appeared more stiff than before, roentgen reexamination showing no change in the position of the parts. The soldier declined further manipulations or operation. Suspension of the entire body from the head was of no avail.

COMMENT

There are some very interesting points regarding this case:

1. *History*.—It seems unreasonable to believe that we have the correct history of the case. The tonsillectomy was done under local anesthesia (procain), and this trouble came on suddenly the night of the operation. I have corresponded with the base hos-

any one would have simply palpated or examined the nasopharynx, the condition would have been diagnosed at once. The failure to recognize early such a marked pathologic condition on the roentgen plate seems unpardonable, yet the patient states he was rayed about six times. However, this is the second case of anterior dislocation of the atlas I have observed that has not been recognized on the roentgenogram.

PNEUMONIA AT CAMP FUNSTON

REPORT TO THE SURGEON-GENERAL *

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CAMP PIKE, LITTLE ROCK, ARK.

This investigation of pneumonia made at the base hospital at Fort Riley includes all cases of pneumonia that have occurred between July 23 and Aug. 31, 1918, at Camp Funston, including Detention Camp No. 1 for white troops and Detention Camp No. 2 for colored troops, in the 311th Cavalry stationed at Fort Riley, at the base hospital, and at the Medical Officers' Training Camp.

During the period of the investigation there has been no large outbreak of pneumonia at Camp Funston. The average number of cases has been two a day, the total number studied being 62. The number of troops in the camp has been approximately 42,000, so that for the month of August the pneumonia rate has not exceeded 1.5 per thousand.

Pneumonia has been of mild type; there have been only three deaths, and empyema has occurred in one instance. The clinical diagnosis has been lobar pneumonia in fifty-five cases and bronchopneumonia in seven cases. The pneumonia observed here has presented no unusual clinical characters, and in the three cases in which necropsy has been performed, there has been lax consolidation of one or more lobes of the lungs.

Pneumonia of this period has in considerable part affected newly drafted negro troops from Southern states, namely, Louisiana and Mississippi. This pneumonia of newly drafted troops has presented characters that deserve special consideration. During our study, cases of pneumonia from two drafts of colored troops have been fairly numerous. In the period from June 19 to 23, 5,982 drafted colored men reached Camp Funston, and were sent to Detention Camp No. 2, located 5 miles from Camp Funston. They were held in detention camp two or three weeks, until assigned to units stationed at Camp Funston. Among these drafted men, between June 15 and August 31, sixty-nine cases of pneumonia have occurred. Among 12,000 white men drafted in June there has been only one case of pneumonia.

* Because of lack of space, this article is abbreviated in *THE JOURNAL* by omission of Tables 3 and 13. The complete article will appear in the authors' reprints.

Simple anterior dislocation of the atlas.

pital from which the patient was sent. It is stated that there is no history of trauma, and the patient denies any himself.

ANATOMIC POINTS NOTED ON A TRUE LATERAL PLATE OF CERVICAL REGION, OBSERVED IN SIMPLE ANTERIOR DISLOCATION OF THE ATLAS

NORMAL	DISLOCATED ATLAS
1. Posterior pharyngeal wall practically vertical.	1. Posterior pharyngeal wall markedly curved forward, anterior to atlas.
2. Anterior margin of anterior tubercle of atlas in line with anterior margin of body of axis.	2. Anterior tubercle on a more anterior level.
3. Lateral masses of atlas rest on superior articular processes of axis.	3. Lateral masses of atlas on a more anterior level.
4. Odontoid process in contact with anterior arch of atlas.	4. Odontoid process free.
5. Anterior margin of posterior tubercle of atlas on a plane posterior to anterior margin of spinous process of axis.	5. Anterior margin of posterior tubercle on a plane anterior to anterior margin of spinous process of axis.

2. *Error in Diagnosis*.—It is somewhat difficult to believe that such a gross condition as this would pass with a diagnosis of osteoarthritis for six months. If

In July there was a similar outbreak of pneumonia in 5,997 newly drafted negroes. They were in great part from Mississippi, and entered Detention Camp No. 2 from July 16 to 20. The greater number of these men were transferred to Camp Funston after periods of from two to three weeks. Among them, in the period from their arrival to August 31, there have been twenty cases of pneumonia. Among 15,000 white troops drafted in July, from the 22d to 27th, eight developed pneumonia.

The incidence of pneumonia among troops in Camp Funston (Chart 1) from June 15 to August 31 is given in Table 1.

These figures suggest at first sight that pneumonia is much more common in colored than in white troops, but an analysis of the state of origin of newly drafted colored men shows that comparison is possible only between men from the same states (Table 2).

the order of their geographic location from south to north, namely, Louisiana, Mississippi (factor of time prevents comparison of these two states), Oklahoma,

TABLE 2.—PNEUMONIA AMONG COLORED TROOPS
ACCORDING TO STATES

Drafts of Colored Men by States:	No. of Troops	Pneumonia	
		No. of Cases	Per Thousand
June:			
Missouri	482	0	.00
Oklahoma	500	2	4.00
Louisiana	5,000	67	13.40
July:			
Kansas	1,009	0	.00
Missouri	988	0	.00
Mississippi	4,000	19	4.75
August:			
Nebraska	236	0	.00
Kansas	468	0	.00
Missouri	3,230	2	.62

Missouri, Kansas and Nebraska. It is evident that the white and colored drafts cannot be compared, since

Chart 1.—Pneumonia at Camp Funston, from June 15 to Aug. 15, 1918.

Figures for one draft are not comparable with those from another, because the periods of observation differ, and departure from the camp of units formed from

none of the white troops came from Louisiana and Mississippi.

