

Biological Warfare in World War II

Lecture No. 3

1. Outline

- The French Programme
 - Slides 2 - 3
- The British Programme
 - Slides 4 - 11
- The Japanese Programme
 - Slides 12 - 16
- The US Programme
 - Slides 17 - 20

Notes: The aim of this lecture is to review what might be called the second generation of biological warfare programmes. These produced the first effective biological weapons and the first attempts to use modern biological weapons against people. Unless stated otherwise the main source for the lecture is the SIPRI Volume No 18 as in lecture 2.

Ref:

Geissler, E., and van Courtland Moon, J. (2001) *Biological and Toxin Weapons Research, Development and Use from the Middle Ages to 1945* (SIPRI Chemical & Biological Warfare Studies No. 18). Oxford: Oxford University Press.

2. The French Programme 1935 – 1940 (i)

- Probably influenced by its position as the Depositary State for the 1925 Geneva Protocol, France's programme was relatively dormant between 1926 and 1934
- The research seems to have been reduced to technological monitoring to retain an adequate scientific capability particularly in regard to defence against biological attack
- By 1934 German rearmament led to a renewed concerns about biological attacks. Trials were undertaken of the use of non-pathogenic bacteria in the Paris Metro and botulinum toxin was added to the list of agents that might be used
- By 1937 increasing concerns about war with Germany led to the establishment of a specialist laboratory at Le Bouchet

Notes: The point that is important for students to grasp is that France was responding to fears about German activities. Actually Germany had little interest in offensive biological warfare in World War II, but this was not clear to its adversaries at the time. For further analysis of the failure of intelligence, see chapter 8 of Dando, M. R. (2006) *Bioterror and Biowarfare: A Beginner's Guide*. Oxford: One World.

3. The French Programme 1935 – 1940 (ii)

- In 1938 a plenary session of the oversight committee heard reports on the dispersion of botulinum toxin in the air and on protection against ricin. Results of the experiments on the Paris Metro led to the view that epidemics could be generated in the civilian population
- The programme accelerated significantly in 1939 and considered both attacks and defence against ricin and attacks on German staple food crops by beetles and fungal agents. Work was also done on projectiles contaminated with tetanus or gangrene to attack human beings
- In early 1940 it was reported that it was quite feasible to infect cattle using aerosols of bovine plague virus

Notes: Clearly in a few years before the German occupation France had explored a very wide range of possible uses of biological weapons against humans, animals and plants.

Ref:

Centre d'Etudes du Bouchet (CEB), Vert-le-Petit, Commission de Prophylaxie veterinaire contre la guerre modern, proces-verbal no 3, reunion du 10 fevrier 1949 a l'etat-major de la defense nationale [Commission for Veterinary Prophylaxis against Modern Warfare, Minutes no. 3, meeting of 10 Feb. 1949at the National Defence Headquarters] pp. 3-4

Cited at p. 87 Lepick, O. (1999) 'French activities related to biological warfare, 1919-45',. In: Geissler, E. and van Courtland Moon, J. E. (eds.) *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*. SIPRI Chemical & Biological Warfare Studies, no.18. Oxford: Oxford University Press. pp. 70-90.

4. The British Programme in World War II (i)

- Because of similar concerns to France the UK's Committee of Imperial Defence established a Bacteriological Warfare Subcommittee in November 1936
- The UK had ratified the Geneva Protocol in 1930. Like many other states it had entered reservations that meant that it was bound only in regard to other parties and only if such states and their allies remained bound by the prohibition
- In late 1939 the Bacteriological Warfare Subcommittee reconvened as the War Cabinet Committee on Biological Warfare and it was authorised also to consider work "from the offensive angle"
- The work in the UK was strongly linked with Canadian activities and later with those in the US

Notes: What is clear once again in the British example is the impact of the 1925 Geneva Protocol initially conditioning a defensive response, but then fears of German activities leading to a perceived need for a retaliatory deterrent.

Ref:

Balmer, B. (2001) *Britain and Biological Warfare: Expert Advice and Science Policy, 1930-65*, New York: Palgrave Macmillan.

Carter, G. B., and Pearson, G. S (2001). 'British Biological Warfare and Biological Defense: 1925-45', in Geissler, E., and van Courtland Moon, J. (eds.) *Biological and Toxin Weapons Research, Development and Use from the Middle Ages to 1945* (SIPRI Chemical & Biological Warfare Studies No. 18). Oxford: Oxford University Press. pp. 168-189.

