SINUS THROMBOSIS

Thrombosis of the cavernous and circular sinuses gives rise to marked eye symptoms, such as edema of the lids and exophthalmos. These cases are more frequently referred to the ophthalmologist than to the rhinologist and surgeon.

BRAIN ABSCESS

The symptoms which lead one to suspect an abscess of the frontal lobe of the brain are persistent headache, slight elevation in the temperature, pulse slow, possibly choked disc and a blunted mental activity, as apparent delay in comprehending the questions asked and slow response. I believe that there is a field as yet insufficiently developed, namely, skiagraphy, by which we shall be able to determine abscesses of the brain. I do not pretend to say that every novice in the use of x-rays can make a plate which will show an abscess when it exists, but I do believe that, if an opportunity were given to a few of the experts in this line of work to skiagraph patients with brain abscess, the radiographer would soon learn the proper tube and time of exposure so that in many cases brain abscess might be accurately located by this method.

OPERATION

The operative technic which has been most satisfactory to me in exploring the sinuses has been what is known as the ethmoidal route. Skin incision begins beneath the eyebrow at the supraorbital notch, is carried in a curved direction downward midway between the inner canthus of the eye and the dorsum of the nose, and terminates at the middle portion of the nasal bone. The periosteum is peeled forward and backward, the capsule of the orbit freed from its attachment to the inner wall of the orbit. With chisel, mallet and rongeur forceps the nasal process of the superior maxilla is cut away, opening at once into the anterior group of ethmoid cells. By following this back through the whole of the ethmoid labyrinth and opening and enlarging the sphenoid sinus one traverses and explores very thoroughly the region from which the majority of infections reach the cranial and orbital cavities. The operation is a bloody one and should be performed only by one who has acquired the ability to reflect light into the cavity so as to see into the depths of the ethmoid and sphenoid regions. By this route one is working parallel with the floor of the cranium and is much less likely to perforate the floor than by the maxillary route which is advocated by some. This exposure enables one to remove the floor of the frontal sinus and by means of probe to explore the frontal sinus, and in that way to determine whether this cavity may be the seat of the trouble. If this is found to be the case, then a horizontal incision through the eyebrow with the elevation of the periosteum over the frontal bone and the removal of the entire anterior wall of the frontal sinus is indicated. As many of these patients are desperately ill, it is exceedingly important that whatever operative procedure is undertaken shall be terminated as quickly as possible. The shock of a short operation is much less than that of a long one. In my opinion, it has been advisable in these cases not to attempt to do the most thorough operation that one does in chronic suppurative sinusitis without cranial complications, but to exenterate all the cells as quickly as possible, introduce iodoform gauze drainage through the opening, and leave the wound

open without any attempt at suture. Should the patient recover from his acute symptoms, secondary suturing may be done in the course of a few days with but little more scar than if the wound had been closed at the time of operation.

53 West Fifty-sixth Street.

[THE DISCUSSION ON THE PAPERS OF DRS. HARTLEY, McKERNON AND COAKLEY WILL APPEAR NEXT WEEK WITH THE OTHER PAPER IN THE SYMPOSIUM ON CRANIAL TECHNIC, THAT OF DR. CUSHING.]

DIPHTHERIA "CARRIERS"

THEIR DISCOVERY AND CONTROL*

MYER SOLIS-COHEN, A.B., M.D.

PHILADELPHIA

The part played by the sanitarian in the control of contagious diseases is a most difficult one. On the one hand, the public resents any infringement on its personal liberty, and many physicians object, on scientific or other grounds, to whatever restrictive measures are enforced. On the other hand, reliance is placed by both the public and the profession on the precautions adopted by the health authorities, whether sufficient or insufficient, in consequence of which a false sense of security is often imparted.

Of no disease is this truer than of diphtheria. When the sanitary officials have disinfected the premises and removed the placard after recovery from this disease, all danger of infection is believed to be ended. The feeling of safety is the same whether this be done on the attending physician's statement that all clinical evidence of diphtheria has disappeared or only on bacteriologic evidence that the bacilli no longer are present.

That fomites infected by a diphtheria patient may transmit the disease to others all seem to recognize. Terminal disinfection of the sick room and its contents, therefore, is universally employed. Seldom, however, is any effort made to discover and disinfect animate carriers of the contagion. Yet it has been shown repeatedly that Klebs-Löffler bacilli from a diphtheria patient may be deposited on the skin or mucous membrane of persons coming in contact with him, and that throats so infected may retain the organisms for weeks and months.

PROPORTION OF "CONTACTS" INFECTED

During the past four years I have discovered diphtheria germs on the throats of many healthy persons who had been in contact with persons suffering from clinical diphtheria. These so-called infected "contacts" or diphtheria "carriers" were found in orphanages and homes, in public schools and in private dwellings.

