sary to give it for its systemic protection. Diphtheria antitoxin as a wet dressing was used in two cases, but without effect.

Acetic acid, suggested as a specific, was given a thorough trial in four cases, but was also of no value.

Two wounds cauterized for a few seconds with phenol were reported positive the next day.

The Carrel-Dakin method, applied very exactly in eight cases, was a failure in six. Two of the cases cleared up within forty-eight hours, but in my opinion they would have cleared up just as quickly under the iodine treatment. In the six failures the method was used over periods of from two to three weeks each, and these wounds cleared up very promptly after the Carrel-Dakin method had been discontinued and the iodine treatment instituted. Dakin's paste was not available. Dichloramin-T had previously caused so much skin irritation in the unit that its use had been discontinued by order.

II. BACTERIOLOGIC

BY MAJOR MORRIS

Entering on the discussion of this series of wound diphtheria cases from the point of view of bacteriology, pathology and hygiene, let me first call attention to the fact that we are well aware that not all of our series were infected with virulent diphtheria organisms. Owing to a dearth of laboratory animals, however, it was not possible to test the offending organisms for virulence. One that we did test proved beyond the shadow of a doubt that it possessed virulence to a high degree. Our criterion in branding wounds as infected with diphtheria bacilli was based purely on cultural methods, with the resulting study of the morphologic characteristics, and to some extent the biologic. We also realize the fact that a wound might contain diphtheria bacilli and yet not necessarily be a case of wound diphtheria, any more than diphtheria bacilli found in a clinically normal throat make that a case of throat diphtheria; yet as we consider the latter a "throat carrier," so must we consider the former "wound carriers."

We called diphtheria bacilli only such organisms as showed the typical morphologic characteristics, that is, those which showed when grown for from eighteen to twenty-four hours on Loeffler's blood serum medium as slender rods of practically uniform thickness except for the "clubbing" at both extremities. The stain used was Loeffler's alkaline methylene blue, and microscopically it showed the organisms taking a blue stain throughout except at the extremities. The bodies either appeared granular (fine) or had the striped appearance so often noted. The "clubbed" ends took on a more violaceous hue and were homogeneous. Some showed a central swelling.

Let me add the following data in proof of virulence: As is noted above in this paper, from Oct. 14 to Nov. 16, 1918, six clinical throat diphtheria cases and five carriers were discovered in Ward A-1. During December, 1918, five more true throat diphtherias and four more throat carriers were found in this ward. Up to this time, or rather up to Dec. 13, 1918, we followed the routine prophylactic course for eradicating diphtheria in the hospital by repeated throat cultures for the detection of carriers, and it was always an easy matter to find a carrier in this ward for reasons that will soon become apparent. Yet the incidence of throat infection continued unabated, despite repeated

culturing, quarantine, etc. The futility of the methods used is what prompted us to seek the cause elsewhere than in the throat. Accordingly, Dec. 13, 1918, all of the wounds in Ward A-1 were cultured on ordinary Loeffler's blood serum medium. Twenty-eight positive wounds were found, some of the patients having two or three positive wounds.

The following steps were at once taken: 1. Absolute quarantine of the ward was established, and by this is meant that no one was allowed to leave the ward except the ward surgeon and the nurses. Even the enlisted personnel employed in the ward were sequestered there. Food, clothing, etc., were brought to the door of the ward and left there. 2. Blankets, mattresses, pillows, bedclothing, etc., were all thoroughly sterilized, for here were materials that were undoubtedly harboring billions of the provoking organisms after coming into such intimate contact with badly infected dressings. From these infected bedclothes, etc., the organisms were carried far and wide by the hands and clothes of the patients, attendants and others. 3. Routine cultures of wounds and throats were taken both in this and in the other wards. 4. Schick tests were performed in this and other wards, but the value gained from this source was negligible. 5. Extra precautions as regards sterility of dressing instruments and dressings were taken.

Soon after the foregoing precautions were taken, the incidence of throat diphtheria fell. From Dec. 13, 1918, to Jan. 1, 1919, the record of throat diphtheria in Ward A-1 was two cases, one coming to light, Dec. 21, 1918, and the other six days later. Between Jan. 1 and Feb. 1, 1919, no cases of throat diphtheria developed in that ward, and the incidence of diphtheria throughout the entire hospital during that month was practically nil.

AN EPIDEMIC OF BRONCHOPNEUMONIA

ROENTGENOLOGIC STUDY

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During the recent epidemic of respiratory infection at this cantonment, arrangements were made to examine by screen or plate all cases of so-called influenza that were admitted to the base hospital. These examinations were undertaken because of the detection of many cases of mild bronchopneumonia during the routine examination of the chests of the draftees, of whom about 23,000 have been fluoroscopically studied for the tuberculosis board of Camp Lewis. In this study, many cases of bronchopneumonia of one or both bases were discovered. Each case was examined carefully, and each patient stated that he had been suffering with a cold for several days. Verification of the diagnosis of bronchopneumonia was obtained clinically.

So much assistance was afforded the clinician, that after a few weeks at the suggestion of Capt. Charles A. Ballard, all patients except those distinctly pneumonic were admitted to the observation ward and roentgenographed before being distributed to the different pneumonia wards. Those admitted in the evening were sent to the roentgen-ray laboratory the next day at 11 a. m. Those only slightly ill were screened, while those more seriously ill were plated. The fluoroscopic

reports were immediately returned to the observation ward. The plates were developed at once and the report was furnished in about one hour. The patients were then distributed to the various wards.