5. The British Programme in World War II (ii)

- Canada was involved with the British biological warfare programme because of its links with the British military and government, and its excellent scientists including Sir Frederick Banting
- Banting had received the Nobel Prize for Physiology and Medicine as the co-discoverer of insulin in 1923, and ran an outstanding medical research laboratory at the University of Toronto. He had prestige and connections
- In 1937 concerned again about reports of German activities, Banting prepared a detailed analysis of potential biological attacks – which he considered a grave and immediate threat

Notes: Banting was an influential scientist and was important in raising concerns about biological warfare in Canada and the UK. Banting's involvement in biological warfare has been discussed in detail by Jeanne Guillemin

Ref:

Guillemin, J. (2007) *Biological Weapons: From the Invention of State-Sponsored Programs to Contemporary Bioterrorism*, New York: Columbia University Press.

6. The British Programme in World War II (iii)

- On the outbreak of war Banting led a mission to the UK where his main concern was pursuing biological warfare issues. He was killed in 1941 when flying again to the UK to deal, in part, with biological warfare issues
- By that time, however, he had engaged a number of other outstanding Canadian scientists in work on biological warfare
- Banting's view was that "the only safe defensive position against any weapon is afforded by a thorough understanding which can only be gained by a complete preparation for the offensive use of that weapon"

Notes: The Canadian link with the UK and the US in biological warfare activities was important during and after the war. For details see Avery's account in SIPRI No 18.

Ref:

Avery, D. (1999) 'Canadian Biological and Toxin Warfare Research, Development and Planning', in Geissler, E., and van Courtland Moon, J. (Eds.), *Biological and Toxin Weapons Research, Development and Use from the Middle Ages to 1945* (SIPRI Chemical & Biological Warfare Studies No. 18). Oxford: Oxford University Press. pp. 190-214 at p. 197

7. The British Programme in World War II (iv)

- In August 1940 after the fall of France a new department to deal with biological warfare was set up at Porton Down where the Chemical Defence Experimental Station was located. The new department was headed by Paul Fildes who had been head of the Bacterial Chemistry Unit at the Middlesex Hospital
- The immediate need was seen to be a requirement for a retaliatory deterrent. This need was met by the production of an anthrax anti-animal weapon which could significantly damage Germany's vulnerable wartime agriculture
- Experiments were carried out to determine the anthrax lethal doses for sheep, horses and cattle and it was shown that these animals could locate and eat randomly distributed linseed meal cattle cakes spread on pasture land

Notes: It is important to stress to students that a careful experimental approach was used in this British programme to ensure that useable and effective weapons were available if needed.

Ref:

Hammond, P. M., and Carter, G. (2002) *From Biological Warfare To Healthcare: Porton Down 1940-2000*, New York: Palgrave Macmillan.

8. The British Programme in World War II (v)

- Cattle cakes were made by a London soap maker and sent to Porton in weekly batches of 250,000. A simple machine injected 0.05ml of a 10^{10} ml spore suspension into each cake and the cake was sealed and dried.
- The required 5 million anthrax-laced cakes were made in late 1942 and early 1943 and boxed up in 400s.
- Estimates were made of the proportion of land devoted to grazing in Germany, the likely number of cattle and operational flying heights and speeds.
- One type of attack scenario envisaged a massive single raid by 1250 aircraft each with 9 – 10 boxes of cakes which would be disseminated over a 18 to 20 minute run at 200mph.

Notes: Anti-agriculture attacks are not what most people will first think of when discussing biological warfare, but the open literature has a number of detailed examples of scientific analyses of how biological weapons could be used to destroy staple crops and animal husbandry.

9. The British Programme in World War II (vi)

- Whilst the anti-animal weapon was being developed Fildes and his colleagues concentrated their research on producing an anti-personnel biological weapon
- Consultation with the chemical weapons experts at Porton led to the conclusion that the best method of infecting people was through the respiratory tract. So if a biological agent could be aerosolised from a munition such an infection might best be achieved
- An apparatus was devised to produce bacterial clouds in the laboratory and it was shown that experimental animals could easily be infected
- Anthrax was chosen for most work for obvious reasons. The agent was code named "N"

Notes: This was the crucial discovery that led to similar conclusions and attempts to produce aerosolising weapons in subsequent offensive programmes.