The healthy inmates of several homes for children were examined bacteriologically during nine different outbreaks of diphtheria, as many as 124 being examined on one occasion and as few as two on another. The percentage found infected varied from 50 to none, the average for the nine epidemics being 9.14 per cent. Altogether, 269 individuals were examined, of whom 35 (13 per cent.) harbored the germs. On four occasions children suffering from sore throat were examined, the greatest number tested at one time being eight and the smallest four. The percentage harboring diphtheria

* Read in the Section on Hygiene and Sanitary Science of the American Medical Association, at the Fifty-ninth Annual Session, held at Chicago, June, 1908.

bacilli, and in consequence regarded as cases of latent diphtheria, varied from 100 per cent. to 33.3 per cent., the average being 62.5 per cent. Of the 22 examined altogether 12 (55 per cent.) had latent diphtheria.

In eleven private dwellings, where one of the family was sick with diphtheria, the healthy inmates were cultured, from eight to one being tested at a time. The percentage infected was 100 per cent. in three instances and zero in one, the average of the eleven being 57.3 per cent. The total number examined was 40, of which 22 (55 per cent.) were infected. In four of these houses persons with sore throat were similarly investigated, the number in each house not exceeding four and in one instance being as small as one. From 66.6 per cent. to 100 per cent. of cases of latent diphtheria were discovered, the average being 91.6 per cent. Of the 10 examined the report was positive in 9 (90 per cent.).

In a block where several cases of typical and latent diphtheria had occurred, three children who were suffering from sore throat were examined, two (66.6 per cent.) proving to have latent diphtheria.

Twenty-three school children who had been in contact in the class room with a child convalescent from latent diphtheria and with one who subsequently developed the disease, and who themselves exhibited reddened fauces or enlarged tonsils, were examined bacteriologically, but only one (4.3 per cent) was found infected. The details of all these cases may be obtained from the histories appended.

The figures just given correspond fairly well with those of other observers. These latter have recently been compiled by Graham-Smith.¹ According to them 66 per cent. of the members of the family to which the diseased person belonged were infected, the proportion being higher (100 to 50 per cent.) in families in which no precautions were taken to isolate the sick and much lower (10 per cent.) when every precaution was taken. Of the more distant relatives examined, 29 per cent. were found to be infected. Bacilli were found in 37 per cent. of persons in attendance on the sick. Observations on the inmates of hospital wards and institutions showed that 14 per cent. are likely to give positive cultures when diphtheria occurs among them. In infected schools 8.7 per cent. of the scholars were found to be harboring the germs.

THE INFECTED "CONTACT" A SERIOUS MENACE

An infected "contact" may later develop diphtheria, typical or latent, or he may remain healthy. In either instance he is capable of transmitting virulent bacilli to others, who may then develop clinical diphtheria in a mild or a severe form, or, remaining healthy, may themselves act as diphtheria "carriers." Consequently, the infected "contact" is as great a menace to the public health as is a patient convalescent from diphtheria; for in the one, as in the other, it is the presence on the mucous membrane of diphtheria bacilli that makes them a source of danger. In point of fact, the former is even the more dangerous, for he goes about among healthy people unrestrained, while the convalescent usually is isolated until the bacilli disappear from his throat.

I believe that it is the latent and "carrier" cases that are mostly responsible for the prevalence of diphtheria in cities where the usual precautions are taken in regard to clinical cases that are reported or "notified" to the health authorities. Not until these hitherto unrecognized

cases are discovered and removed as sources of contagion will much headway be made in checking the spread or preventing the occurrence of diphtheria.

In a large proportion of diphtheria cases the source of the infection is unknown, the patient never having been in contact with the disease; and yet in every instance there must have been some contact with an animate or inanimate carrier of the Klebs-Löffler bacilli. Is it not fair in these cases to assume that the sick person has been in close proximity in the street car, shop, factory, office, class room or dwelling with an unrecognized case of latent diphtheria or with an infected "contact" or diphtheria "carrier"?

I have tabulated, with a view to ascertaining their possible sources of infection, 268 cases of typical diphtheria and 130 cases of latent diphtheria that I have investigated, most of them in my capacity as assistant medical inspector of the bureau of health.

