this may recur for some time

afterward on each fresh exposure of the patient to cold. Schmithersen³³ reports twelve cases of this nature. I have not thought it proper, however, to consider cases following traumatism as instances of true membranous rhinitis.

During the past year I have had the opportunity of studying ten cases of typical membranous rhinitis, the histories of which are given in detail :

CASE I.—Annie H., white, five years old, was sent by Dr. B. A. Randall. She had been under treatment for some time for ear-trouble, which was about cured, the suppuration having ceased. She gave a history of having played with a cousin, who had at the time a "sore-throat," but who had recovered when the patient presented herself. A second child of the same family had no trouble whatever. Examination showed the right nostril to be occluded by a thick and somewhat gelatinous membrane, which was detached with difficulty, leaving a bleeding surface. The left nostril secreted pus, and formed ill-smelling crusts—once a large cast—but showed no membrane at any time. No part of the fauces or of the posterior nares was affected. Cultures were made on blood-serum (Loeffler's) after the third treatment, and the Klebs-Loeffler bacillus was found in abundance. The organism was isolated, and proved fatal to a guinea-pig of about 350 grams weight, in sixty hours, the dose being one loopful of a culture on blood-serum forty-eight hours old. The autopsy showed the typical lesions caused by the Klebs Loeffler bacillus, and the organism was recovered from the site of inoculation.

The child made a good recovery under local treatment only, and there were at no time any constitutional symptoms of moment, nor have there been any sequelæ.

CASE II.—Annie R., white, six years old, was sent by Dr. B. A. Randall. She had been troubled for three weeks with a discharge from the nostrils, which excoriated the upper lip. The nostrils became occluded at night, causing restlessness. There were no constitutional symptoms that attracted attention, and the child was brought to the clinic at the Children's Hospital on account of the "sore nose." An examination showed the formation of a false membrane in both nares, not very thick or extensive, and limited to the anterior portion. Cultures from the membrane were made on blood-serum, and also from the discharge at the orifice of the nares. In both the Klebs-Loeffler bacillus was found in large numbers. Pure cultures were isolated from the membrane only, and proved fatal to a guinea-pig of about 350 grams weight in forty hours, the dose being a loopful from the surface of a culture on blood-serum forty-eight hours old.

The fauces and posterior nares were at no time affected, and the child made a good recovery under local treatment, followed by no sequelæ.

CASE III.—Herbert B., white, ten months old, was sent by Dr. T. S. Westcott, to the clinic of the University Hospital for treatment for bronchitis. The child showed symptoms also of a mild rachitis. On the twenty-fourth day of treatment the mother reported that the child had been restless the night before, and just before coming to the dispensary there had been a discharge of "blood and corruption" from the nose. Examination showed the left nostril to be occluded by a soft, somewhat gelatinous membrane. Cultures were made on blood-serum, and the Klebs-Loeffler bacillus isolated. A guinea-pig of about 400 grams weight was inoculated, but the culture did not prove fatal. At the point of inoculation a slough formed the size of a silver half-dollar, leaving an ulcer with thick, indurated edges.

The animal was killed on the eighteenth day. The organs were normal in appearance to the naked eye. The retro-peritoneal glands were considerably enlarged, and the peritoneum was injected. Sections of the tissues from the site of inoculation showed a condition of necrosis, accompanied by nuclear fragmentation, quite similar to that observed in animals that have died after inoculation with virulent diphtheria-bacilli, though it was somewhat less in extent.

The constitutional symptoms in this case were at no time alarming, and easily accounted for by the bronchitis, which had existed some four weeks before any trouble with the nose had attracted attention. The fauces were at no time affected, and the patient recovered under local treatment, with a prescription given for the relief of the bronchitis. Diphtheria had occurred in houses on each side of the patient's home.

CASE IV.—Josephine McI., eleven years old, was sent by Dr. W. J. Freeman for the treatment of a sore nose, which had begun three weeks before. The child slept with the mouth open, and snored. There was some headache and fever every day. Examination showed a membranous deposit in both nares, especially marked on the right side. Membrane was found also on both tonsils and on the pharyngeal tonsil, also in the back part of the left naris. Cultures on blood-serum were made from the nostrils only, and found to contain the Klebs-Loeffler bacillus in large numbers. One loopful of a forty-eight-hour-old culture on blood-serum was introduced into a guinea-pig of about 400 grams weight, and caused death in fifty hours, with typical lesions.