10. The British Programme in World War II (vii)

- It was necessary to test if similar effects could be achieved in field tests using bursting munitions as had been found in the laboratory at Porton. Thus tests were made on an isolated island off the coast of Scotland
- A team from Porton and the services carried out the tests in the summer of 1942. They were to “ascertain the feasibility of producing lethal effects by explosion of a modified 30lb..bomb charged with a suspension of anthrax spores.”
- The bomb was suspended four feet off the ground and detonated electronically. Sheep and air-sampling devices were set out in arcs downwind of the device. A series of tests showed that the lethal effect was attained at least 250 yards downwind of the explosion

Notes: These tests clearly confirmed what had been found in the laboratory, but a real weapons test was still required.

Ref:

Center for Disease Control and Prevention (2006) 'History of Bioterrorism: Anthrax', *Podcasts at the CDC* [Online] CDC [retrieved at 15 June 2009]. Available from <http://www2a.cdc.gov/podcasts/player.asp?f=1#>

11. The British Programme in World War II (viii)

- A weapons test was carried out on an isolated shore off the coast of Wales in October 1942
- The bomb was dropped by a Blenheim bomber flying at 4950 feet. The single bomb fell some 20yards upwind of the intended aim point. Sheep placed in 120 and 320 yard (110metre and 295 metre) arcs subsequently died of anthrax
- The trial showed that anti-personnel biological warfare was feasible. The defined minimum lethal dose (LD50) for sheep showed that there was a serious risk downwind at 500yards
- On a weight-for-weight basis the anthrax bomb was 100-1,000 times more potent than any chemical weapons agent available to the British at that time

Further details of the British work in World War II are available in Pearson's chapter in SIPRI No18 and the more detailed books noted in the links in previous slides.

12. The Japanese Programme before and during World War II (i)

- Military medical doctor Ishii Shiro undoubtedly played a leading role in this large scale attempt to develop and use biological weapons
- After hearing about the 1925 Geneva Protocol Ishii reasoned that “if the weapons were placed on a forbidden list, then Japan should possess them in order to acquire an advantage over its opponents in future wars”.
- There were four major offensive biological warfare units. The most well-known is Unit 731 in Ping Fan Manchuria. If ancillary units are added perhaps some 15,000 people were involved in total
- After the war the US gave immunity to those involved in exchange for information gained during the programme

Notes: The following slides are developed mainly from Seldon Harris' article in SIPRI No 18. Two major books by Harris and Peter Williams and David Wallace are available in English, but much probably remains obscure.

13. The Japanese Programme before and during World War II (ii)

- Ishii clearly understood that he was involved in flouting conventional morality in the biological research that he carried out
- He is reported to have stated on numerous occasions that:
 - “There are two types of bacteriological warfare research, A and B. A is assault research, and B is defence research. Vaccine research is of the type B, and that can be done in Japan. However, A type research can only be done abroad...”
- Ishii was able to carry out type A research when he was posted to Manchuria in 1932. This involved large scale tests of potential agents on prisoners
- Ishii also invented a water purification system which was used extensively by Japanese armed forces during the war

Notes: As we shall see in more detail when we examine the accounts of the post war Soviet programme, some scientists clearly understood what they were doing. Others had various levels of knowledge and concern.

14. The Japanese Programme before and during World War II (iii)

- This offensive programme was huge. Ishii's annual operating budget was 10 million yen or more for many years. The establishment at Ping Fan had at least 76 substantial buildings including the enormous "administrative" block
- Kitano Masaji was Ishii's second in command and eventually succeeded him as commander at Ping Fan from 1942. Masaji is said to have been a bitter rival of Ishii's, but a much better scientist
- Wakamatsu Yujiro was a veterinarian who commanded Unit 100 in a suburb of Changchun. This units' main concern was animal and plant biological warfare
- Masuda Tomosada headed Unit 1644 In Nanking. He was a friend of Ishii and supported his activities in a number of ways

Notes: This slide is intended to give an idea of the size and scope of the programme and of the number of scientists involved.

15. The Japanese Programme before and during World War II (iv)

- Ishii's unit was able to produce large quantities of bacteria using methods he devised. In 1939 production capacity for anthrax was 500 – 600 kilograms and for plague 300 kilograms
- The main aim of the offensive research was to determine the minimum dose necessary to infect 50 per cent of humans struck by the disease (MD50) for every biological warfare agent
- Much work was also undertaken on crop destruction agents. Fungi, bacteria, and nematodes were studied, particularly for the effects on practically all grains and vegetables, especially those grown in Manchuria and Siberia
- Viruses and rickettsia were not considered as Ishii's unit did not have the necessary production facilities, and only limited work was done on toxins

Notes: Clearly this was a wide ranging programme. However, it does not seem to have been well directed and coordinated so as to achieve a viable weapon. Nevertheless, field trials were carried out on a very large scale as shown on the next slide.