By typical diphtheria I mean cases with pseudo-membrane. I regard as suffering from latent diphtheria all persons giving positive cultures who exhibit some pathologic condition, local or general, unassociated with pseudo-membrane. Healthy infected persons I term infected "contacts" or diphtheria "carriers." The cultures were examined by the city bacteriological laboratory, which judges the organisms according to morphology alone. It is possible that in some instances what I have called latent diphtheria may have been cases of ordinary tonsillitis in whose throats a non-virulent diphtheria-like organism chanced to be present. It is only fair to state that from ten of these so-called cases of latent diphtheria discovered in school during a diphtheria epidemic pure cultures were isolated and inoculated into guinea-pigs. Only two of the pigs died and in but one were Klebs-Löffler bacilli recovered at autopsy. Considerable time elapsed, however, in many instances between the dates of the first culture and the one that was tested for virulence, seventeen days intervening in one case. It is conceivable that virulent Klebs-Löffler organisms may have been present at first and were replaced later by non-virulent bacilli, as is the usual occurrence in true clinical diphtheria. Still, from the public health standpoint, I feel that these doubts are outweighed in importance by the fact that virulent bacilli remained for twenty days on a boy's throat despite vigorous antiseptic measures and that seven persons with latent diphtheria gave typical diphtheria to others.

TABLE SHOWING POSSIBLE SOURCES OF INFECTION

	Typical Diphtheria.		Latent Diphtheria.	
	No. Cases.	P.C.	No. Cases.	P.C.
Total number of cases investigated.....	268		130	
Case of typical diphtheria in same house.....	57	21	23	17.5
Case of latent diphtheria in same house.....	8	3	4	3
Infected "contact" diphtheria in same house.....	5	2	1	1
Case of sore throat in same house.....	12	4.5	6	4.5
Case of typical diphtheria in same school or Sunday school.....	29	11	20	15.5
Case of latent diphtheria in same school or Sunday school.....	10	4	56	43
Case of typical diphtheria in same factory.....	0	0	1	1
Case of typical diphtheria in same street.....	3	1	3	2
Case of typical diphtheria in school at- tended by other members of family.....	14	5	0	0
Case of latent diphtheria in school at- tended by other members of family.....	1	0.5	0	0
Case of typical diphtheria in Sunday school attended by other members of family.....	2	1	0	0
Inmate of institution with no history of recent known contact.....	14	5	1	1
No history elicited of direct or indirect contact as above (exclusive of inmates of institutions).....	113	42	15	11

1. "The Bacteriology of Diphtheria." Edited by G. H. F. Nuttall and G. S. Graham-Smith, Cambridge, 1908.

In most of the cases of typical diphtheria where no history of direct or indirect contact was elicited no inquiry was made as to the existence in the house of cases of sore throat. Many attended schools outside of my district (which included about one-fiftieth of the population of Philadelphia). Not being acquainted with conditions in those schools, I did not know whether or not cases of diphtheria had occurred there. Probably more attended infected schools than the figures show. Had cultures been taken of the cases of sore throat existing in the same house with the patient many doubtless would have proved to be instances of unrecognized latent or mild diphtheria.

Patients who attended schools where pupils had recently been stricken with diphtheria did not necessarily contract the disease from those pupils. It is possible that some may have been infected by unrecognized cases of latent diphtheria or by healthy diphtheria "carriers" who were attending school in ignorance of their infectivity and who may themselves have been infected by the first cases that occurred. In like manner, when other members of the family attended schools where diphtheria was prevalent they may have become infected, though remaining healthy, and may thus have brought the germs home to the susceptible children. Enough has been shown, at any rate, to demonstrate how great a factor in the spread of diphtheria is the unrecognized human carrier of contagion.

DISCOVERY AND CONTROL OF INFECTED "CONTACTS"

The one thing, however, that probably more than any other prevents public health officials from taking action in regard to the infected "contacts" is the knowledge that healthy persons may have in their throats diphtheria-like bacilli indistinguishable, morphologically, from virulent Klebs-Löffler bacilli, but which, nevertheless, are harmless. Many bacteriologists regard these as varieties of or attenuated or modified Klebs-Löffler organisms. Others believe them to be completely distinct from the latter and refer to them as the Hoffman or pseudo-diphtheria bacilli. Whichever view is accepted, the fact remains that non-virulent diphtheria-like bacilli frequently are present on the throats of healthy persons.

Depending on cultural tests alone, such persons, when found in the same house with a diphtheria patient, would naturally be looked on as infected "contacts," and when suffering from sore throat could easily be mistaken for cases of latent diphtheria. It is no wonder, therefore, that health authorities hesitate before applying restrictive measures to those inmates of a diphtheria house whose throats may give positive cultures.

However, as I recently pointed out,² the consensus of opinion among bacteriologists and sanitarians is that the diphtheria-like bacilli found in the throats of healthy persons who have not been in contact with cases of diphtheria, typical or latent, or with infected "contacts" are practically always non-virulent. On the other hand, the diphtheria-like bacilli found in persons who have recently been in contact with the disease are usually virulent.

