# SCIENCE

FRIDAY, NOVEMBER 8, 1918

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MSS. intended for publication and books, etc., intended for review should be sent to The Editor of Science, Garrison-on-Hudson, N. Y.

## THE INFLUENZA PNEUMONIA PANDEMIC IN THE AMERICAN ARMY CAMPS DURING SEPTEMBER AND OCTOBER, 1918[1]

THE pandemic of influenza which has been prevalent in Europe and which swept over the United States in the spring of 1918, causing much suffering and disability in industrial plants and loss of training time in American army camps, reappeared with greatly intensified violence in September and October. Within a month of its recognition it had been reported from nearly every quarter of the United States, civil and military.

The army and navy camps suffered severely from the outset. Rarely before in the history of war has infection exhibited a more explosive character or has so large a proportion of troops been infected in camps under conditions of abundant shelter and food and freedom from the strains and anxieties of conflict. The epidemic has been attended by an unusual fatality.

The data and deductions contained in this report are such as are warranted by daily telegrams and other sources of information collected during the course of the pandemic. The final and complete statistics will not be available until after the outbreak is completely over.

During the period September 12–October 18, 1918, inclusive, there were 274,745 cases of influenza reported among the troops in America. During the same period there were 46,286 cases of pneumonia and 14,616 deaths.

The incidence of influenza and pneumonia among all troops in the United States, week by week, from the outbreak to and including October 18, 1918, follows:

[1] Published by permission of the Surgeon General of the U. S. Army.

CASES OF INFLUENZA AND PNEUMONIA AND DEATHS EACH WEEK AMONG ALL TROOPS IN THE UNITED STATES FOR THE PERIOD, SEPTEMBER 12–OCTOBER 18, 1918

| | September | | October | | | Total |
|---|---|---|---|---|---|---|
| | 20 | 27 | 4 | 11 | 18 | |
| Influenza .. | 10,094 | 37,493 | 88,478 | 90,393 | 48,287 | 274,745 |
| Pneumonia. | 758 | 4,313 | 8,655 | 17,882 | 14,768 | 46,286 |
| Deaths .... | 96 | 951 | 2,275 | 6,005 | 5,289 | 14,616 |

The foregoing table indicates that the pandemic claimed the greatest number of victims in the week ended October 11; this was four weeks after the first local outbreak was discovered. In this week, roughly one third of all the cases of influenza and pneumonia and deaths occurred.

### THE OUTBREAK OF THE PANDEMIC

The first report that a serious epidemic existed in any camp came from Devens, at Ayer, Mass. On September 16 the camp sanitary inspector, reporting through the camp surgeon to the Surgeon General of the Army, announced that an epidemic of so-called "Spanish influenza" had broken out at Devens as a part of a general epidemic which had attacked Boston and the neighboring states and towns some weeks before.

The Devens epidemic is supposed to have commenced on September 7, 1918, in D Company, 42d Infantry. On that date a case of supposed meningitis was sent to hospital from this company; on the following day twelve cases were sent for observation. These proved to be influenza. By the sixteenth 37 cases had gone from the same company. One death from pneumonia had occurred. Almost simultaneously, other cases appeared in other organizations. By September 12 the total number of cases which had been admitted was 599. The disease spread rapidly, in spite of the measures taken to check it. On September 20 the epidemic reached its maximum intensity. On that day 1,543 new cases were reported as having been admitted to sick report. After reaching this high point the number of new cases rapidly became less, so that by the end of the month there were less than 100 new cases reported per day.

Meanwhile, pneumonia had become a frequent and fatal accompaniment of the influenza at Devens. Fifty new cases were reported September 19, less than three weeks after the influenza had broken out. The number rapidly increased; on September 24, there were 342 new cases. The number each day remained at about 200 for four days; then there was a decrease, until, before the end of the month, 40 per day had been reached. Since October 4 there have been less than five new cases daily.

The Devens outbreak, so far as may be understood from the records at hand, could be divided into 4 parts as shown in the following table:

THE RISE AND FALL OF THE INFLUENZA-PNEUMONIA EPIDEMIC AT CAMP DEVENS, AYER, MASSACHUSETTS, 1918

| | Duration Days | Cases Infl. | Cases Pneu. | Deaths |
|---|---|---|---|---|
| Rise (Sept. 12–19) ..... | 8 | 3,283 | 43 | 16 |
| Peak (Sept. 20–21)..... | 2 | 2,722 | 205 | 43 |
| Rapid decline (Sept. 22–29) .. | 8 | 3,141 | 1,495 | 298 |
| Slow decline (Sept. 30–Oct. 18) | 19 | 571 | 571 | 310 |

It will be observed from the foregoing table that the rise of the epidemic covered a period of about 8 days; the peak 2 days; the rapid decline 8 days, and the slow decline 19 days. Half the deaths and nearly three quarters of the pneumonia occurred during the period of rapid decline or within less than three weeks of the outbreak.

