

unpolished rice rather than the polished rice we had had so far. We also requested that letters be allowed through (not one had arrived at the hospital, although we had heard that about 20 000 were held up in Batavia) and that books, dentures, glasses, and exercise facilities be provided.

The Japanese announced that they intended to return the POWs fit and well and that, subject to general shortages in Java, they would do what they could to supply better food. But no promises were made and it remains to be seen if anything will happen.

Afterwards

I stayed at Mater Dolorosa for just over one year. Between May 1944 and April 1945 I was moved twice

more, ending up at the old jail where I had first been imprisoned. It was now grossly overcrowded, 3000 men (British, Australian, and Dutch) having a space of some 80 by 200 cm for each man. But there was some comfort—Red Cross parcels (the first we had seen) arrived with bully beef. And it was here that we finally heard that the war had ended on 24 August. I waited a month, assisting in the evacuation of British and Dutch patients, before flying to Singapore to sail home. Even then, I had an uncomfortable half an hour while the Dakota aeroplane almost had to turn back because of bad weather.

Within six months of arriving home I passed the primary fellowship. The American copy of *Gray's Anatomy*, given to me by Weary Dunlop, had stood me in good stead.

Deception by immunisation, revisited

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An article published in *American Society of Microbiology News* was brought to wider attention by a *BMJ* editorial entitled "Deception by immunisation."^{1,2} The authors described how they used an artificial false positive Weil-Felix reaction to deceive the occupying Nazi forces into thinking their Polish village was endemic for typhus. This spared the villagers from being deported to slave labour camps. The editorial urged that two questions which arose be explored further: that the artificially induced antibody titre remains constant rather than varying as in the disease, and that the mortality of typhus is considerable. How then were the thorough, methodical occupying Nazi forces outwitted? We attempted to unravel the mystery.

Historical background

The appeasement of Hitler by the allies came to an end with his invasion of Poland on 1 September 1939, which precipitated the second world war. His three Panzer (armoured) corps made swift work of the Polish defences, and Warsaw, which was ruthlessly bombed, was reached within a week. The real objective of the attack, however, lay 120 miles further east at Brest-Litovsk, where the northern and southern corps linked in a giant pincer movement, enveloping the capital and ensuring the collapse of Poland. There was little doubt as to Hitler's plans, which he had alluded to in a speech to his generals on 23 May 1939 and which were quickly put into effect: "Danzig is not by any means the main cause of the disagreement. The chief objective is to get new areas for Germany in the east and to control and safeguard new sources of food stuffs." A reign of terror ensued, resulting in the deaths of five and a half million Poles and mass deportation to labour camps. Here a total of 500 000 to 600 000 slaves were sent to work in the factories of the Reich and the occupied countries.³

Typhus fever

In 1910 W James Wilson stated that typhus fever was "a disease which modern sanitary reform has banished from the midst of progressive communities." It had not been recognised as separate from typhoid fever until the 1840s or '50s, and often it was impossible to make a distinction clinically. It was often separated from typhoid fever and classified with the acute exanthemata, which it resembles in its infectivity, onset, and rash, but "on the other hand it differs

entirely from these in that it is always associated with unhygienic conditions."⁴ The view that contagion of typhus is conveyed by fleas was advocated on epidemiological grounds by Hay in 1907.⁵ In 1910 Ricketts and Wilder showed that the infecting agent was present in the blood and that insects, probably *Pediculi vestimenti*, were the agents carrying infection.⁶

It is useful to consider some work done by two military microbiologists who have not received the recognition by history that perhaps they are due. The first was W James Wilson, who served with the Royal Army Medical Corps in France during the first world war. From there he wrote a very mild letter to the *BMJ* acknowledging the fact that the Germans were testing the blood of suspected victims of typhoid fever with the Weil-Felix reaction, which had been described in 1916. He drew attention to the fact that he had described this reaction in 1910, at which time he said: "Results definitely prove that in typhus fever agglutinins for the typho-coli group of micro-organisms are present in the blood serum of the patients. The knowledge recently acquired regarding the presence of heterologous agglutinins in cerebrospinal fever prevents us from drawing the unwarranted conclusion that the presence of a bacillus in the intestine and urine and the discovery of an agglutinin for it in the blood indicate that such an organism is the cause of the disease in question."⁴ The Weil-Felix reaction takes advantage of the fact that certain proteus organisms share a common antigen with the rickettsias. Antibodies that agglutinate proteus O_x-19 are found in the serum of patients suffering from typhus borne by the European louse.