Consequently, public health officials would undoubtedly be justified in demanding that the inmates of an institution, hospital ward or private dwelling which contains a diphtheria patient be examined bacteriologically, and, if found infected, be isolated until the bacilli disappear. But owing to the possibility of the organisms

being non-virulent, I think that inoculation tests on guinea-pigs should be made when requested by a healthy infected "contact" or by his physician, and, in the event of the animal surviving, that all restrictions should be removed.

The measures here recommended I have been carrying out whenever possible since September, 1906. While attending a case of diphtheria I invariably take cultures of the throats of all the inmates of the house. In institutions and dwellings that I visit as medical inspector, however, I am permitted to take cultures only when the attending physician requests it. All persons found infected are confined to the house; many are isolated; a few are sent to the hospital.

The beneficial results of such a procedure and the unfortunate consequences of its omission may be seen from the appended histories of epidemics that have occurred at various times in institutions and private families. Institution A, for instance, had experienced prolonged epidemics despite the fact that every recognized case of diphtheria was sent to the hospital and the building disinfected. But when all the children were examined bacteriologically and those found infected isolated, spread of the disease was speedily checked. The reverse occurred in Institution B. On one occasion discovery and isolation of the infected "contacts" had brought an epidemic to an early termination. At a subsequent outbreak, when this was not done, the disease persisted for several months. In both institutions children who had been immunized contracted diphtheria after the effect of the antitoxin had worn off.

Protective doses of antitoxin were always administered to the healthy inmates and unquestionably were an important aid in fighting the epidemics. Their greatest value, in my opinion, lies in protecting the non-infected healthy children from the infected healthy children, and in protecting the latter from themselves. The antitoxin does not influence the bacilli, which still persist in spite of it.

Infected children, despite their immunization, remain dangerous to all unprotected persons with whom they come in contact, and even, as soon as the period of immunity has expired, to those who have received prophylactic injections. In Institution E, infected "contacts" gave typical diphtheria to children admitted to the Home subsequent to the immunization, to a servant who had refused the antitoxin and even to inmates who had been protected two months previously. Hence the necessity of discovering the diphtheria "carriers" and isolating them until bacteriologically clean, in addition to general immunization.

Routine bacteriologic examination of all those living in a house where diphtheria has occurred will sometimes disclose the original source of infection, as happened in house infection C.

When secondary cases arise in a family where one member has had diphtheria the disease is not necessarily communicated by the patient, but may be transmitted by a healthy infected "contact." This is clearly shown in house infection A.

That persons who have never been near a case of clinical diphtheria may contract the disease from a diphtheria "carrier," house infections B and H give ample evidence.

The latter also illustrates how persons become infected in an industrial establishment and remaining healthy themselves may yet give diphtheria to others.

2. Latent Diphtheria a Public Health Problem, *THE JOURNAL A. M. A.*, July 6, 1907, xlix, 30.

Without asserting any relationship between cause and effect, I merely mention the fact that during an epidemic of diphtheria, in the course of which I discovered and isolated many cases of latent diphtheria, there were markedly fewer cases of typical diphtheria in my district than in an adjoining district where such measures were not carried out.

Appended will be found detailed histories of epidemics in institutions and private dwellings with brief accounts of the culturing of healthy contacts.

CONCLUSIONS

1. Persons coming in contact with a diphtheria patient frequently have virulent Klebs-Löffler bacilli deposited on their mucous membranes.
2. Such infected "contacts" may later develop diphtheria or, remaining healthy, may act as diphtheria "carriers," transmitting the bacilli to others who thereupon may develop the disease or may themselves become diphtheria "carriers."
3. To prevent their becoming a source of danger to others, diphtheria "carriers" should be isolated until bacteriologically clean.
4. Recognition of the infected "contacts" must precede their control. This can be brought about only by taking cultures of the throats of all the inmates of a house where diphtheria exists.
5. Little progress need be expected in the prophylaxis of diphtheria so long as we neglect the animate carriers of the contagion.

DIPHTHERIA EPIDEMICS IN INSTITUTIONS

In all these institutions, whenever a child presented a suspicious throat it was immediately isolated and as soon as a diagnosis of diphtheria was made it was sent to the hospital. The building was always disinfected on the following day.

Institution A, consisting of a large central building, two cottages and an infirmary. Between May 11 and 20, 1904, four cases of diphtheria occurred. On May 26 I examined six children who had tonsillitis, with positive culture results in four (66 per cent.). Two days later, and again in three days, a diphtheria patient was removed to the hospital. Then forty-eight inmates were immunized but no cultures were taken. Two of these subsequently developed diphtheria, one on June 3 and the other on June 25. An assistant caretaker was stricken on Sept. 12, 1904.

The orphanage then remained free of the disease until Oct. 29, 1906, when a case developed and was removed two days later. The other children, 124 in number, all healthy, were examined bacteriologically and thirteen (10.5 per cent.) were found infected. Eleven did not retain the germs long, but one gave positive cultures for two weeks and another for over three weeks despite vigorous antiseptic measures. The infected children were each given 3,000 units of antitoxin and the rest were immunized. No subsequent cases arose.