BACTERIOLOGIC STUDY OF PNEUMONIA

In view of the selective occurrence of pneumonia in newly drafted colored troops from Louisiana and Mississippi, it is important to know the etiologic factors concerned in the production of the pneumonia that has occurred. Bacteriologic study has been made of the sputum of all pneumonia patients entering the base hospital between July 23 and August 31 (Table 3). White mice have been inoculated intraperitoneally with sputum, and the Avery method for identification of pneumococci has been used. Cultures from throat swabs have been examined.

The incidence of pneumococcus, *Streptococcus hemolyticus* and *Bacillus influenzae* in the sputum of newly drafted negroes is given in Table 4. The observations made on the June draft are almost wholly limited to colored men from Louisiana, exceptions being one case from Mississippi and one from Okla-

TABLE 1.—INCIDENCE OF PNEUMONIA AT CAMP FUNSTON

White	No. of Troops	Pneumonia	
		No. of Cases	Per Thousand
In Camp Funston prior to June 15..	14,198	7	0.49
20th Infantry, which arrived June 30	2,278	8	3.51
June draft	12,000	1	.08
July draft	15,000	8	.53
August draft	6,006	0	.00
Total	49,482	24	.48
Colored			
In Camp Funston prior to June 15..	1,700	4	2.35
June draft	5,982	69	11.53
July draft	5,997	19	3.17
August draft	3,934	2	0.51
Total	17,613	94	5.34

different drafts modifies the exact accuracy of the figures for each draft; but these factors will not alter the relations indicated in the table. Pneumonia has been common in negro drafts from different states in

homa; observations for the July draft are on negroes from Mississippi.

With pneumonia of drafted colored men from Louisiana and Mississippi, organisms which are frequently found in the mouths of normal individuals, namely, pneumococcus IV, III and Atypical II, have been found in twenty-five of thirty-five cases, that is, in 71 per cent. No pneumococci of Type II were found. In contrast to this relation, the distribution of various pneumococcus types among pneumonia patients from a variety of organizations located at or near Camp

TABLE 4.—ORGANISMS IN SPUTUM OF NEWLY DRAFTED NEGROES

JUNE DRAFT	
Pneumococcus, Type I	6
Pneumococcus, Type II	0
Pneumococcus, Type II, atypical	3
Pneumococcus, Type III	1
Pneumococcus, Type IV	5
Hemolytic streptococcus alone	0
Total	15

Bacillus influenzae was found in two instances, associated with pneumococcus Type I. Hemolytic streptococcus was found in throat swab once with pneumococcus atypical Type II, once with Type IV. It was not present in the sputum of these patients.

JULY DRAFT	
Pneumococcus, Type I	3
Pneumococcus, Type II	0
Pneumococcus, Type II, atypical	4
Pneumococcus, Type III	4
Pneumococcus, Type IV	8
Hemolytic streptococcus alone	1
Total	20

Bacillus influenzae has been found once, associated with pneumococcus atypical Type II, once with Type III, and once with Type IV. Hemolytic streptococcus has been found in throat swab once with bronchopneumonia. The sputum of this patient contained pneumococcus atypical Type II, but no hemolytic streptococci.

For completeness, the three cases of pneumonia from the August draft are cited below:

AUGUST DRAFT	
Pneumococcus, Type I	1
Pneumococcus, Type II, atypical	1
Pneumococcus, Type IV	1
Total	3

For comparison with the pneumonia of the June and July drafts cited above, other cases of pneumonia scattered among eleven organizations, and with three exceptions in white men, are summarized below.

From eleven organizations at or near Camp Funston:

Pneumococcus, Type I	9
Pneumococcus, Type II	5
Pneumococcus, Type II, atypical	0
Pneumococcus, Type III	1
Pneumococcus, Type IV	8
Hemolytic streptococcus alone	1
Total	24

Bacillus influenzae has been found once in association with pneumococcus Type II and twice with Type IV. Hemolytic streptococci have been found in throat swab once with Type I (also in sputum), once with Type III, and once with Type IV.

Funston has closely approximated that of civil life, Types I and II constituting the greater number of cases. Among these miscellaneous cases of pneumonia, the percentage of mouth types has been only 37.5 per cent., in sharp contrast with that found in the pneumonia among newly drafted Southern negroes. Of eight white men with pneumonia from the July draft (four from Missouri and four from Kansas), four (50 per cent.) had pneumococcus Type I, two Type II (25 per cent.), and two Type IV (25 per cent.).

It is noteworthy that two of the small number of cases of Type I pneumonia among Louisiana negroes, and two among Mississippi negroes, occurred in one small unit, namely, the Twenty-Second Provisional Company of the 164th Depot Brigade, a body containing 250 men. It seems not improbable that the members of this company were brought into contact with Type I pneumococcus after formation of the company. An examination of the saliva of twenty-five healthy members of this company disclosed one man who harbored in his mouth pneumococcus Type I.

Among sixty-two cases of pneumonia, pneumococcus Type II was found only five times. It is noteworthy that two of these four instances of Type II occurred in a small body of enlisted men of the Medical Officers' Training Camp in Quarters 4 M, consisting of a group of tents. The onset of the second of these cases was on August 17. August 22 the saliva of thirty-two men then in these quarters was examined for pneumococcus. No carriers of pneumococcus Type II were found.

Pneumococci and Other Bacteria in Mouths of Healthy Men in Military Organizations at Camp Funston.—Since the groups of cases that have been mentioned show variations, it has seemed desirable to determine if corresponding variations might be found in the incidence of pneumococcus in the mouths of healthy men of the organizations in which pneumonia occurred. It was further desirable to determine if carriers of pneumococcus Types I and II were present in units in which several instances of corresponding types of pneumonia had occurred. At the time of the investigation colored troops in Detention Camp No. 2, where pneumonia had been most prevalent, were in large part from the July draft.