The second doctor, Rudolf Weigl, was four times a candidate for a Nobel Prize (1932, 1936, 1942, 1946). He worked in military bacteriological laboratories in Krakow and Przemysl during the years 1916-9, when many cases of typhus occurred among the prisoners of war. He cultivated a rickettsia suspension in the louse gastrointestinal tract (with the aid of a capillary tube through the louse's anus) and managed in 1924 to make a vaccine. This did not produce immunity but ensured that the disease would take a mild course. It was successfully used in various parts of the world where typhus was endemic, and it was estimated that eight million people were vaccinated in Poland and Russia during the 1930s.⁸ He also proved that dead dried lice were infective and louse excreta remained infective for many months. Hence to control an epidemic not only vaccination but disinfection was needed.

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The scourges of typhus and other rickettsial louse borne diseases were well known to the Germans. During the first world war trench fever was described by His in 1916, who named it febris Wolhynia as he had first observed it in the Polish province of Wolhynia.⁹ It was probably conveyed early in 1915 to the western front by louse infested soldiers. The sufferers all admitted to being lice ridden, and the incidence of disease paralleled the cleanliness of the units involved. This knowledge was not new. In 1855, two months after her arrival in the Crimea, Florence Nightingale observed in a letter to Sidney Herbert: "This last catastrophe is occasioned by the sick from the ships bringing in their dirty blankets with them, instead of leaving all at the gate, & finding the clean Hospl. linen provided for them." In 1918 the work of the American trench fever committee proved that transmission of *Rickettsia quintana* by lice caused trench fever.

Military deception

There was thus sufficient background knowledge and fear about the consequences of louse borne rickettsial disease, both trench fever and typhus. So great was this fear that after registration at the concentration camp at Auschwitz (Oświęcim) prisoners were sent to quarantine for six to eight weeks. Gestapo doctors prevented epidemics by killing patients suspected of having these diseases. On 29 August 1942, 746 met this fate. Even under these circumstances ingenuity surfaced. The word Fleckfieberverdacht (typhus suspected) was put on a room in block 20 (the camp hospital) by the Auschwitz resistance movement when meetings were being held and often kept the SS away.¹⁰

A combination of circumstances allowed two Polish doctors to put this fear to good use. In so doing they saved many of their neighbours from deportation and probable death. Drs Stanislav Matulewicz (actually born in Russia) and Eugeniusz Łazowski were both graduates of the University of Warsaw, where Weigl's work was well known. At the time of the Nazi invasion they were in general practice in the villages of Rozwadów and Zbydniów, about 200 km south west of Warsaw. Capitalising on Wilson's work, Dr Matulewicz had the idea that it might be possible by injecting a healthy person with proteus to cause a false positive Weil-Felix reaction, thus creating a false epidemic in their practice. As the Germans were inclined to avoid such areas the inhabitants would be relatively free from atrocities and deportations.

Accordingly, a labourer on leave of absence became the first volunteer to receive an injection of proteus Ox-19 suspension. The Weil-Felix test was found to have a positive result with a titre of 1:500, and a blood sample was sent to the German state laboratory. A telegram was received in reply confirming the result, and this was presented to the local German authorities, thus excusing the labourer from returning to Germany. The experiment was repeated successfully, and Rozwadów and a dozen surrounding villages were declared an "epidemic area." The Germans were aware

that blood samples of ill patients could be substituted for those of healthy patients and periodically took their own samples. The beauty of the deception lay in the fact that the blood of each person who had been injected with proteus would produce a positive test result for typhus—no substitution of samples was necessary. For security the patients were not told the nature of their injection. As there was a vogue for a variety of different forms of immunotherapy this did not arouse suspicion.¹¹

There are, however, two more serious problems: the antibody titre in a genuine case would vary with the course of the disease, and the disease has a high mortality. The Germans were fooled so successfully by a combination of factors: undue reliance on laboratory results, lack of thoroughness in clinical examination, and fear of contagion. In addition, hard drink played its part. A Nazi deputation consisting of an elderly doctor and two younger assistants was sent to investigate the results sent by Drs Matulewicz and Łazowski. They were cordially received and in the traditional Polish manner given food and vodka. The senior doctor did not personally inspect any of the village, but remained to be entertained, despatching his juniors. They made a cursory examination of the buildings but, being aware of the risks of infection, were easily dissuaded from closer inspection. An old man dying of pneumonia was brought in for the senior doctor and with much drama shown to be severely ill with, it was claimed, typhus fever. As Goethe said, "We see what we know." They saw, were convinced, and left.

Conclusion

Military applications of biological science are well known, and there are also many examples of new diseases resulting from the upheavals caused by war. What makes this story unusual is not anything particularly new—rather, the combination of circumstances. The ingenuity of two doctors who remembered what probably during their medical school days seemed rather irrelevant, coupled with a lack of thorough clinical method by investigators who saw what they expected to see, allowed the lives of many Poles to be spared.

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