This child made a good recovery under local treatment. She was the youngest of a family of eight, all of whom remained perfectly well. She

had no severe constitutional symptoms, and no sequelæ followed.

In this case it was impossible to tell the seat of the primary lesion. The nose-trouble was first noticed, and there were at no time any symptoms referable to the larynx or fauces. It is possible that this was a case of faucial diphtheria, with secondary involvement of the nares. In such cases, however, the membrane usually disappears from the fauces, while it persists in the nose.

CASE V.—Lizzie McG., white, six years old, was sent by Dr. W. J. Freeman from the dispensary of the Polyclinic Hospital. The nose had been "sore" for three weeks when the patient applied for treatment, and during much of the time was occluded. There was considerable discharge, often bloody, and the external opening was excoriated. The child was restless at night, her appetite was poor, and she complained of a pain across the nose below the eyes. Examination showed a mild follicular pharyngitis, and the pharyngeal tonsil was somewhat enlarged. On the right side of the septum was a thin pseudo-membrane, while the left side showed some ulceration. The glands below the angle of the lower jaw were enlarged and tender. Cultures from the membrane in the right nostril were made on blood-serum, and the Klebs-Loeffler bacillus was found present in large numbers. Considerable difficulty was found in obtaining it in pure culture on account of its feeble growth. One loopful from a blood-serum culture was inoculated into a guinea-pig of about 350 grams weight, and caused death on the seventeenth day. A slough the size of a silver twenty-five-cent-piece had formed at the site of inoculation, and the edges of the ulcer were

much thickened. There was much increase in pleural fluid, and the retro-peritoneal glands were considerably enlarged. The adrenals were paler than normal and of the usual size. Two days before this patient was sent to me, and when treatment had not been begun, cultures were made by Dr. S. S. Kneass, bacteriologist of the Polyclinic Hospital, and from them he isolated a culture of the Klebs-Loeffler bacillus, which proved fatal to a guinea-pig of about 500 grams weight in sixty hours. At no time during the progress of the disease were the constitutional symptoms marked, and a good recovery was made under local applications, there being no sequelæ. The source of infection could not be traced.

CASE VI.—Louisa McG., nine years old, a sister of Case V, and who had been sleeping in the same bed, was sent by Dr. W. J. Freeman. This child's nose had just begun to discharge the day before a thin muco-purulent fluid. She had no constitutional symptoms whatever, and did not complain of any soreness in the nose. Examination showed the mucous membrane of the anterior nares to be somewhat injected and with a thin exudate on the surface of the same character as the discharge. Cultures were made on blood-serum from this exudate, and a bacillus resembling the Klebs-Loeffler closely was found in considerable numbers. Much difficulty was experienced in obtaining it in pure culture on account of its feeble growth. One loopful from the surface of a culture on blood-serum caused death in a guinea-pig of about 350 grams weight on the fifteenth day. The lesions found were not characteristic of the Klebs-Loeffler bacillus. There were very slight edema and thickening at the site of inoculation, and the organism was not found here either in cover-slip preparations or in cultures. The liver, spleen, and kidneys were

normal in appearance, while the adrenals were slightly enlarged and somewhat injected, but not much darker than normal. The retro-peritoneal glands were of the normal size. There was no increase of the pleural fluid, and very little, if any, in the peritoneal cavity.

Microscopic examination of the tissues also gave negative results. In none of them were the changes described by Welch and Flexner⁵⁵ found, and beyond intense congestion there was no departure from the normal observed.

This child recovered promptly under local treatment, and at no time showed any constitutional symptoms. In neither case did the fauces become involved. Some two weeks later the mother of these children presented herself at the Polyclinic Hospital on account of a discharge from the nostrils, without constitutional symptoms. Cultures were made by Dr. S. S. Kneass at once, but he failed to find any Klebs-Loeffler bacilli. The discharge ceased in the course of three or four days under local treatment.