Saliva from twenty-five men of the Twenty-Second Provisional Colored Company of the 164th Depot Brigade was injected into the peritoneal cavities of mice, and the micro-organisms that developed were determined (Table 5). This company was selected because

TABLE 5.—ORGANISMS IN SALIVA OF MEN OF 164TH DEPOT BRIGADE, 22D PROVISIONAL COLORED COMPANY

	Number	Per Cent.
Pneumococcus, Type I	1	4
Pneumococcus, Type II	0	0
Pneumococcus, Type II, atypical	1	4
Pneumococcus, Type III	2	8
Pneumococcus, Type IV	13	52
No pneumococci found	8	32
Total	25	

Bacillus influenzae was found six times, and *Streptococcus hemolyticus* once.

four instances of pneumonia, due to pneumococcus Type I, had occurred in it.

Since twelve of our cases of pneumonia occurred in the Third Development Battalion, an organization in which colored men partially disqualified for military service are given training, this organization was next selected for study. The saliva of twenty-five men from Company D was examined, with the result given in Table 6.

For comparison with the observations made on colored organizations, saliva from twenty-five white men was tested (Table 7). The Seventieth Infantry was selected because no pneumonia had occurred in this organization within the period of our observation.

Examination of the records of the hospital showed that the man from whom pneumococcus Type I was

obtained had been admitted to the base hospital, May 27, 1918, and returned to duty, July 10, five weeks before examination of the saliva. While in the hospital he suffered with acute bilateral suppurative otitis media and pyorrhea alveolaris; tonsillectomy was performed.

The saliva of twenty-seven men from the 210th Engineers, a white regiment in which no pneumonia

TABLE 6.—ORGANISMS IN SALIVA FROM MEN OF THIRD DEVELOPMENT BATTALION, CO. D

	Number	Per Cent.
Pneumococcus, Type I	0	0
Pneumococcus, Type II	0	0
Pneumococcus, Type II, atypical	3	12
Pneumococcus, Type III	3	12
Pneumococcus, Type IV	6	24
No pneumococci found	13	52
Total	25	

Bacillus influenzae was found eleven times. *Streptococcus hemolyticus* five times, and *Bacillus mucosus-capsulatus* twice.

TABLE 7.—ORGANISMS IN SALIVA OF MEN OF SEVENTIETH INFANTRY

	Number	Per Cent.
Pneumococcus, Type I	1	4
Pneumococcus, Type II	0	0
Pneumococcus, Type II, atypical	1	4
Pneumococcus, Type III	1	4
Pneumococcus, Type IV	15	60
No pneumococci found	7	28
Total	25	

Bacillus influenzae was found eleven times, and *Streptococcus hemolyticus* twice.

had occurred during our study, was examined, with the results given in Table 8.

In view of the occurrence of two cases of pneumonia associated with pneumococcus Type II, in Quarters 4 M of the Medical Officers' Training Camp, five days after the admission of the second of these patients with Type II pneumonia to the hospital, search was made for pneumococci in the mouths of thirty-two men from the squad occupying these quarters. The examination of these normal men had the result given in Table 9.

The observations indicate that approximately two thirds of the men in the organizations examined harbor pneumococci, with few exceptions belonging to the groups that have heretofore been found in the mouths of healthy men. In view of the uniformity of the results obtained, the examinations were discontinued.

The high incidence of *Bacillus influenzae* in the mouths of healthy men is noteworthy. It serves as a basis for comparison with conditions such as influenza, bronchitis, and other diseases of the respiratory passages. Its significance in relation to the existence of an epidemic of influenza in this camp during March, April and May cannot be determined.

COMMENT

The foregoing study has shown that lobar pneumonia caused by pneumococcus has occurred with unusual frequency among negroes drafted from Louisiana and Mississippi. The types of pneumococcus concerned are in great part those that occur in the mouths of healthy individuals, namely, Atypical Type II, Type III and Type IV. Type I has been less frequent than with the pneumonia of civil life, and Type II has not been found in this group of cases. Predominance of mouth types has been more conspicuous in the more recently drafted troops from Mississippi.

To explain the occurrence of this pneumonia of

newly drafted men, two groups of factors may be considered: First, conditions that depress resistance, such as exposure to cold or wet, exposure to dust, fatigue from the unusual exertions of military training, and the reaction from typhoid-paratyphoid inoculation. Second, conditions that favor transmission of various respiratory infections, when large numbers of men are brought into intimate contact with one another.

We have obtained no evidence that these negro drafts which have developed pneumonia have been exposed to cold or wet during transportation to the camp, or after their arrival. Organizations in which pneumonia has prevailed have not been exposed to dust in greater degree than those which have been relatively free from it. Negro troops at Detention Camp No. 2 have not been required to perform prolonged or severe drill; their work has not been heavier than that of white troops.

There is little support for the suggestion that typhoid inoculation has had any part in the production of the disease. Although white drafts and colored drafts, both from Missouri and Kansas, and from Mississippi and Louisiana, have all been subjected to the same procedure, pneumonia has been conspicuously selective.

The small number of cases of pneumonia under observation has offered scant opportunity to study the epidemiology of various types classified with regard to the type of infecting pneumococcus. The small amount of evidence at hand tends to favor the view that susceptible individuals from far Southern states are brought into intimate contact, perhaps for the first time, with types of pneumococci capable of producing in them lobar pneumonia. These types are at first widely distributed pneumococci, such as frequently occur in the mouths of normal individuals. We have obtained some evidence to support the view that introduction of Type I pneumococcus into a group of

TABLE 8.—ORGANISMS IN SALIVA OF MEN OF 210TH ENGINEERS

	Number	Per Cent.
Pneumococcus, Type I	0	0.0
Pneumococcus, Type II	0	0.0
Pneumococcus, Type II, atypical	1	3.7
Pneumococcus, Type III	1	3.7
Pneumococcus, Type IV	14	51.9
No pneumococci found	11	40.7
Total	27	

Bacillus influenzae was found three times, *Streptococcus hemolyticus* once, and *Bacillus mucosus-capsulatus* once.