### CHARACTERISTICS OF THE DEVENS EPIDEMIC

The characteristics of the Devens epidemic have been described here because they represent what has occurred at many camps. The earliest cases have often escaped identification. They may be taken for cases of food poisoning, meningitis, or one of the common exanthemata. The disease which is epidemic bears little resemblance to the coryzas and other respiratory

affections to which the term influenza has been generally applied for the last twenty years.

The leading symptoms in the typical cases are: severe headache; chills or chiliness; pains in the back and legs; temperature sometimes as high as 104; great prostration; drowsiness. Occasionally there are nervous symptoms; sometimes, but not always, the eyes and the air passages of the nose and throat are affected; there may be gastro-intestinal disturbances. The onset is sudden. The patient can often tell the exact moment of his attack. In the typical case he is very sick—wholly incapacitated for exertion. He lies curled up and can hardly be roused for food. In two or three days the fever usually disappears by crisis and the patient feels that he is rapidly recovering. It is highly important that he be well cared for and kept comfortably warm during the next week. Pneumonia occurs in about 18 per cent. of the cases; it proves fatal in over one third of those attacked.

The fact that an epidemic existed in a camp has generally been recognized when the number of new cases has amounted to 100 or more per day. The incidence then increases rapidly. Sometimes the records show a great number of cases at the start, and there are marked fluctuations in the daily incidence as the epidemic continues. Striking irregularities do not represent the way in which the disease occurs but are to be accounted for by the stress and difficulty with which the returns are collected. The greatest number of new cases reported for any day has often considerably exceeded 1,500 in a camp. At Devens the maximum was 1,543. At Grant, 1,810 and Custer, 2,800. The high point has often been reached on about the tenth day of the epidemic.

Epidemics commonly subside almost as rapidly as they arise. Within from 16 to 20 days after the outbreak the number of new cases per day falls to 200 or less, after which there is a more gradual decline to the end. In its epidemic aspect, as in the individual case, the disease is characterized by sudden onset, great intensity, and rapid recovery.

Within about a week after the outbreak of the influenza there occurs an ominous prevalence of pneumonia. The pneumonia does not exist as a separate epidemic, but is always a follower of the influenza. How the two diseases are related is not positively known. It is clear that the influenza paves the way for the pneumonia, if it does not actually produce it. Most of the pneumonia is of the lobular type and presents various unusual aspects. The time of greatest incidence is usually about a week after the greatest incidence of influenza.

### SPREAD OF THE PANDEMIC

The second camp to report an epidemic following Devens, was Upton, on Long Island, N. Y.; the third was Lee, in Virginia. Dix, in New Jersey, and Jackson, in South Carolina, followed immediately. Hoboken, N. J., Syracuse, N. Y., Gordon, in Georgia and Humphreys, in Virginia, all reported on the same day. Within a week from the start, nine large camps in widely separated parts of the country were attacked. Others followed in rapid succession. The table on the following page gives the order in which the camps were attacked. In addition there were many epidemics reported from posts, aviation stations and other troop centers.

### THE OUTLOOK FOR THE FUTURE

How far the pandemic will spread will apparently depend only upon the material which it can feed upon. It is too early to foretell the end or to measure the damage which will be done before the pandemic disappears. Enough is known to show that hereafter influenza is not to be ranked merely as an endemic disease of civil life, but an infection of first-class military possibilities. It is not improbable that the present pandemic may disappear as rapidly as it came, although most persons hold the opinion that its final disappearance will be gradual, the extinction of the disease being postponed for many months. In the pandemics which sweep over the earth at long intervals, recurring waves of the disease in greater or less degree commonly occur. If this rule holds

| Order | Camp | Location | Date |
|---|---|---|---|
| 1 | Devens | Massachusetts | Sept. 12 |
| 2 | Upton | New York | " 13 |
| 3 | Lee | Virginia | " 17 |
| 4 | Dix | New Jersey | " 18 |
| 4 | Jackson | South Carolina | " 18 |
| 5 | Hoboken | New Jersey | " 19 |
| 5 | Syracuse | New York | " 19 |
| 5 | Gordon | Georgia | " 19 |
| 5 | Humphreys | Virginia | " 19 |
| 6 | Logan | Texas | " 20 |
| 6 | Funston | Kansas | " 20 |
| 6 | Meade | Maryland | " 20 |
| 7 | Grant | Illinois | " 22 |
| 7 | Taylor | Kentucky | " 22 |
| 8 | Sevier | South Carolina | " 23 |
| 8 | Lewis | Washington | " 23 |
| 8 | Newport News | Virginia | " 23 |
| 9 | Pike | Arkansas | " 24 |
| 10 | Beuregard | Louisana | " 25 |
| 10 | Eustis | Virginia | " 25 |
| 11 | Greene | North Carolina | " 26 |
| 11 | McClellan | Alabama | " 26 |
| 12 | Kearney | California | " 27 |
| 12 | Bowie | Texas | " 27 |
| 13 | Johnston | Florida | " 28 |
| 13 | Sheridan | Alabama | " 28 |
| 14 | Sherman | Ohio | " 29 |
| 14 | Dodge | Iowa | " 29 |
| 14 | Shelby | Mississippi | " 29 |
| 15 | Custer | Michigan | " 30 |
| 16 | Travis | Texas | Oct. 1 |
| 17 | Cody | New Mexico | " 3 |
| 18 | Forrest | Georgia | " 6 |
| 19 | MacArthur | Texas | " 7 |
| 20 | Wadsworth | South Carolina | " 11 |
| 20 | Wheeler | Georgia | " 11 |
| 20 | Greenleaf | Georgia | " 11 |

