

EPIDEMIC OF BRONCHOPNEUMONIA  
AT CAMP GRANT, ILL.

## PRELIMINARY BACTERIOLOGIC REPORT \*

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Sept. 21, 1918, an epidemic disease characterized by a sore or dry throat, cough, fever, general prostration, and in a certain number of patients by a rapidly progressing pneumonia, broke out at Camp Grant. While the date September 21 is given as the day of onset during which fifty-six patients were admitted to the base hospital, there had been about fifteen or twenty patients admitted during the three or four days immediately preceding with symptoms identical, and had been considered to have "influenza."

The rapidity with which the disease spread can be appreciated best by reviewing the number of hospital admissions on the days succeeding the onset of the epidemic, indicated in Chart 1. The first death occurred on the third day, and the postmortem examination confirmed the clinical diagnosis of bronchopneumonia. The number of deaths on the subsequent days of the epidemic are indicated in Chart 2. Practically all deaths followed a clinical diagnosis of pneumonia, a diagnosis largely supported by postmortem examinations.

The arrival in the hospital of a large number of patients with symptoms referable to infection of the respiratory passages suggested at once that the possible or even highly probable portal of entry of the disease-producing organism or organisms was through the nasopharynx, and that a bacteriologic examination of these tissues would demonstrate the variety of bacteria as well as the predominating type of organism, if there be such. Following this as a reasonable basis for investigation, throat cultures were taken on Loeffler's medium from the posterior pharynx of the first 300 hospital admissions and examined after twenty-four hours' incubation. The predominating organisms growing on this medium were gram-positive, usually diplococci as such or in short chains. Following this, 159 throat cultures were taken on blood agar plates in order to differentiate the gram-positive organisms, as well as to favor the growth of the influenza bacillus whenever it would be present. Many of these plates were pure cultures of fine green colonies containing gram-positive diplococci as such or in short chains, frequently lancet shaped. In all throat cultures the occurrence of the influenza bacillus was only occa-

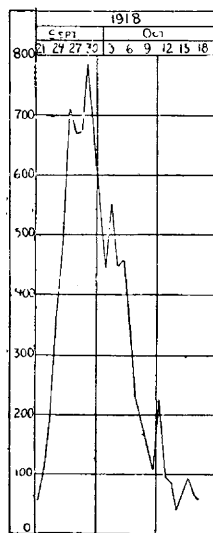


Chart 1.—Admission rate: September 21, 56; 22, 108; 23, 193; 24, 369; 25, 491; 26, 711; 27, 670; 28, 671; 29, 788; 30, 689; October 1, 567; 2, 440; 3, 566; 4, 445; 5, 459; 6, 375; 7, 235; 8, 197; 9, 155; 10, 118; 11, 229; 12, 98; 13, 87; 14, 40; 15, 64; 16, 95; 17, 67; 18, 54.

sional, never in pure culture, and, when found, always with a predominating number of diplococci with tinctorial, morphologic and cultural characteristics as mentioned above. A few colonies of hemolytic streptococci were noted in twenty of the 159 blood agar plates, nonhemolytic in not more than twelve.

Approximately 200 postmortem examinations were made during the epidemic, and there was found regularly an extensive irregular consolidation of the lungs. The gross appearance of these lungs was striking in that they appeared voluminous and dark red, with much blood and edema. On the pleural surfaces there was little fibrin. The bronchi contained a thin gray or brown fluid and were lined by a red mucous membrane. During the decline of the epidemic, gray nodular consolidations were found, and complications and sequelae of a pneumonia, such as huge serofibrinous pleuritis, empyema, acute serofibrinous and acute suppurative pericarditis, all of these contributing no small part in continuing the mortality.

Cultures on blood agar plates and direct smears on glass slides were made from the exudate of the consolidated lungs at all postmortem examinations. The surface streaks of the blood agar plates frequently were purely fine green colonies containing gram-positive, lancet-shaped diplococci. Organisms resembling the influenza bacillus were rarely found, and never in pure culture.

Heart's blood was taken at each necropsy and cultivated. In a large number the gram-positive organism described above was isolated in pure culture. Blood cultures were made on ninety patients in the hospital and forty-five of them were positive, a gram-positive diplococcus being isolated in pure strain without exception.