An epidemic of scarlet fever began shortly afterward, the patients being sent to the municipal hospital for contagious diseases. On January 13 two cases of diphtheria were reported, another on the seventeenth, and two more on the nineteenth. Cultures taken on January 14 of two children who had been in contact with the patients proved negative. On January 20 the whole institution was immunized and cultures were taken of six children who had sore throats, two being found in-

fect. A child who had not been cultured developed latent diphtheria two days later.

On May 24, 1907, three days after a boy had returned from the infirmary where he had been eighteen days with tonsillitis, another boy in the same cottage contracted diphtheria. A culture taken of the one who had had tonsillitis was positive. All the boys in the cottage were immunized. A case developed on June 24 and another on September 1. On each occasion prophylactic doses of antitoxin were administered to all the children in the infected cottage.

Institution B, a colored home occupying a converted house. On July 11, 1906, two children developed diphtheria, two more cases occurring on July 14. The other children were neither examined nor immunized.

On Oct. 10, 1906, a child contracted diphtheria. The physician in charge, Dr. John M. Swan, took cultures of all the inmates, 36 in number. Six (20 per cent.) were found to be infected. All of these exhibited enlarged lymph nodes on the posterior pharyngeal wall. All but one had enlarged tonsils and a frequent pulse. Only one showed membrane. None complained of headache.³ The infected children were isolated and their throats treated antiseptically. The bacilli persisted in some for a long period.

On March 14, 1907, another case of diphtheria developed. A different physician was in charge, who took cultures only of suspicious cases. Of eight persons with sore throat examined at various times three gave positive cultures. One whose culture was then negative subsequently developed another attack of tonsillitis at which time Klebs-Löffler bacilli were found. All the inmates were immunized on April 3. The germs persisted in one of the cases from March 29 to May 20.

On April 10 another case developed that was not bacteriologically clean until June 5. On June 25 a child who had been immunized developed diphtheria and remained infected until June 18. At no time were cultures taken of the healthy children.

Institution C, a large children's home, having a large building and a separate isolation building. On Feb. 24, 1906, the son of the superintendent was reported sick with diphtheria, and cultures taken on the same day of three suspicious cases showed two of them to be also suffering with the disease.

Two days later nine children with measles who were in the infirmary where the diphtheria cases were isolated were immunized and examined bacteriologically, and the following day sixty healthy inmates received similar treatment. None of the former and three of the latter gave positive cultures. Three more were examined March 1, one on March 3 and two three days later. All were negative.

The home was then free of the disease until Jan. 23, 1907, when a child developed diphtheria. Five of the most intimate "contacts" were cultured, but only one was found to be infected, although another had dull gray patches on both tonsils. The former was isolated until bacteriologically clean. All the more intimate "contacts" were immunized. No case has occurred since.

Institution D, a home for colored crippled children, consisting of two converted dwellings. A nurse developed diphtheria in the fall of 1906, and seven children that showed some abnormality were examined, bacilli being found in three. These were isolated, and all the inmates were immunized. No more cases arose

3. I am indebted to Dr. Swan for these notes.

for nearly two years, a sporadic case occurring in March, 1906.

While at school, Oct. 16, 1906, a child from the home was examined by the medical inspector who was examining the members of her class on account of the prevalence of typical and latent diphtheria among the pupils of that school. Although her throat was only slightly inflamed and received constant treatment, the bacilli persisted for three weeks. On November 4 a child developed fever, vomiting and sore throat, associated with the presence of Klebs-Löffler bacilli, but without membrane formation. The twenty inmates were examined, four being found infected, of whom two had enlarged tonsils.

November 6 a nurse became sick and gave a positive culture, although no membrane was present. She was sent to the hospital and fumigation was ordered. Two weeks later a boy developed typical diphtheria and the following day another infected "contact" was discovered. The home has been free since.

Institution E, a children's home utilizing a large mansion. A sporadic case developed in March, 1905. On Oct. 6, 1907, a child took sick, was treated for "croup" without any precautions being ordered and twenty-four hours later diphtheria was diagnosed. On this day another sick child was said to have "stomach trouble" and was allowed to mingle with the other children until the next day, when a diagnosis of diphtheria was made. All the children in the home were immunized by the medical inspector, who, however, gave 3,000 units to one who seemed feverish, with foul breath, reddened fauces and secretion in the tonsillar crypts. The inspector ordered this boy isolated and his physician summoned. The latter's first impression was that the boy had diphtheria, but as all signs rapidly cleared up he decided that the lad merely had been frightened by the injection.

