THE ROYAL SOCIETY

*doi* 10.1098/rstb.2001.1012

# The so-called Great Spanish Influenza Pandemic of 1918 may have originated in France in 1916

**J. S. Oxford**

*Department of Medical Microbiology, Retroscreen Virology Ltd, St Bartholomew's and The London Queen Mary School of Medicine and Dentistry, 327 Mile End Road, London EC1 4NS, UK*

This discussion piece examines the likely epicentre of the influenza pandemic of 1918–1919. Contrary to previous studies that have proposed a Chinese origin, there is documentation that suggests that, in this instance, the virus spread eastwards to China from Europe. Although more recent oubreaks of influenza have undoubtedly had an Oriental origin, the evidence indicates that future outbreaks could conceivably arise anywhere in the world.

**Keywords:** influenza; pandemic; heliotrope cyanosis; outbreak

A very short period of time from late September to November 1918 saw the deaths of the US Army private, Private Vaughan, in South Carolina (Taubenberger *et al*. 1997), of 'Lucy' at Brevig Mission, Alaska (Reid *et al*. 1999), and of seven Norwegian coalminers in Spitsbergen (Davis *et al*. 2000) from so-called Spanish influenza. Reports of influenza deaths in countries as widely spread as Norway, Sweden, Finland, Canada, Spain, Britain, France, Germany, Senegal, Tanzania, Nigeria, China, Zimbabwe, South Africa, India and Indonesia were also recorded in this small time-frame (HMSO 1920; Stuart-Harris *et al*. 1984). The very wide geographical spread of these deaths in such a short period, in the absence of air travel at that time, suggested to us (J. S. Oxford, W. Innes, R. Daniels, R. Jackson, A. Sefton and N. P. A. S. Johnson) that the disease had spread around the globe prior to this time and that earlier 'seeding' had occurred. We therefore investigated explosive outbreaks of respiratory disease, affecting young persons, in the winter periods of 1916 to 1918 with high mortality and with the characteristic heliotrope cyanosis in Germany, England and France. All of these latter features characterized the 1918–1919 influenza pandemic. To date, we have identified two British Army camps where early outbreaks may have occurred as early as the winter of 1916.

Most significantly, in our opinion, Hammond *et al*. (1917) described an outbreak of respiratory infection, termed at the time purulent bronchitis, in a huge British Army base at Etaples on the edge of the sea in northern France in the winter of 1916. This camp housed 100 000 soldiers on any one day and over 1 million soldiers stayed here en route from England to the Western Front between 1916 and 1918. In the 1916 outbreak, many soldiers were admitted to the base hospital, suffering from an acute respiratory infection, high temperature and cough at a time when recognized influenza was present. Undoubtedly, conditions in the camp were ideal for spread of a respiratory virus, with most soldiers housed in tents or temporary wooden barracks. This outbreak was characterized clinically by heliotrope cyanosis, described so extensively in the ensuing 1918 outbreak, and finally by the extremely high mortality. Clinical examination showed, in most cases, signs of bronchopneumonia, and histology showed an acute purulent bronchitis. Our clinical microbiological review of the paper now ranks the description as classic influenza, being essentially similar to the extensive literature of deaths in 1918–1919 (Opie *et al*. 1921).

An almost identical epidemic of so-called purulent bronchitis with bronchopneumonia, with cases showing the peculiar dusky heliotrope cyanosis and mortality rates of 25–50%, was also described in Aldershot barracks in March 1917 (Abrahams *et al*. 1917). These authors commented that the typical case 'had an acute onset with elevated temperature with rapid breathing and a peculiar dusky heliotrope cyanosis of the face, lips and ears, so characteristic as to hall mark the nature of the patients malady even on superficial inspection' (p. 377). These same authors commented at the end of the main wave of the pandemic in 1919 that these earlier 1916 and 1917 epidemics were essentially the same disease.

The protracted period that we postulate for the emergence of the Great Pandemic of 1918, almost 2 years, could be explained by the absence of air travel and the distortion and restriction of travel during the Great War itself. However, conversely, demobilization in the Autumn of 1918 would have provided an ideal set of enhanced circumstances for intimate person-to-person spread and very wide dispersion as young soldiers returned home by sea and rail to countries around the entire globe. Family parties on arrival at home could have further exacerbated the situation (N. P. A. S. Johnson, unpublished data).

Our study also sheds light on the second important question, the geographical origin of the new pandemic influenza viruses, and suggests an origin in France in 1916

 

Figure 1. Soldiers plucking turkeys on the Western Front. (Photograph: IWM.)

Figure 2. One of several well-established piggeries at Etaples camp photographed in 1917. (Photograph: IWM.)

for the greatest influenza outbreak of the 20th century and perhaps of all time. At present, most surveillance for influenza pandemics is concentrated upon China, and indeed a small outbreak of avian influenza was detected in Hong Kong in 1997. As regards an avian origin of pandemic influenza, or the mixing-bowl hypothesis in swine, there is photographic evidence of contact of soldiers with live chickens, geese and turkeys (figure 1) in the Etaples region, and we have also located piggeries inside the camp at Etaples (figure 2; J. Oxford, unpublished data). We cannot exclude the possibility of a Chinese origin of the Great Pandemic, although we think it unlikely. In fact there is documentation suggesting an eastward spread of the virus from Europe towards China in 1918–1919 rather than a westward spread. Chinese labourers were present in the Etaples camp in 1918. However, Vera Brittain, in her classic description of the overcrowded and fraught conditions in this immense base camp at Etaples where she worked as a nurse (Brittain 1989), identifies soldiers, administrative and medical staff only of European and Indian origin in 1916–1917.

We conclude that it would be wise to incorporate into the present pandemic and surveillance plans the possibility that the next pandemic influenza virus may not arise in the Far East but in other parts of the world, including Europe.

Figures 1 and 2 are reproduced with permission of the Trustees of the Imperial War Museum, London.

## REFERENCES

Abrahams, A., Hallows, N. F., Eyre, J. W. H. & French, H. 1917 Purulent bronchitis: its influenza and pneumococcal bacteriology. *Lancet* **ii**, 377–380.

Brittain, V. 1989 *Testament of youth: an autobiographical study of the years 1900–1925*. London: Penguin Books.

Davis, J. L. (and 11 others) 2000 Ground penetrating radar surveys to locate 1918 Spanish flu victims in permafrost. *J. Forensic Sci.* **20**, 68–76.

Hammond, J. A. R., Rolland, W. & Shore, T. H. G. 1917 Purulent bronchitis: a study of cases occurring amongst the British troops at a base in France. *Lancet* **ii**, 41–45.

HMSO 1920 *Report on the pandemic of influenza 1918–1919. Reports on Public Health and Medical Subjects*, vol. 4. London: His Majesty's Stationery Office.

Opie, E. L., Blake, F. G., Small, J. C. & Rivers, T. M. (eds) 1921 *Epidemic respiratory disease: the pneumonias and other infections of the respiratory tract accompanying influenza and measles*. London: H. Kimpton.

Reid, A. H., Fanning, T. G., Hultin, J. V. & Taubenberger, J. K. 1999 Origin and evolution of the 1918 'Spanish' influenza hemagglutinin gene. *Proc. Natl Acad. Sci. USA* **96**, 1651–1656.

Stuart-Harris, C. H., Schild, G. C. & Oxford, J. S. 1984 *Influenza, the virus and the disease*. London: Edward Arnold.

Taubenberger, J. K., Reid, A. H., Krafft, A. E., Bijwaard, K. E. & Fanning, T. G. 1997 Initial genetic characterisation of 'Spanish' influenza virus. *Science* **275**, 1793–1796.