CASE VII.— —, white, five years old, was seen at the Children's Hospital. While under treatment for some other trouble this child developed symptoms referable to the nose, with occlusion and a mucopurulent discharge. I did not see the child until it had been under treatment for nearly a week. The right nostril was almost occluded by crusts of dried secretion, but I could find no membrane. The resident physician reported that a membrane had existed in the anterior portion of the right naris. Cultures on blood-serum were made from the discharge at the external orifice, and also from the secretion higher up. In the latter an organism was found identical morphologically with the Klebs-Loeffler bacillus. Repeated attempts were made to obtain it in pure culture, but in every instance I failed to

find it in cultures made directly from the original tube. I believe it to have been the Klebs-Loeffler bacillus possessed of such low vitality that it failed to grow even in the second generation. The patient made a good recovery under local treatment, the fauces never became involved, and there were no sequelæ.

CASE VIII.—, six-and-a-half years old, was sent by Dr. L. J. Hammond. The local condition had been noticed only a short time before the patient applied for treatment. There were no constitutional symptoms of moment. The membrane was confined to the left nostril. Cultures on blood-serum were made before any local applications were made. I failed to find the Klebs-Loeffler bacillus, and the growth was made up largely of a large coccus. An interesting feature of this case was the profuse hemorrhage when the membrane was dislodged, even by such means as blowing the nose or the application of hydrogen dioxid. No history of contagion could be traced, and five children of the same family remain well. The case is still under treatment at this time.

CASE IX.—Thomas M., white, five years old, was sent by Dr. W. J. Freeman, for treatment at the dispensary of the Children's Hospital on account of occlusion of the nostrils, accompanied by a somewhat bloody discharge. When an infant, there was some trouble with the nose, which had ceased under treatment by the family physician, and there had been no return of it until five days before. Two months before the present attack the patient had suffered from earache and a discharge from both ears, for which there had been no treatment. The present attack began with the symptoms of an ordinary coryza. The nostrils were occluded by a thick, dense membrane, which when removed left a bleeding surface. No history of contagion could be traced. There had been no constitutional symptoms noticeable,

and the membrane was confined entirely to the nose. At the time of writing the patient is doing well under local treatment.

Cultures made on blood-serum from bits of the membrane showed the Klebs-Loeffler bacillus in large numbers. One loopful from a blood-serum culture thirty-six hours old caused the death of a guinea-pig of about 350 grams weight in forty hours. The lesions were characteristic. There were much injection and edema at the point of inoculation; the pleural fluid was much increased; the adrenals were enlarged and dark-colored, and the retro-peritoneal glands were enlarged and injected.

CASE X.—George M., white, two years old, was sent by Dr. W. J. Freeman. The child applied for treatment at the dispensary of the Children's Hospital, on account of occlusion of the nostrils and a bloody discharge, first observed about five days before. Both nostrils were occluded by a dense membrane covering the entire surface as far as visible. There were no general symptoms, the child being perfectly well apparently. No history of contagion could be traced. Cultures on blood-serum were made from the false membrane, and the Klebs-Loeffler bacillus was found present in large numbers. One loopful of a pure culture on blood-serum forty-eight hours old killed a guinea-pig of 350 grams weight in sixty hours, the lesions being typical. There were considerable edema and thickening about the site of inoculation. The adrenals were enlarged, dark-colored and congested, and the retro-peritoneal glands were much enlarged. There was no increase in the pleural fluid.

This child is still under treatment and doing well under local applications only.

Through the kindness of Dr. W. J. Freeman I am enabled to publish the following cases, which are of unusual interest and importance, as it is likely

they represent a series of infections that started with the first child, who was sick with membranous rhinitis. It is to be regretted that the histories are not more complete as regards the bacteriologic examinations:

CASE XI.—Philip G., white, five years old, applied for treatment at the clinic of the Children's Hospital, on March 24, 1894, on account of a discharge from the nostrils that had been first noticed three weeks before. There had been no constitutional symptoms severe enough to attract attention, and relief was sought mainly for the "sore nose." The left inferior turbinated bone was found to be covered with a false membrane, and on the pharyngeal tonsil there was a muco-purulent exudate. The child made a good recovery under local treatment, the fauces did not become involved, and there were no sequelæ.

The bacteriologic examination was made by Dr. W. S. Carter, who found the Klebs-Loeffler bacillus present. The degree of virulence was not ascertained.