Another child took sick the morning after he was immunized, complaining of headache but showing nothing abnormal in his throat. Fearing diphtheria, the physician had the child isolated, but as all the symptoms disappeared in a day he finally believed that the boy did not have diphtheria. At the medical inspector's request, however, he took cultures of these children. Both were positive and remained so for eleven days, the boys then being sent to the hospital.

On December 6 of the same year a child that had been admitted to the home only five days previously seemed droopy, and four days later exhibited a false membrane. The physician then examined a child who had been in the home but a few weeks and who for four days had been suffering from a "cold" and one who had been immunized two months before and who was not feeling well, although neither complained of sore throat. Both showed evidence of diphtheria. The other children were promptly immunized. Cultures were taken of eight who had slightly reddened throats, four proving positive and being thereupon sent to the hospital. A chambermaid who had refused to be immunized developed diphtheria two weeks later.

Diphtheria Epidemic in a Block.—Two children in a family developed diphtheria in July, 1906, one going to the hospital, the other remaining at home. The mother, who nursed the latter, gave a negative culture, but a sister, who was healthy and whose throat was clear, was found on July 27 to be harboring the germs. Two months later a culture was still positive. The

yard of this house faces the yards of the houses on the next street.

In one of these houses a boy took sick Sept. 5, 1906, with sore throat. Four days later he was seen by his physician, who diagnosed "abscess in the throat." The child went about the neighborhood. A culture taken on September 15 showed Klebs-Löffler bacilli. The throat was reddened and the tonsils appeared enlarged when palpated externally. The cultures continuing positive, the boy was sent to the hospital.

September 10 his brother was taken with fever, vomiting and diarrhea. The attending physician noticed nothing abnormal in his throat, but thought he detected some pulmonary consolidation, and suspected the existence of typhoid fever. September 15 I was asked to see the patient, and on looking at the throat observed a small, gray, non-typical patch on the right tonsil. The child was very weak. A diagnosis of diphtheria was made and the lad was sent to the hospital, where the diagnosis was confirmed. The culture I took, nevertheless, was negative, but there was a large amount of mucus in the throat at the time.

The mother, who nursed both children, and who herself had a sore throat, gave a negative culture. Another healthy brother was likewise free from germs. A sister had a sore throat from the afternoon of September 16 to the morning of September 17. The mother, who looked at her throat, said it was reddened, but that nothing else was wrong. The girl felt perfectly well, and when I examined her on the evening of September 17 the throat was clear. A culture taken at this time was positive. This girl was working in the kitchen of an apartment house until the report of the culture was received.

September 17 I visited every house on the block and took cultures of all who were suffering or who recently had suffered from sore throat. A little boy living next door to the above mentioned case had been ill with sore throat and gave a positive culture. A boy living two doors away, who had played with the infected children and who had had sore throat, was bacteriologically clean. A child living further down the block, who had played with the infected children and who had a slight sore throat with slightly reddened fauces, was found to be harboring diphtheria bacilli which persisted for over seventeen days. Her mother, who had suffered from pain and stiffness in the side of the neck, was free from germs on September 19.

DIPHTHERIA IN PRIVATE HOUSES

House Infection A.—A child whose mother was a disciple of Dowie died of diphtheria without having received medical attention. After the child's burial the whole house was thoroughly fumigated. Cultures were taken on Dec. 14, 1906, of four children, and on December 18 of the mother and of two elders of the church who had prayed over the child. Only one was positive, that of a sister, R., whose tonsils were enlarged and reddened. All the others were healthy. The mother would not permit immunization nor would she allow the infected child to use an antiseptic gargle or spray or to be swabbed. The child was not isolated, although the bacilli persisted until December 25. The throats of all the children were examined visually and bacteriologically at frequent intervals.

On December 18 M.'s culture became positive. E. took sick on December 25. When seen by me on Decem-

ber 28 she had typical diphtheria, a pseudomembrane being present on the left tonsil. The culture taken December 28 was positive. At the request of the father, who was not a Dowieite, and despite the mother's protests, I assumed charge of the case, administering 2,500 units of antitoxin at once, 3,000 the day following and 3,500 the next day. The child was well on January 7, but despite frequent and vigorous swabbing with a strong formaldehyd solution, the bacilli did not disappear until January 20. The child's nurse and the mother, though healthy, gave positive cultures on January 12, but the next two cultures of both were negative. The father's throat contained no bacilli on January 12.