Spinal fluid removed at the postmortem examinations and from patients in the hospital has yielded this organism frequently, and it has been cultivated in pure strains from the exudate in the middle ears, from the frontal, maxillary and ethmoidal sinuses. In none of the sinus infections of the head has the influenza bacillus been observed either in direct smears of the exudate or in the blood agar plate cultures.

A large number of strains of this organism have been isolated from the lungs and the heart's blood at the postmortem examinations, and from the circulating blood stream of patients in the hospital. Table 1 contains certain cultural, morphologic and virulence properties for a few from the heart's blood, and Table 2 the same for those isolated from the blood stream of patients in the hospital, while Table 3 lists a few from the lungs. These tables indicate that the gram-positive diplococcus recovered from these fluids and tissues has all the morphologic and cultural characteristics of

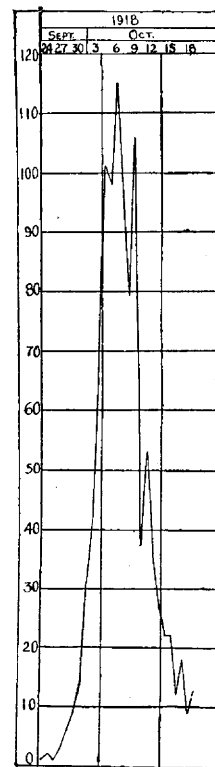


Chart 2.—Death rate: September 24, 1; 25, 2; 26, 1; 27, 3; 28, 6; 29, 9; 30, 14; October 1, 31; 2, 43; 3, 76; 4, 101; 5, 98; 6, 115; 7, 98; 8, 79; 9, 106; 10, 37; 11, 53; 12, 36; 13, 27; 14, 22; 15, 22; 16, 12; 17, 18; 18, 9; 19, 13.

\*From the Laboratory of the Base Hospital.

a pneumococcus, at least so far as modern standards of identification permit. They further detail experiments demonstrating the exceedingly great virulence these strains possess for susceptible laboratory animals. A guinea-pig of 328 gm. weight was dead ten hours after an intraperitoneal injection of half the twenty-four-hour growth on a blood agar slant of one of the strains isolated from the heart's blood. The virulence of these strains exceeds by far that known for pneumococci usually associated with disease, and while the organisms meet all the morphologic and cultural require-

TABLE 1.—HEART'S BLOOD CULTURES, POSTMORTEM

Cul- ture	Inulin Fer- menta- tion	Capsule		Bile Sol- ubility	Amount of 1-24 Hr. Blood Agar Slant Injected into W. Mouse	Dose Fatal in Hours	Type	Organ- ism Re- covered Pure from Mouse Heart's Blood
		On Blood Agar	In h. b. of Mouse					
1024	+	—	+	+	0.0231	38	II	+
1029	+	—	+	+	0.0231	26	II	+
1030	+	—	+	+	0.0231	31	II	+
1031	+	—	+	+	0.0231	25	II	+
1032	+	—	+	+	0.0231	25	IV	+
1033	—	—	+	+	0.0231	25	IV	+
1034	+	+	+	+	0.0231	25	IV	+
1035	+	—	+	+	0.0231	31	II	+
1037	—	—	+	+	0.0231	27	II	+
1038	+	—	+	+	0.0231	25	II	+
1039	+	—	+	+	0.0231	25	II	+
1040	+	—	+	+	0.0231	24	IV	+
1041	—	+	+	+	0.0231	30	IV	+
1050	+	—	+	+	0.0231	28	II	+
1053	+	—	+	+	0.0231	43	II	+
1056	+	—	+	+	0.0231	21	IV	+

ments of a pneumococcus, this difference in virulence makes them distinctive.