true now we may look forward to another pandemic before many months are past. It is to be remembered that the present is the second, not the first, great wave which has occurred here this year.

The pandemic now raging may truly be termed an epidemic of epidemics. However desirable it may be to ferret out the cause to the first case this can not be done. Like all great outbreaks of this most infectious of communicable diseases, the epidemics now occurring appear with electric suddenness, and, acting like powerful, uncontrolled currents, produce violent and eccentric effects. The disease never spreads slowly and insidiously. Wherever it occurs its presence is startling. The consternation and alarm which it produces frequently lead to irrational and futile measures to check it.

In theory and practise influenza is preventable but it is very difficult to control under municipal and military conditions. It rarely happens that the necessary measures—chiefly isolation—are taken in time. In the present pandemic the disease has, on more than one occasion, been confined to certain wards of hospitals to the exclusion of others. It is not possible as yet to state to what extent it has been restricted in camps. No large camp has escaped it.

The following table gives the numbers attacked and the deaths recorded up to October 18 in twenty of the largest camps and cantonments:

TABLE OF CASES AND DEATHS AMONG 20 CAMPS GROUPED IN THEIR CHRONOLOGICAL ORDER OF ATTACK

| | Total Cases Influenza | Total Cases Pneumonia | Total Deaths Pneumonia | Per Cent. Attacked Influenza | Per Cent. Pneumonia to Influenza | Per Cent. Deaths Pneumonia |
|---|---|---|---|---|---|---|
| Five camps attacked (Sept. 12–18)[2] | 45,789 | 7,671 | 2,861 | 20.6 | 16.7 | 37.3 |
| Five camps attacked (Sept. 22–24)[3] | 42,267 | 7,399 | 2,591 | 21.2 | 17.3 | 35. |
| Five camps attacked (Sept. 29–Oct. 1)[4] | 32,932 | 6,818 | 2,280 | 21.8 | 20.7 | 33.6 |
| Five camps attacked (Oct. 3–11)[5] | 17,307 | 1,236 | 210 | 22.8 | 7.1 | 17.8 |

As the pandemic has progressed the proportion of soldiers attacked has increased, and the proportion developing pneumonia has increased while the fatality of the pneumonia has diminished. These differences have been slight, but they seem to be unmistakable. If these figures are fully substantiated by later

[2] Devens, Upton, Lee, Dix, Jackson.

[3] Grant, Taylor, Sevier, Pike, Newport News.

[4] Sherman, Dodge, Shelby, Custer, Travis.

[5] Cody, Forrest, MacArthur, Wadsworth, Greenleaf.

and more complete returns, the facts and inferences to be drawn from them will be of great moment.

The disease is carried from place to place by persons, not things or by the general atmosphere, as was once supposed. Its rapidity of spread is due to its great infectivity, short period of incubation, missed cases and absence of timely precautionary measures. It would appear that an epidemic does not easily start, but once the flame is well kindled a conflagration occurs which can not be stopped. The epidemics stop themselves. This they do either by the exhaustion of the susceptible material, by a reduction in the virulence of the causative agent, or both.

The causative agent is believed to be the bacillus of Pfeiffer; the means of transfer; the air and objects recently contaminated by the buccal and nasal secretions of those who harbor the virus. It is a fundamental assumption that influenza is produced when, and only when, material from the mouth or nose of infected persons gets into the mouth or nose of someone who is susceptible. As is plainly recognized in respect to intestinal infections, the hand probably plays an important part in the transmission of influenza. Coughing and sneezing help greatly to spread infection.

### CHANGES IN VIRULENCE

It has long been known that interchanges of bacteria occur commonly from mouth to mouth under ordinary conditions of social intercourse. Most of the organisms are harmless under normal conditions of health. That their virulence is sometimes increased, sometimes reduced, according to circumstances, appears to be certain. But what the circumstances are which raise or lower the virulence is conjectural. The Pfeiffer bacillus is no stranger to America; it was believed to be present in many healthy persons before the present pandemic. To account for the pandemic it has been suggested that something must have happened to increase its virulence or a new and more active strain has appeared, or the susceptibility of those attacked has become greater.