TABLE 9.—ORGANISMS IN MOUTHS OF MEN FROM QUARTERS 4 M, MEDICAL OFFICERS' TRAINING CAMP

	Number	Per Cent.
Pneumococcus, Type I	0	0.0
Pneumococcus, Type II	0	0.0
Pneumococcus, Type II, atypical	1	3.1
Pneumococcus, Type III	2	6.3
Pneumococcus, Type IV	21	65.6
No pneumococci found	8	25.0
Total	32	

Bacillus influenzae was found sixteen times, *Streptococcus hemolyticus* twice, and *Bacillus mucosus-capsulatus* four times. No carriers of pneumococcus Type II were found.

drafted Southern negroes is followed by pneumonia referable to this organism. Four of the nine cases of Type I pneumonia occurred in the Twenty-Second Provisional Company of the 164th Depot Brigade, and examination of twenty-five healthy men from this company disclosed one carrier. The absence of Type II pneumonia among drafted negroes from Louisiana and

Mississippi indicates that they had not come into contact with the corresponding pneumococcus.

HEMOLYTIC STREPTOCOCCI

Among the cases of pneumonia that we have studied, hemolyzing streptococci have had an insignificant part. There have been only two cases of pneumonia in which the result of bacteriologic examination has suggested that this organism was concerned in the production of the disease. There has been no evidence that streptococci have produced complications during the course of pneumonia caused by pneumococci. During the period of our study, 112 patients with measles have been admitted to the base hospital at Fort Riley. There has been no instance of associated pneumonia, and otitis media, the sole complication, has occurred in only two instances. In both cases, staphylococci were obtained from the discharge.

Hemolytic Streptococci in the Throats of Healthy Men.—Observations on the occurrence of hemolytic streptococci in the mouths of normal men and of patients with measles and with pneumonia have been made here in order to explain, if possible, the infrequency of those respiratory complications due to streptococci which have greatly increased the severity of measles in some other camps.

In swabbing the throat the attempt was made to produce gagging. The swab was then quickly touched to both tonsils and lastly to the pharynx. The swab was introduced into a tube containing broth, and freely twirled. The broth tube was brought to the laboratory, and melted agar-agar containing 5 per cent. of defibrinated horse blood was inoculated with a loopful of the broth and poured into a Petri plate. A second loopful of the broth was streaked over the surface of one half of the plate, when solidified. Hemolytic streptococci were identified by the methods for the isolation and identification of *Streptococcus hemolyticus* adopted by the Medical Department of the Army.

The throats of 274 men on duty have been examined in the organizations listed in Table 10.

TABLE 10.—INCIDENCE OF HEMOLYTIC STREPTOCOCCI

	Number Examined	Hemolytic Streptococci Present	Per Cent. with Hemolytic Streptococci
White men:			
70th Infantry	24	4	16.7
210th Engineers, Co. C.....	26	6	23.1
164th Depot Brigade, Co. 15.....	50	10	20.0
164th Depot Brigade, Co. 18.....	51	13	25.5
164th Depot Brigade, Co. 28.....	50	13	26.0
Total	201	46	22.9
Colored men, all from Detention Camp No. 2:			
164th Depot Brigade, Prov. Co. 22.	25	6	24
3d Development Bn., Co. A.....	24	3	12.5
3d Development Bn., Co. D.....	24	5	20.8
Total	73	14	19.2
Men resident in the hospital:			
Laboratory workers	10	3	30.0
Patients in surgical ward	14	4	28.6
Total	24	7	29.2

The figures cited indicate that one in four or five of healthy men in this camp harbor hemolytic streptococci, and this proportion is not materially influenced by residence in the hospital.

Hemolytic Streptococci with Measles.—In view of the foregoing observation, it was surprising to find that hemolytic streptococci were present in only three of 112 measles patients at the time of their admission to the hospital. The hospital routine for measles is as follows: After a throat swab has been made, the

throat is gargled with 20 per cent. argyrol, and sprayed with argyrol three times a day. The same solution is dropped into the conjunctival sac to relieve discomfort caused by conjunctivitis. Patients in bed are separated by sheets. Convalescent patients are not strictly segregated, and assist in the care of patients in bed. Face masks are not worn. Hemolytic streptococcus carriers remain in the ward. Eating utensils are sterilized. Complications due to streptococcus have not been present during the period of our investigation.

The incidence of hemolytic streptococci in the throats of patients with measles (Table 11A), was very small

TABLE 11.—HEMOLYTIC STREPTOCOCCI WITH MEASLES AT CAMP FUNSTON

A. ALL MEASLES PATIENTS ADMITTED TO THE WARDS					
	Days in Hospital	Approximate Day of Disease	No. of Patients Swabbed	Number with Hemolytic Streptococci	Per Cent. with Hemolytic Streptococci
First swabbing ..	0 to 1	1 to 8	112	3	2.67
Second swabbing.	3 to 10	4 to 16	86	11	12.79
Third swabbing..	8 to 23	12 to 26	58	14	24.14

The first swabbing represents the findings on admission, in the series of 112 cases; 86 patients were swabbed twice; 58 patients were swabbed three times.