In the neighborhood of 7,000 influenza patients were subjected to roentgenographic examination. Those able to walk were screened but ill patients were brought to the roentgen-ray laboratory, well wrapped, on the hospital litter carts, and were placed on the table face down, without being allowed the least exertion. A stereoscopic set was made, for the most part gas tubes being used because they produce a plate of better detail and more contrast than does the Coolidge. Although the work proved to be more wholesale than delicate, we strived to obtain the most perfect plate, and our plates were surprisingly uniform, possessing excellent detail. The desperately ill patients were examined in the ward by means of the portable bedside unit. Exposure was made on the thin double coated film between two block screens.

Bronchopneumonia was found in some 2,200 cases. By far the larger percentage (about 80) was an involvement of one or both bases. All degrees of involvement in all combinations were found. The lobe involvements were classed as mild, moderate or severe in the different lobes. The parenchymal involvement we tabulated as:

1. Peribronchial, only the air sacs adjacent to the bronchioles being involved (capillary bronchitis?).
2. Central, apparently beginning at the hilum and extending bronchogenetically toward the periphery.
3. Confluent, involving an entire lobe and presenting a picture suggestive of lobar pneumonia.
4. Lobular, which distinctly involved the lobules.
5. Diffused, presenting one or more of the foregoing in an entire lobe, an entire lung or both lungs.

We were often able to suggest bronchopneumonia before clinical findings were obtained. This was especially true in those cases in which the involved area was small and centrally located in the body of the lobe, particularly the lower. Again, our findings were often indefinite when the clinical indications were pronounced. This occurred in those cases in which the process was posteriorly situated, especially as the area was far removed from the plate (the patient lying face down). In the very mild parenchymal involvement occurring in the capillary bronchitis, the plate showed definite indications while physical findings were minimal. Medium and coarse râles were heard, but the finer ones were not made out, especially if centrally located, until the process became more advanced. It usually did so in a few hours, and the most painstaking physical examination was necessary in many cases before the delicate change in breath sounds, the slight dulness and the finer râles of bronchopneumonia were detected.

A great many cases were examined a number of times and the process was watched, as it insidiously advanced from the small primary area to a very extensive involvement of both lungs. Every possible complication was found and studied.

In addition to the exact involvement of the lungs, we made careful observations of the heart silhouette, and its area, position and configuration. Each patient's weight, age and height was reported on the request for roentgenographic examination. The heart condition was reported, allowing for a reasonable increase or decrease in area from the average. Cardiac stimu-

lants were often suggested to the ward surgeon because of marked increase in the cardiac silhouette area with increase in radiability, as is the case in dilatation.

Five cases presented shadows indicative of a chronic tuberculous process in addition to the bronchopneumonia. The tuberculous process presents entirely different shadows than does the bronchopneumonia. This is very obvious when both processes are seen on one plate. Streptococcus bronchopneumonia is difficult to differentiate from an active fibrous tuberculosis, particularly during the resolving stage.

In many cases showing distinct shadows indicative of bronchopneumonia, the physical findings were absolutely negative, except for bronchitis. Our findings were so pronounced that we carefully investigated these cases and determined the areas of density resulting from parenchymal exudation. These cases subsequently presented the physical findings of mild bronchopneumonia. At necropsy, about 10 per cent. of the bronchopneumonia patients had one or more areas of parenchymal hemorrhage in addition to the areas of consolidation. This suggests that probably in some cases hemorrhage into the lung tissue was the beginning of the bronchopneumonic process.

After resolution is complete, abnormal shadows persist for some time. This is particularly true in the lower quadrants, where the trunks are large. It is, however, not difficult to distinguish an active from a resolved process. In many cases the streaks of air along the course of the blood vessels (emphysematous air streaks) are distinctly seen, and although they occur in all stages of the process, they are suggestive, for the most part, of beginning resolution. The air streaks are apparently the result of air sac rupture following increased distal pressure from impingement on the bronchiole. The air released into the interstitial tissues follows along the vessels as the path of least resistance. These air streaks are often readily made out as scalloped dark streaks leading toward the hilum.

For detecting mild processes and determining the extent of the involvement, the roentgen ray is an ideal means, and should be employed in every case of respiratory infection, both in civil and in military hospitals.

Roentgenographic findings are definite in bronchopneumonia and enable the clinicians to appreciate the extent of parenchymal involvement. The degree of involvement in bronchopneumonia should receive a more careful consideration. Many cases of "colds" and bronchitis present a mild degree of bronchopneumonia.

Direct Prophylaxis of Rabies.—All the dogs in the Kanagawa district, Japan, were inoculated last year against rabies, a total of 6,644 dogs. This region is said to include two cities and six districts. During the year there were twenty cases of rabies among the dogs in September, three in November and none in December. The preceding years the incidence of rabies reached its highest point in December. The *Japan Medical World*, which reports these facts, gives the details of Umeno's method of preparing the antirabic vaccine for the purpose, and its applications in the research described by Drs. T. Kitano and K. Sukegawa, sanitary officers of the Kanagawa prefecture, Yokohama. A single inoculation apparently answered the purpose; half the dose was injected on each side of the dog. No by-effects were observed of any moment, merely an occasional transient local swelling.