The conditions which govern susceptibility are not understood. Good general health, absence of fatigue and avoidance of cold and hunger are standard methods of prevention for the individual. Vaccination against pneumonia is practicable but such preventive treatment is in the experimental stage as respects influenza.

The belief that immunity is conferred by an attack is partly confirmed by the observation that in Europe and America a preponderance of persons who have suffered in the present pandemic are relatively young persons, few of whom could have experienced the disease during the pandemic of 1889–90.

The weather has always been supposed to exert an influence upon influenza—the very name is derived from the effect which extraterrestrial conditions were supposed to exert upon it. But although there has been a great deal of study of this subtle matter, little is known concerning it. It seems probable that the weather this fall has aggravated the disease and contributed to the incidence of pneumonia.

The epidemics which occurred in the spring of 1918 were like those which are taking place now, except that the disease was milder and there was less pneumonia. Until recently the influenza reported from Europe was of this mild type. It seems to have been as infectious as it is now. Reports coming from all parts of Europe indicate that the percentage of persons attacked was about the same at that at present.

Something seems to have occurred during the summer greatly to increase the virulence of the disease. During July and August a number of vessels plying between Europe and America experienced intense outbreaks of influenza, accompanied by very fatal pneumonia. That cases of the disease were being brought into the country in this manner was stated in the daily press and in official reports in July.

### COMPARISON WITH OTHER PANDEMICS

It is interesting to compare the present pandemic with others, but it is impossible to say

how severe were some of those which are recorded in history for the reason that statistical data concerning them is meager and imperfect. It is said that in 1889–90 no less than 25 per cent. of the population was attacked in London; 33 in Antwerp; 39 in Massachusetts, and in Paris, 50. In 1832–33 about 40 per cent. of the population of Paris is believed to have been affected. In 1872, three quarters of the population of London and some German cities were supposed to have suffered. The records of earlier visitation are more obscure.

Many observers of pandemics in other years have pointed out that influenza is a more fatal disease than is commonly understood, the fatality being due chiefly to lung and heart complications which do not promptly manifest themselves. Thus, although the number of deaths directly attributed to influenza in England and Wales in 1890 was reported as 4,523 per million, the Registrar General, by analysis of the vital statistics for the period, stated that the number of deaths directly or indirectly attributable was 27,074 per million, or nearly seven times the apparent rate. In London the general death rate was increased by over 20 per cent., in Berlin by more than 60 per cent. and in Paris and Brussels by over 100 per cent. No records now available show that there has ever been so much fatal pneumonia as in the present pandemic

The total number of cases of influenza in the present outbreak, inside and outside of the army camps, will never be accurately known. Although it is beyond doubt that the disease which is prevalent in the camps is the same as that which is widely distributed in civil life, it is not to be assumed that all the cases which occur are officially reported or that every case which is supposed to be influenza is really that disease. At this season of year there are always epidemics of colds and other respiratory infections. The weather this year has been particularly favorable to their occurrence. Under the present conditions of public anxiety, it is but natural that all cases of illness which at all resemble influenza should receive that designation. The net result of all the factors which enter into the matter is confusion. The army records have been systematically tabulated and studied from the first. When the pandemic has subsided the information to be derived from these data should be of much permanent value.

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Major, Sanitary Corps, U. S. A.,
October 26, 1918

## BRITISH SCIENCE IN INDUSTRY[1]

After years of what appeared to be fruitless discussion of the relations between industry and science and an annual crop of proposals as to the means whereby these relations might be improved, it would seem that a beginning is being made with the garnering of the harvest. We have not altogether perhaps lost our old habit of carrying out the pioneer work in the scientific field and leaving to others the commercial tillage; but the shock of war has modified the attitude of the devotee of pure science to industrial problems, and the manufacturer has had proof that the head of the research worker is not always in the clouds. Both parties are learning to respect each other, and the result is proving a national benefit. Some of the directions in which the gain has been made are revealed in the exhibition organized by the British Science Guild which is now being held at King's College.

### INITIAL DIFFICULTIES

It need hardly be stated that the difficulties which stood in the way of the organizers were by no means insignificant. Not only had the sanction of the Ministry of Munitions and the Board of Trade to be obtained, but as the usual charge for space has not been made to exhibitors it has been necessary to meet the cost mainly by voluntary contributions and the fact that the exhibition is in no sense a trade fair where orders may be obtained has limited the display to those who were actuated by a sense of public spirit rather than any hope of pecuniary gain. The scope of the exhibition, which it was desired to make representative of industrial development since the war be-

[1] From the London *Times*.