B. HEMOLYTIC STREPTOCOCCI WITH MEASLES IN 164TH DEPOT BRIGADE, COMPANY 28

	Days in Hospital	No. of Those Swabbed	Number with Hemolytic Streptococci	Per Cent. with Hemolytic Streptococci
First swabbing	0 to 1	23	0	0
Second swabbing	3 to 9	23	4*	17.39
Third swabbing	10 to 21	21	4	19.05
Normal men of Co. 28		50	13	26.00

* Two cases positive for hemolytic streptococci on this swabbing were negative on subsequent swabbing.

This is a comparison of the percentage of carriers among patients with measles spending less than ten days in the hospital, and that of patients spending more than ten days in the hospital; it also compares the percentage of carriers among the convalescents from measles and that among the normal men on active duty in the same company.

C. HEMOLYTIC STREPTOCOCCI WITH MEASLES IN SEVENTIETH INFANTRY

	Days in Hospital	No. of Those Swabbed	Number with Hemolytic Streptococci	Per Cent. with Hemolytic Streptococci
First swabbing	0 to 1	38	0	0
Second swabbing	5 to 9	25	1	4.0
Third swabbing	8 to 17	12	2	16.7
Normals on duty with 70th Inf.		24	4	16.7

This represents a series of 38 cases of measles from the 70th Infantry and the findings on admission. It shows that 25 patients were swabbed twice, with the results of the second swabbing made after from 5 to 9 days in the hospital; it shows that 12 patients were swabbed three times, and the findings on third swabbing after from 8 to 17 days in the hospital. A series of normals from the same organization is introduced for comparison.

On admission, but later on in the disease gradually increased. On admission to the hospital only three of 112 patients with measles harbored hemolytic streptococci. In a period from the third to the tenth day in the hospital, eighty-six patients were reswabbed and hemolytic streptococci were found in eleven (12.8 per cent.); between the eighth and the twenty-third day, fifty-eight were swabbed a third time, and fourteen (24.1 per cent.) were found to carry the organism.

Comparison of these figures for measles with those for normal men suggests the possibility that hemolytic streptococci temporarily disappear from the throat during the early stage of measles, at a time when the rash is present. During the period of our study, an outbreak of measles occurred in the Twenty-Eighth Company of the 164th Depot Brigade; twenty-three patients from this company were admitted to the hospital (Table 11B). On admission, throat swabs dis-

closed no carriers of hemolytic streptococcus, yet subsequent examinations, made between the third and the ninth day after admission, demonstrated that four of twenty-three patients (17.4 per cent.) harbored hemolytic streptococci; between the tenth and twenty-first days, four of twenty-one patients examined (19.1 per cent.) were found to be carriers of the organism. The throats of fifty healthy men in Company 28 were examined, and 26 per cent., a figure closely approximating that obtained for other organizations, were found to contain hemolytic streptococci.

From various companies of the Seventieth Infantry, thirty-eight patients with measles were admitted to the hospital (Table 11C), and no hemolytic streptococci were found in admission. Subsequently hemolytic streptococci were obtained from the throats of one of twenty-five men examined from the fifth to the ninth day of their stay in the hospital, and among twelve examined from the eighth to the seventeenth day, hemolytic streptococci were found in two (16.7 per cent.). Many of these cases of measles occurred late in August, and could not be followed throughout their stay in the hospital. From various companies of the Seventieth Infantry, twenty-four men on duty were examined, and four (16.7 per cent.) were found to harbor hemolytic streptococci. The observations made on these two organizations furnish further evidence that hemolytic streptococci have temporarily disappeared from the throats of men attacked by measles.

Hemolytic Streptococci with Pneumonia.—Throat swabs were made from sixty-one cases of pneumonia. In eight, hemolytic streptococci were found; in two instances of bronchopneumonia, hemolytic streptococci, but no pneumococci, were found in the sputum, and there is little doubt that pneumonia was caused by hemolytic streptococci. In one instance, hemolytic streptococci were found in the sputum but not in the throat swab. It is noteworthy that the proportion of patients with pneumonia harboring hemolytic streptococci, 14.8 per cent., is less than that of the normal men.

BACTERIOLOGY OF BRONCHITIS

With the purpose of determining what micro-organisms are associated with bronchitis, and the possible relation of this disease to bronchopneumonia, throat swabs were made in the small number of cases, namely, thirteen, available for study, and at the same time sputum was injected into mice. The results of bacteriologic examinations are given in Table 12.

TABLE 12.—BACTERIOLOGIC FINDINGS IN BRONCHITIS

Throat Swab	Sputum
1. Negative	B. influenzae and Pneumococcus IV
2. Hemolytic streptococcus	No examination
3. Hemolytic streptococcus	No examination
4. Negative	Pneumococcus IV
5. Hemolytic streptococcus	Pneumococcus IV
6. Negative	B. influenzae and Pneumococcus IV
7. Hemolytic streptococcus	No examination
8. Negative	B. influenzae and Pneumococcus IV
9. Negative	B. influenzae and Pneumococcus IV
10. Negative	B. influenzae and Pneumococcus IV
11. Negative	B. influenzae and Pneumococcus II atypical
12. Negative	Pneumococcus IV
13. Negative	B. influenzae and Pneumococcus IV

Pneumococcus Type IV or in one instance Atypical Type II was found in all cases in which the sputum was examined. In four of thirteen cases (30.7 per cent.) hemolytic streptococci were found. This proportion, uncertain by reason of the small number of

cases, is greater than that found in Camp Funston among normal men.

Bacillus influenzae was found in seven of thirteen cases of bronchitis, that is, in 53.8 per cent. of the cases examined and in 70 per cent. of those examined by mouse inoculation. The highest percentage of incidence of *Bacillus influenzae* in any group of normal men was 50 per cent. in men from Quarters 4 M, Medical Officers' Training Camp, examined by mouse inoculation. In cases of bronchitis with *Bacillus influenzae* and in one case with *Streptococcus hemolyticus* these organisms were associated with pneumococci.