December 18 V.'s throat was still negative, but on December 28 the culture was positive. On this latter date the mother took the three children, R., M. and V., the last two being infected at the time, to the house of friends who were also followers of Dowie. A culture taken of M.'s throat was examined at the Pepper Clinical Laboratory of the University of Pennsylvania and pronounced positive. (All the other cultures were examined by the Bacteriological Laboratory of the Philadelphia Bureau of Health.) While away this child became sick and was sent back home. When examined by me on December 31 she was sick and complained of sore throat, but had no fever. No membrane was visible. I administered 1,500 units of antitoxin. On the next day the temperature was 99.2 F. and plugs of membrane could be seen in the crypts of the left tonsil. The same condition appeared in the opposite tonsil. The temperature remained slightly elevated for several days. On January 7 the child was well and bacteriologically clean. A culture of V. taken by his father at his retreat on January 13 was negative.

House Infection B.—A child had developed chronic lymphatic leukemia following an attack of diphtheria in December, 1906, and was being treated in a children's hospital. A case of diphtheria having broken out in the ward where the child lay, all the children there were examined and immunized. A number were found infected, including this case of leukemia. The child was sent home and came under my care on June 1, 1907. Despite antiseptic and hygienic treatment, the bacilli persisted until the child's death on June 17. June 8 the child was given 2,000 units of antitoxin in the hope that it might influence the leukemia, in view of the history.

June 15 the mother's median basilic vein was attached to the child's radial artery by Dr. George M. Dorrance and transfusion attempted. The mother suffered from shock and the evening following the operation had fever and sore throat, associated with the presence of a slight membrane. Antitoxin was immediately administered. A culture taken June 15 was doubtful, but one taken on June 16 proved positive. Cultures taken the following three days were negative. The husband was also examined, being found infected on June 17, but free from germs on June 19.

House Infection C.—The families of a brother and a sister lived in the same house. About April 4, 1907, P. C., the father of one family, was taken with sore throat which lasted all week. A day or two afterward his son, J. C., developed sore throat and headache. The latter was put to bed for a day and in four days felt all right. On April 9 a daughter, M. C., was taken sick with membranous croup and two days later was sent to

the hospital. On the following day the house was disinfected.

I immunized all who would permit it, and took cultures of their throats. The father, P. C., still complained a little of sore throat. The fauces were reddened and the cervical glands were slightly enlarged. The culture taken April 1 was positive and inasmuch as the cultures continued positive for thirty-eight days, despite faithful antiseptic treatment, the man was sent to the hospital. The boy, J. C., when examined April 12 felt well and his throat was normal, but his cervical glands were markedly enlarged. A culture taken then proved positive, but cultures taken ten and twelve days later were negative.

A. McG., of the other family, although perfectly healthy, gave a positive culture on April 12 and it was not until May 11, one month later, that the first negative culture was obtained. The mother of this girl, C. McG., the brother, B. McG., and the sister, M. McG., gave negative cultures on April 12, as did M. C. and H. C. of the other family. This last child, H. C., subsequently developed a mild attack of diphtheria on May 5, twenty-three days after immunization. Diphtheria bacilli were present in her throat on May 7, and as they still persisted on May 22 the child was sent to the hospital.

House Infection D.—About March 17, 1907, H. P. had tonsillitis. Two days later her brother, F. L., had a similar attack. March 26 another brother, L. L., took sick with what was reported to the board of health five days later as suspicions of diphtheria. March 31 the latter's twin, H. L., took sick.

The whole family was examined and immunized on March 31. All of them, the four mentioned above, the mother and another brother, the last two perfectly healthy, were found to be infected. The girl, H. L., kept giving positive cultures up to May 3, a period of thirty-four days. F. L. gave negative cultures after April 12. The twin babies, L. L. and H. L., were sick. L. L. gave positive cultures from March 29 to May 9, a period of six weeks. The last positive culture from H. L. was taken April 12. J. C. gave his first negative culture on April 12. Antiseptic gargles were used by the older children. The babies were swabbed.

House Infection E.—In September, 1906, a little girl suffered with diphtheria in the family summer residence in the country, after which the house was disinfected. A month or so after the family had returned to the city the gardener's child, who had remained in the country, was stricken with diphtheria. About March 1, 1907, the baby of the family which had moved to the city was taken ill with diphtheria.

The rest of the children, seven in number, were at once immunized and removed to another house, where they were placed under my care. Two were found to be free of germs on two successive tests. One gave a negative culture on March 4, positive cultures on March 7 and 10 and negative March 13 and 14. Two gave a positive culture at first, followed by two successive negative cultures. Another gave a series of two positives, followed by two negatives. The one who had been sick in the fall was also found to be harboring diphtheria germs which persisted for two weeks.

The infected children were isolated until two successive negative cultures were obtained, meanwhile gargling and being swabbed with antiseptic solutions. The sick child's nurse and his mother, who was con-

stantly with him, were examined March 18 with negative results. Later, however, before the germs had left the sick child's throat, the mother contracted diphtheria. No cases have occurred since.