CASE XII.—Elizabeth G., white, eighteen months old, a sister of Case XI, applied for treatment at the Children's Hospital on May 1, 1894, on account of a thick discharge from the nostrils, first noticed the previous week. There was a membrane on both sides of the septum and on both inferior turbinated bones. Local treatment was employed, and after several weeks the child was discharged, apparently well, though it was found to be impossible to examine the naso-pharynx thoroughly, and it is here that the membrane is apt to remain after it has disappeared from the more-readily accessible parts. On August 27, 1894, the child was brought to the medical dispensary of the Children's Hospital

on account of a swelling of the throat. It was admitted to the wards, but on the following day the evidences of diphtheria were so marked that it was transferred to the Municipal Hospital, from which institution it was discharged on October 2d. There is no record of a bacteriologic examination in this case when the nose only was affected. When the throat became involved an examination was made by Dr. W. S. Carter, and the Klebs-Loeffler bacillus was found. During the first attack there were no constitutional symptoms of any moment.

On October 5, 1894, Annie G., nine years old, a sister of Cases XI and XII, was brought to the Children's Hospital, complaining of headache, pain in the eyes and throat, and dyspepsia, the symptoms dating from the day before. There was a fibrinous exudate from the crypts of both faucial tonsils, and from the lacunæ of the right lateral fold, while the pharyngeal tonsil was acutely inflamed. Cultures made from the exudate on the tonsils showed the Klebs-Loeffler bacillus, and the child was transferred to the Municipal Hospital. On October 30th she was discharged.

On October 6, 1894, Helen K., white, ten years old, applied to Dr. Freeman's clinic at the Polyclinic Hospital for treatment, complaining of sore-throat. An exudate from both faucial tonsils was found, and a slight deposit on the pharyngeal tonsil. The cervical glands were somewhat enlarged. There was no more prostration than is usually seen in cases of lacunar tonsillitis. On October 9th a slight exudate was seen on the left anterior half-arch, and this had increased by the next day. On October 10th the child was sent to me, and cultures were made on blood-serum from the patch of exudate on the half-arch, which contained the Klebs-Loeffler bacillus in large numbers. The patient recovered under local treatment, and cultures made on Octo-

ber 22d showed no Klebs-Loeffler bacilli. She lived in the same house with the three preceding cases, and was a playmate of Annie G.

Several of the authors quoted as having reported cases of membranous rhinitis do not give the number or the details, so that I have not been able to ascertain with accuracy the total number on record. I have collected in all about seventy-seven cases, including those given in this paper; but these figures are no doubt smaller than they should be. In forty-one there is a clear record of a bacteriologic examination, and in thirty-three the Klebs-Loeffler bacillus was found, while in one the result was doubtful. In several other cases the membranes were examined, and found not to differ from those of diphtheria. In all of the cases the disease ran a benign course, and in all but a few the membrane was limited exclusively to the nose, and the constitutional symptoms were not marked or were entirely absent.

It is important to note these facts, as many writers regard the absence of constitutional symptoms and the limitation of the membrane to the nose, with no disposition to extend to the fauces, as cardinal points in the diagnosis from diphtheria. I believe the histories here given will show this idea to be fallacious. The most virulent cultures of the Klebs-Loeffler bacillus have more than once been obtained from those patients in whom the general disturbance was very slight or entirely absent. For this very reason these cases are especially dangerous, as there is little or nothing to attract attention to them, and they are allowed to associate with playmates as usual.

In the great majority of cases, if not in all, the bacteriologic diagnosis is the only safe one, and I would urge that all should be considered as diphtheria until the contrary has been proved by cultural methods. In the meantime isolation and disinfection should be insisted upon. Should the Klebs-Loeffler bacillus be found present, it seems needless to say that these should be regarded as cases of diphtheria, and all the safeguards usually employed against this disease should be rigorously enforced.¹

[NOTE.—As this article goes to press there appears an important communication on the subject by Gerber and Podack (*Deutsches Archiv für klinische Medicin*, Band 54, Hefte 2 and 3, pp. 262-304), in which the nature of membranous rhinitis is discussed *in extenso*. Unfortunately time does not permit of an analysis of the contents being presented here; it must suffice to say that of five cases of *rhinitis fibrinosa* studied by them, the Klebs-Loeffler bacillus was found in all. The paper contains matter having an important bearing on other aspects of the subject.]

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¹ I desire to express my obligations to Drs. Randall, Freeman, Westcott, and Hammond, through whose kindness I have been able to study these cases, and who have courteously furnished the clinical histories, with permission to publish them; and to Dr. A. C. Abbott, First Assistant at this Laboratory, who has taken much interest in the work, and to whom I am indebted for valuable advice and assistance.

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