It is significant that either hemolytic streptococci or *Bacillus influenzae* was found in all but two of thirteen cases of bronchitis. Even should we assume that none of these organisms is the primary cause of the disease, it is probable that their multiplication and doubtless their invasion of the lower respiratory passages has occurred with it.

There has been no opportunity to study the bacteriologic flora of the throat or of the sputum of patients suffering with cases diagnosed as influenza.

HISTORY OF PNEUMONIA AT CAMP FUNSTON

It has seemed to us desirable to obtain an insight into the history of pneumonia at the camp since its organization so that we might determine what types of pneumonia have occurred and what relation they bear to the outbreak that we have observed. Through the cordial cooperation of the officers of the hospital, we have tabulated from the records the incidence of pneumonia from the establishment of Camp Funston in August, 1917, up to the present date, Aug. 31, 1918. Chart 2 shows changes in the incidence of pneumonia. Primary pneumonia, pneumonia secondary to measles and a very small group of pneumonias definitely secondary to scarlet fever, diphtheria, mumps and surgical operations have been charted separately.

To obtain further insight into the relationship of pneumonia to other diseases, conditions affecting the air passages have been charted, namely, bronchitis and a disease that has been designated "influenza."

From Sept. 20, 1917, to November 8, with an increasing number of newly recruited troops in the camp, there was a gradual increase in the number of cases of pneumonia. Subsequently with slight fluctuation, there has been a continuous incidence of from one to five or even more cases per day, interrupted at only one time, namely, from May 26 to June 26, 1918, when pneumonia well-nigh disappeared. This relatively steady incidence has been twice augmented by sharply defined outbreaks of pneumonia, namely, (1) between November 8 and December 25, when cases of pneumonia following measles occurred in large number, and (2) between March 1 and May, 26, 1918, when there was a far greater number of cases of pneumonia occurring in very accurate conformity with an outbreak of influenza.

Outbreak of Pneumonia Due to Measles from Nov. 8 to Dec. 25, 1917.—By its relation to measles, this group of cases is sharply defined. Pneumonia was designated bronchopneumonia in ninety-two cases (78.6 per cent.) and lobar pneumonia in twenty-five cases (21.4 per cent.). It was associated with a high incidence of empyema and a mortality of 45.3 per cent. The disease doubtless exhibited close similarity with the pneumonia following measles studied elsewhere.

Outbreak of Pneumonia Occurring in Association with Influenza Between March 1 and May 26, 1918.—Before considering this subject, it is desirable to describe the disease which has been diagnosed influenza, which prevailed continuously since the establishment of the camp, and which within a few days swept as a great epidemic through Camp Funston. The disease, save in very mild cases, was accompanied by fever with elevation of temperature to from 99 to 102 or 103 F. The patient was prostrated, had severe headache, and complained of aching pains in the muscles of the back of the neck, of the lumbar region and at times of the arms or legs. Only a few patients had coryza; and cough, with other evidence of bronchitis, was unusual. With physical signs of bronchitis this diagnosis was added to that of influenza. At the beginning of the outbreak of the disease some patients were sent to the meningitis ward as suspects on account of headache and pain in the back of the neck. Some patients had abdominal pain and were first sent to the surgical ward. Later it became evident that there were no characteristic physical signs associated with the disease. After from twenty-four to forty-eight hours the temperature fell and the patient felt better.

than other units in the camp during the entire time since the organization of the camp in September. From this regiment, 163 patients were admitted to the hospital during the week March 9 to 15, but in the subsequent weeks there were few cases.

Every organization in the camp except the 314th Engineers and 341st Artillery was attacked; only five patients were admitted to the hospital from these two units during the week March 9 to 15. The men in the Medical Department, including corps men and officers attached to organizations in camp, as well as officers and corps men at the Medical Officers' Training Camp, were attacked early in the outbreak and suffered severely (seventy-two cases in the week March 9 to 15; sixty-two cases, March 16 to 22).

The units that suffered most severely had been organized six months or more, and the men attacked by the disease with few exceptions had been in the camp from three to six months (Table 14).

The outbreak of influenza quickly spent itself after about two weeks, and the line on Chart 2 representing incidence falls

Chart 2.—Respiratory diseases at Camp Funston: admissions to base hospital from pneumonia, influenza, and acute bronchitis by days from Sept. 20, 1917, to Aug. 20, 1918.

Between March 4 and March 29, 1,127 men from Camp Funston, which then contained 29,000 men, were sent to the base hospital with the disease just described, and many more were cared for in the infirmaries of the camp. A dust storm occurred, Saturday, March 9, and on Monday, March 11, 107 patients with "influenza" were admitted to the hospital; from the 342d Field Artillery alone thirty-eight enlisted men and six officers were admitted. This explosive outbreak is well shown on the chart. The ascent of the line representing incidence of the disease before March 9 gives little support to the view held by many who observed the outbreak, that the dust storm was responsible for it.

Table 13 shows the incidence of influenza in various organizations. The first units attacked by the outbreak in March were the 164th Depot Brigade (white) with fourteen cases in the week March 2 to 8, eighteen cases, March 9 to 15, and seventy-seven cases, March 15 to 22; and the 317 Headquarters Trains of the Ninety-Second Division, in which thirteen cases occurred on March 8 and forty-nine additional cases in the following week. The 342d Field Artillery was attacked early; it had suffered with the disease more severely

as suddenly as it rose. The disease did not disappear, but the daily incidence was not much in excess of that prior to the outbreak. Later at intervals of somewhat less than one month, a second, a third and even a fourth and fifth wave of the disease is represented in the admissions to the hospital. Each is less severe than the one preceding. The second wave, beginning April 3, reached a maximum on April 8, twenty-five days after that of the primary outbreak, and then quickly disappeared within ten days after its onset. It was almost wholly confined to the 164th Depot Brigade and affected with few exceptions white and colored drafts which had arrived at the camp four or five days before the onset of the disease.