House Infection F.—A boy had a mild attack of diphtheria, unrecognized at first. The whole family was examined bacteriologically, the bacilli being absent in the mother, one brother and one sister. Another brother, although healthy, gave a positive culture and remained infected from November 20 to December 17, 1907. Another sister, whose culture was positive, later went through a typical attack of diphtheria, followed by paralysis of the soft palate. No other case resulted in this group.

House Infection G.—A little girl, G. R., was absent from school the week of Nov. 11, 1904, on account of sore throat, but received no medical attention. A child living next door also had sore throat. On November 22 J. R.'s two sisters, F. R. and H. R., developed diphtheria. A brother, P. R., who had left the house on November 24, was taken sick with the disease four days later.

House Infection H.—A girl working in a candy factory contracted diphtheria. Shortly afterward the daughter of the forelady of the sick girl was also stricken with the disease. A culture taken of the forelady proved positive. Although the latter was perfectly healthy and gargled assiduously, the next eight cultures were still positive, the daughter having recovered and been free from germs two weeks before the mother was bacteriologically clean.

House Infection I.—Sept. 7, 1904, a boy contracted diphtheria. Two sisters were immediately sent from the house, but continued attending school. The throats of both were examined visually and bacteriologically September 19. One was normal in every way. The other had no subjective symptoms, but presented greatly enlarged and reddened tonsils and gave positive cultures for twenty-two days.

House Infection J.—The mother and the sister, both healthy, of a diphtheria patient were examined for the Klebs-Löffler bacilli, which were found present in both persons.

House Infection K.—Cultures were taken of the mother and two brothers of a diphtheria patient. One brother was infected, the others were not. All were healthy.

LATENT DIPHTHERIA IN PRIVATE FAMILIES

The healthy brother of a person with latent diphtheria was found to be harboring the germs. Cultures taken of two healthy sisters of a person with latent diphtheria both proved negative.

SCHOOL CONTACTS

A girl, J. R., probably convalescent from latent diphtheria (see House Infection G) was in school from Nov. 21 to 23, 1904. Her sister, F. R., who developed typical diphtheria November 22, had been in school that same day. All the children in the same classes with these girls were examined by the medical inspector and cultures were taken of all those that exhibited reddened fauces or enlarged tonsils. Of the seven cultures taken in J. R.'s class all were negative. Twelve of F. R.'s classmates were examined bacteriologically; only one was found infected. Four children from other classes tested at the same time were all found to be free from germs.

BISMUTH PASTE IN THE TREATMENT OF SUPPURATION OF THE EAR, NOSE AND THROAT

JOSEPH C. BECK, M.D.

CHICAGO

The use of bismuth paste in general surgery has been followed with such excellent results that, except for the fact that the nose and middle ear and their accessory cavities are non-collapsible and lined with mucous membrane, one might reasonably expect equally good results in the treatment of chronic suppurations of the nose, throat and ear. Nevertheless, my results have been so satisfactory and encouraging that I desire to present my efforts to the profession.

I began to employ the paste shortly after Dr. Emil Beck noticed cures in his cases of chronic suppurative fistulas and abscess cavities; that is, about one year ago. During this period I have treated 319 cases, which are classified in the accompanying tables, and the results of treatment noted.

Judging from the manifold varieties of pathologic conditions in which I employed the paste, one may be led to believe that my enthusiasm has carried me too far, and that I am trying to apply the bismuth paste as a panacea for all ills. I acknowledge that I am enthusiastic, but I have never employed a treatment with as much satisfaction as this one.

It will be well to define beforehand what is meant by a cure of a chronic suppuration of the accessory cavities of the nose and ear. To my mind, when the cavities have stopped discharging pus, the mucous membrane appears healthy and the functions of smell, taste and hearing return, as well as the symptoms of pressure and obstruction disappear, one may accept that as a cure. We all know that perfect resolution is not to be expected, owing to some fixed changes and destructions, as necroses, adhesions and atrophies.

I have taken radiograms in some of the cases showing the frontal sinus, ethmoid, antrum and sphenoid before and after being injected, in order to determine how long the bismuth will remain in the cavities, but came to no definite conclusion.

TECHNIC

The principal point in the technic is to be able to reach the very depth and every part of the infected area. The necessary equipment consists of four varieties of the paste and the syringes, with various-shaped tips and canulas (Fig. 1).

PASTE 1	
Bismuth subnitrate	33
Vaselin	67
PASTE 2	
Bismuth subnitrate	30
Vaselin	60
White wax	5
Paraffin, melt 120°	5
PASTE 3	
Bismuth subnitrate	30
Vaselin	50
Paraffin	10
White wax	10
PASTE 4	
Bismuth subnitrate	30
Vaselin	35
Paraffin	25
White wax	10

The paraffin and white wax are added for the purpose of obtaining more firm preparations, when so specially indicated.