

it off on entering a shop or office is reversing the order dictated by common-sense. Probably it would not be possible to enforce the use of masks other than in trains, trams, and other public conveyances, and here their use would probably be of value.

Of inoculation the experience in New Zealand is practically confined to the troops. The results of vaccination in England and France were certainly encouraging, not as a prevention of infection so much as a means of reducing the more serious complications by raising the resistance of the body to pneumococcal and streptococcal invasions. Immunity thus acquired, unfortunately, appears to be very evanescent.

Quarantine.—Theoretically it should be possible to exclude a pandemic wave of influenza from an island community. A brave effort in this direction was made in Australia, but, as we know, has failed. It seems probable that the failure is due not to defects in the quarantine system established on the 16th October, but to the fact that even then it was too late and the elements necessary for the epidemic had already established themselves in the Commonwealth. In this connection we cannot do better than quote Sir Arthur Newsholme, whose wide experience led him to the conclusion that no measures existed which could resist the spread of pandemic influenza, chiefly because we were not able, so far, by bacteriologized or any other methods to distinguish between the normal bacteria of simple "colds" and those which were of a virulence so heightened as to have epidemic potentialities.

FACTORS INFLUENCING THE EPIDEMIC IN NEW ZEALAND.

We have followed the history of the two waves of influenza in New Zealand, and have traced the obvious connection between the first wave and the pandemic in Europe and America which began in April. We have not yet, however, attempted to explain the appearance of the secondary wave of highly virulent pneumonic type, which, as we have seen, did not spread as a wave from country to country, but arose apparently independently and almost instantaneously in every part of the world, so that within four or five weeks it was raging universally. Attention has been drawn to the curious anomaly that while this pandemic did not spread as a wave round the world, yet in New Zealand, as in America and South Africa, when once established it was capable of spreading in wave form very rapidly throughout these countries.

Evidence has been quoted showing that this secondary wave was intimately connected in its earlier stages with shipping, and we know that the establishment of strict quarantine in Australia on the 16th October modified and delayed the spread in the Commonwealth. Yet everywhere the exact part played by shipping has been obscure, chiefly from the fact that seldom has it been possible to trace the implantation of the peculiar infection to any one vessel from overseas. In each country there has been what may best be described as an incubation period, during which the wave in its earliest stages was gaining virulence and power, and in most countries there has been a merging of the first wave in its apparently final stages with the earliest development of the second wave.

The first question which we have to determine is whether the secondary wave was a simple working-up in virulence of the infectious organisms which were brought to the different countries during the first wave.

Relationship between First and Second Waves.

To the student of bacteriology there is nothing inconceivable in the possibility of an organism, by rapid transference from case to case under favourable surroundings, being changed from a harmless saprophyte to a very virulent infective parasite. The epidemiologist meets with such cases constantly in his work—an epidemic altering in character during the course of its spread from mild to severe, and *vice versa*. After all, bacteria are merely plants of low development, and like all plants they thrive on a favourable soil and languish in a resistant one. There is nothing stable about the virulence of an infective organism, and this applies to the influenzal group as to others. But there is this peculiarity as regards the virulence of the first wave of infection in 1918: that, whereas in ordinary epidemics the power falls as the wave recedes, this one showed a recrudescence power. We have observed this in New Zealand, especially at Auckland and Otago during September, and in other countries there was the same increased virulence during this month.

The first wave in itself was an abnormal one, at least in Britain, as Newsholme has pointed out, since it came as a midsummer outbreak, a thing hitherto not recorded. The usual course of influenza in Britain is for the second wave of infection to appear in the very cold season, and until 1918 an interval of perhaps seventy weeks usually elapsed between the waves, the shortest previously being thirty-five weeks. The October wave was only sixteen weeks behind the first. But never before in the world's history were conditions more favourable to the spread of disease. The huge bodies of men gathered together in training-camps throughout the world and then hurried overseas in conditions of unavoidable crowding, and the concentration in Europe of these overseas bodies of men has never occurred before on such a scale. The massing-together of recruits drawn from country districts has produced an ideal field for the cultivation of infective organisms, since these men have not had time to acquire immunity to these organisms. In our own camps it was found that of the victims of cerebro-spinal fever 70 per cent. were farmers or country dwellers.

Again, in Germany, Austria, and Bulgaria were prison camps in which overcrowding, semi-starvation, and appallingly insanitary conditions produced exceptionally favourable conditions for the exhalation of infection. In many countries, too, the general resistance of the population was lowered by insufficient nourishment. Viewing these conditions it is not difficult to account for the abnormal features which during 1918 took by surprise the sanitary authorities of every country.

In addition to these abnormal conditions of population throughout the world, unusual meteorological phenomena have been prevailing for some time; and exceptionally wet and cold weather, which resulted in a very marked increase in disease affecting plant-life. We thus find in 1918 horticulturists in Britain and America, as well as in New Zealand, reporting outbreaks of brown-rot, black-spot, and so forth. Low forms of plant-life, whether parasitic to man or to vegetation, found in this year conditions favourable to their spread.