The third wave of influenza began April 28 and reached a maximum on May 3, twenty-six days after that of the second. This outbreak occurred in a group of recently drafted white men in the Depot Brigade. They were attacked one or two days after their arrival. The outbreak lasted about two weeks.

A fourth insignificant outbreak is represented by a group of twenty-seven cases which occurred from May 30 to June 1 in a group of drafted white men who had

been in camp eight days. These cases occurred several days after the drafted men had been attached to the Fortieth Infantry. June 25, a few more cases occurred in colored men drafted from five to eight days.

This disease having the characteristics commonly attributed to influenza is not one marked by characteristic symptoms. In the presence of an outbreak, such as that just described, there can be no doubt concerning its identity, even in the absence of bacteriologic studies. It seems probable that occasional cases are recognized with much less certainty. Nevertheless, there is a remarkable similarity between the curve representing the incidence of influenza and that representing primary pneumonia, and to a less degree that representing bronchitis from the establishment of the camp to the present date. There had been a continued fairly high but fluctuating incidence of all three diseases until March of the present year. It is significant that the greatest incidence of pneumonia affecting troops in this camp occurred from March 9 to March 29, coincident and immediately following the first outburst of influenza, the maximum for pneumonia being five days after the maximum for influenza. Coincident with the two subsequent waves of influenza there were corresponding exacerbations in the incidence of pneumonia, the maximal points for influenza and pneumonia being almost coincident on April 7 to 8 and again on May 5 to 6; but in general, pneumonia has lagged behind influenza. The coincidence of influenza and pneumonia is further emphasized by the almost complete disappearance of the two diseases in the period from June 3 to 26 and their subsequent reappearance at the end of June and again to a slight extent in July.

To obtain further evidence of the relation of the outbreak of pneumonia to that of influenza, incidence of the two diseases in the organizations attacked has been compared (Table 13). With each wavelike outbreak of influenza there has been a similar outbreak of pneumonia, limited almost entirely to the organizations that had suffered with influenza. Following the first outbreak of influenza, which attacked both old and new organizations, there was a similar widely scattered prevalence of pneumonia. The organizations that suffered most severely were the 164th Depot Brigade, the Medical Department and the 317th Headquarters Trains of the Ninety-Second Division and the 314th Trains (white). These organizations had all suffered very severely with influenza. Organizations which showed the highest incidence of bronchitis were the same as those which suffered most severely with influenza, namely the Depot Brigade (white), the Medical Department, the 342d Field Artillery and the 317th Trains (colored) of the Ninety-Second Division and the 314th Trains (white).

Accompanying the second wave of influenza, which attacked white and colored drafts of the 164th Depot Brigade and reached its maximum on April 8, there was an outbreak of pneumonia limited to the white and colored sections of the draft organization.

Accompanying the third wave of influenza, which was in part limited to the white drafts of the 164th Depot Brigade, the corresponding outbreak of pneumonia was almost exclusively in the same organization.

The epidemic of influenza first attacked the organizations which had been at Camp Funston during six months or more. It seems to have infected all susceptible individuals and to have thus spent itself. Subsequent waves of influenza occurred when newly drafted

men were brought into the camp in April and again in May. Table 14 shows that pneumonia, like influenza, during the primary epidemic of March, attacked in great part men resident several months in the camp; 83.1 per cent. of those attacked by influenza and 72.2 per cent. of those attacked by pneumonia had been in camp more than three months. The pneumonia of April, like the influenza which it followed, was in great part in men who had been in the camp a short time. Only 16.5 per cent. of those with influenza, and 18.2

TABLE 14.—LENGTH OF SERVICE OF PATIENTS WITH INFLUENZA, PNEUMONIA AND ACUTE BRONCHITIS

	Under 1 Month		1-3 Months		Over 3 Months		Total Cases
	Cases	Per Cent.	Cases	Per Cent.	Cases	Per Cent.	
Influenza:							
March	95	8.2	92	7.9	969	83.9	1,156
April	255	70.2	49	13.4	60	16.5	364
May	140	66.8	36	17.1	34	16.1	210
Pneumonia:							
March	37	15.5	29	12.2	172	72.2	238
April	59	59.6	22	22.2	18	18.2	99
May	27	29.3	44	47.8	21	22.8	92
Acute Bronchitis:							
March	29	14.8	32	16.3	135	68.9	196
April	31	27.8	26	31.7	25	30.5	82
May	38	33.9	45	40.2	29	25.9	112

per cent. of those with pneumonia, had been in the camp more than three months, whereas 70.2 per cent. with influenza and 59.6 per cent. with pneumonia had been in the camp less than one month.

In May the figures representing the duration of residence in camp of those with pneumonia do not show the same close agreement with the figures representing influenza that is exhibited by the corresponding figures for April. The majority of cases of influenza occurred during the first month in camp, whereas the majority of cases of pneumonia occurred in the period between one and three months after arrival in camp.

The records of the hospital indicate that the pneumonia which accompanied influenza was lobar pneumonia and not bronchopneumonia. During the prevalence of pneumonia following measles in November and December, 1917, 21.4 per cent. of the cases of measles pneumonia were classified as lobar, and 78.6 per cent. as bronchopneumonia. Deaths occurred in 45.3 per cent. of the cases. Table 15 shows the distribution of lobar and bronchopneumonia and the percentage of deaths in the months of March, April and May.