To control these investigations, throat cultures were taken from fifty of the German prisoners confined at Camp Grant. This group of men has escaped entirely the infection, although they have been in the camp since last spring. Colonies of pneumococci were found in twenty of these cultures and isolated in pure culture. White mice were inoculated with half the

TABLE 2.—BLOOD CULTURES

Cul- ture	Inulin Fer- menta- tion	Capsule		Bile Sol- ubility	Amount of 1-24 Hr. Blood Agar Slant Injected into W. Mouse	Dose Fatal in Hours	Type	Organ- ism Re- covered Pure from Mouse Heart's Blood
		On Blood Agar	In h. b. of Mouse					
604	+	—	—	+	0.0231	18	II	+
605	+	—	+	+	0.0231	22	II	+
606	+	—	+	+	0.0231	22	II	+
608	+	—	+	+	0.0231	24	IV	+
610	+	—	—	+	0.0231	18	IV	+
611	+	—	+	+	0.0231	30	IV	+
614	+	—	+	+	0.0231	12	II	+
615	+	—	+	+	0.0231	16	II	+
630	+	—	+	+	0.0231	32	II	+
636	—	+	+	+	0.0231	22	II	+
638	+	—	+	+	0.0231	16	IV	+
640	+	—	+	+	0.0231	22	II	+
646	+	—	+	+	0.0231	18	II	+
651	+	—	+	+	0.0231	68	I	+
654	+	—	+	+	0.0231	22	II	+
655	+	—	+	+	0.0231	14	II	+
660	+	—	+	+	0.0231	30	IV	+
663	+	—	+	+	0.0231	16	II	+
664	+	—	+	+	0.0231	22	IV	+
665	—	—	+	+	0.0231	16	II	+
666	—	—	+	+	0.0231	36	II	+

growth of these organisms on blood agar slants after twenty-four hours' incubation without the slightest effect on these animals.

## CONCLUSIONS

1. The epidemic of bronchopneumonia at Camp Grant is due to infection by a virulent strain of pneumococcus.

2. The virulence of this organism exceeds greatly that of strains usually identified in pneumonia.

TABLE 3.—LUNG CULTURES, POSTMORTEM

Cul- ture	Inulin Fer- menta- tion	Capsule		Bile Sol- ubility	Amount of 1-24 Hr. Blood Agar Slant Injected into W. Mouse	Dose Fatal in Hours	Type	Organ- ism Re- covered Pure from Mouse Heart's Blood
		On Blood Agar	In h. b. of Mouse					
265	+	—	+	+	0.00555	30	IV	+
276	+	—	+	+	0.00555	24	IV	+
287	+	—	+	+	0.00555	18	IV	+
288	+	—	+	+	0.00555	24	II	+
291	+	—	+	+	0.00555	24	II	+
293	+	—	+	+	0.00555	18	II	+
294	+	—	+	+	0.00555	29	II	+
295	+	—	+	+	0.00555	32	II	+
343	+	—	+	+	0.00185	36	II	+
358	+	—	+	+	0.00185	30	IV	+
369	+	—	+	+	0.00185	36	II	+
384	+	—	+	+	0.00555	14	IV	+
398	+	—	+	+	0.00555	23	II	+

3. This virulence is such as to explain the epidemic of bronchopneumonia.

4. *Bacillus influenzae* played no rôle in the epidemic at Camp Grant.

CLINICAL OBSERVATIONS ON  
INFLUENZA

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The epidemic, or rather pandemic, of influenza through which Chicago has just passed has afforded me an opportunity of making observations that it might be of interest to record, as they were made in family practice, which is not so well represented in medical literature as is that of the hospital, even though the vast bulk of the work of the medical profession lies in the former field rather than in the latter.

One of the startling features of the pandemic was its sudden flaring up and its equally sudden decline, reminding one of a flame consuming highly combustible material, which died down as soon as the supply of the material was exhausted. There is every reason to believe that, within a few weeks of its onset, the infection was universally present in the nose and throat of the people, disseminated by mouth spray given off on talking by innumerable carriers and, in addition, by the coughing and sneezing of the sick. Susceptibility was very general, though it varied greatly in degree. Among those who escaped well marked sickness there are few who could not recall having had an occluded or running nose, or a raw feeling in the throat, or a cough, or aches and pains, at some time during the period of the prevalence of the disease, these probably representing the price such persons paid for their immunization. That blood relationship had something to do with susceptibility was shown by the fact that, in some families, every member developed the disease in well marked form, while in others there was not one definite case, though exposure to the infection had taken place. The very old and the very young showed themselves, on the whole, less susceptible.

In view of this universal prevalence of the infection, quarantine was necessarily useless. During this pandemic, wearing of face masks had no greater prophylactic effect than the liberal consumption of whisky