The relatively low mortality of this outbreak of lobar pneumonia is in contrast with the higher mortality of the bronchopneumonia of measles. It is not possible

TABLE 15.—PNEUMONIA IN MARCH, APRIL AND MAY

	Lobar Pneumonia		Bronchopneumonia		Mortality	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
March	223	93.7	15	6.3	48	20.2
April	92	92.9	7	7.1	16	16.2
May	90	97.9	2	2.1	13	14.1

to state what micro-organisms were concerned in the production of the lobar pneumonia following influenza, but it seems improbable that it was the hemolytic streptococcus which produces the fatal bronchopneumonia of measles. It is noteworthy that the fatality of pneumonia diminished during the outbreaks of April and May.

SUMMARY

Pneumonia which has occurred at Camp Funston since the establishment of the camp may thus be classified:

1. Pneumonia of a relatively stationary camp population. It resembles the pneumonia of civil life, and

has been characterized by the presence of a predominant proportion of pneumococci of Types I and II during the period of our study.

2. Pneumonia of newly drafted colored men from Southern states. This has been of mild type, with a low rate of mortality and few complications. It has been associated during the period of our study with a high proportion of those types of pneumococci which occur in the mouths of healthy men. Pneumococci Type II have not been found; Type I has occurred in great part in one company of men. It is not improbable that the incidence of various types is dependent on exposure of susceptible men to those types which are disseminated when drafts have been recently assembled.

3. Pneumonia following influenza. In March an epidemic of influenza swept through Camp Funston and quickly spent itself, presumably by the infection of all susceptible men. In April there was a second wave of influenza and in May, a third, almost wholly limited to newly drafted men brought into the camp a short time before these outbreaks. Corresponding to each of these three outbreaks of influenza, there was a period of greatly increased incidence of pneumonia and bronchitis. These diseases, in many instances, were associated with influenza. They were prevalent in the organizations attacked by influenza, and maintained the same relation to the length of service of the men affected; that is, men who had been in the Army several months were attacked in the first outbreak, whereas the second and third outbreaks of pneumonia occurred in great part in newly drafted men. The pneumonia associated with influenza was in most instances lobar pneumonia, and was followed by a relatively low rate of mortality (from 14 to 20 per cent.). With the information available, it is not possible to draw a sharp line between (1) the pneumonia of the stable camp population, (2) the pneumonia of the newly drafted Southern troops, and (3) the pneumonia following influenza. It is possible that influenza, in a greater or less degree, also acts as a predisposing factor in the production of the first and second varieties.

4. Pneumonia with measles. In November and December, 1917, there was an outbreak of pneumonia accompanying measles. The disease was predominantly bronchopneumonia, and the rate of mortality was very high (45 per cent.).

Examination of the mouths of healthy men in the camp for pneumococci has shown types usually present in the mouth, namely, Atypical Type II and Types III and IV in 61.2 per cent. of those examined. Pneumococcus Type I has been found only twice—once in a company in which four cases of Type I pneumonia had occurred, and once in a man who a short time before the examination had been in the hospital with otitis media and tonsillitis.

During the period of our investigation, hemolytic streptococci had an insignificant part in the production of pneumonia and its complications. There have been 112 cases of measles, but no complications referable to hemolytic streptococci. Hemolytic streptococci have been found in the mouths of one in four or five healthy men in Camp Funston. Evidence obtained has suggested that hemolytic streptococci may disappear from the mouths of patients with the onset of measles; few carriers were found during the period of the rash, but later the incidence of hemolytic streptococci gradually

increased, and finally reached that of healthy men in their own organizations.

Bacillus influenzae has been found in the mouths of 35.1 per cent. of the healthy men examined at Camp Funston. It has been found associated with pneumococci in eight of sixty-two cases of pneumonia. We have had no opportunity to study the bacteriology of influenza.

A small group of cases of bronchitis have been studied. In all that have been examined by appropriate methods, pneumococci Type IV or Atypical Type II have been found. Of thirteen cases, all but two harbored either *Streptococcus hemolyticus* (four instances) or *Bacillus influenzae* (seven instances).

Clinical Notes, Suggestions, and New Instruments

IODIN CONSERVATION: CAMP LEWIS METHOD

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Tincture of iodine has by reason of its convenience and efficiency largely superseded other antiseptics for skin sterilization preparatory to surgical operations. The ordinary method is to paint the skin with a small gauze mop held in forceps. These mops are usually thrown away.

Long ago it occurred to me that the waste was greater than the use, and the saving of the mops was begun. The greatly increased cost of iodine has lately emphasized the need of conservation.

In collaboration with Sergeant Brown under the direction of Major Staniford in the Camp Lewis laboratory, we have worked out a practical method of conservation which we have now been using for several months.

The iodine mops are dropped into a conveniently placed dish in the surgery and are then saved in large glass jars. When they have accumulated in a sufficient quantity they are taken to the laboratory and the iodine is recovered in the form of tincture by reprecipitation with condensed alcohol vapor. The apparatus here illustrated is simple and may be obtained from any large dealer in chemical glassware.

Apparatus for recovering iodine from iodine mops: A, water bath; B, alcohol; C, iodine mops; D, condenser.

As the boiling point of alcohol is below that of water, it is only necessary to heat the water bath until the alcohol boils. The iodine does not volatilize from the liquid. A piece of moist starch paper placed at the open end of the condensation tube is not discolored. The condensed alcohol vapor drops back through the mops and carries the iodine with it in the form of tincture. It may be readily standardized by the color test, a convenient standard being a 1 dram vial filled with the desired percentage of the tincture. When desired, the residual dilution in the mops may be readily "squeezed"