16. The Japanese Programme before and during World War II (v)

- Three types of dispersion techniques were tried: artillery shells, aircraft spraying and air delivered bombs. The bomb tests were considered the most successful and numerous types were developed
- In 1939 Japanese forces suffered a series of heavy defeats in fighting with Soviet forces and Ishii was given permission to spread salmonella and typhoid in Soviet positions by saboteurs. Artillery shells were also used
- Unit 731 was commended for this operation and between 1939 and 1942 a series of field trials of biological weapons were carried out in China
- Typhoid, cholera, anthrax and plague were all used in various major operations in different areas – to devastating effect in some cases

Notes: Much remains unclear about this programme, but undoubtedly it was a serious and often gruesome effort to effectively develop and utilise biological warfare.

Ref:

Table 7.5 produced in Harris, S (1999) 'The Japanese biological warfare programme: an overview', In: Geissler, E. and van Courtland Moon, J. E. (eds.) *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*. SIPRI Chemical & Biological Warfare Studies, no.18. Oxford: Oxford University Press. pp.127-152

17. The US Programme in World War II (i)

- The US had promoted and signed the 1925 Geneva Protocol, but it had not been possible to gain ratification in the Senate. Thus the US was not formally bound by this treaty obligation during the war
- However, the President supported the principles of the protocol and there was considerable doubt about the possibility of biological warfare before the war
- Intelligence reports, including those concerning Japanese activities in China, began to change this perception as the US moved closer to involvement in the war
- A special committee was set up in the autumn of 1941 and its first report in February stated that “Biological Warfare is regarded as distinctly feasible...”

Notes: This and the following slides are taken from Moon’s chapter in SIPRI No 18.

Ref:

The unpublished manuscript *The Historical Report of the War Research Office, November 1944 Final*. pp. 18-40.

Cited at p. 219 in van Courtland Moon, J. E. (1999) ‘US biological warfare planning and preparedness: the dilemmas of policy’, In: Geissler, E. and van Courtland Moon, J. E. (eds.) *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*. SIPRI Chemical & Biological Warfare Studies, no.18. Oxford: Oxford University Press. pp. 215-254

18. The US Programme in World War II (ii)

- The 1942 report of the special committee listed anti-personnel and anti-animal Agents as follows:
 - Anti-personnel: plague, smallpox, dengue fever, yellow fever, various forms of encephalitis and malaria;
 - Anti-animal: rinderpest, foot-and-mouth disease and fowl plague
- Plant diseases and insect pests were also of concern and were said to warrant study for defensive and offensive possibilities
- In a second report of June 1942 the surprising omissions of anthrax and botulinum toxin were corrected

Notes: The committee was chaired by a civilian Professor of Bacteriology and included a number of other civilian scientists as well as military personnel.

19. The US Programme in World WAR II (iii)

- From the start the programme was top secret and gave equal consideration to offense as to defence. Indeed the best defence was considered to be the ability to react effectively and massively
- Collaboration with the British began in 1942 and at least 8 bacteriologist commissioned into US forces spent time at Porton Down. In May 1943 the UK provided all of its biological warfare results to the US and Canada
- This summary sent by the UK included the data from its 1942 trials of anthrax. In 1943 the US sent a serving officer to be part of the team carrying out further trials in Scotland

Notes: This cooperation began a long term association between the UK, US and Canada in the study of offensive and defensive biological warfare.

20. The US Programme in World War II (iv)

- US concerns about biological warfare were raised in 1944 – 45 by the descent of hundreds of hot air balloons sent from Japan across the Pacific onto the West Coast. Some intelligence officers thought that these might be charged with anti-plant biological agents
- By the end of the war the US programme had produced anti-plant agents thought likely to be effective:
 - Brown spot of rice (code named E)
 - Rice blast (code named IR)
 - Plant growth regulator (code named LN)
- Plans were made to destroy 30 per cent of Japanese rice crops by 1946, but the plans were shelved because of possible Japanese retaliation

Notes: The US did not have a long time during the war to investigate biological warfare, but the basis was laid for a massive programme that followed the war (see the next lecture).

Ref:

Whitby, S. (2002) *Biological Warfare against Crops*, New York: Palgrave Macmillan.

Rogers, P., Whitby, M., Dando, M. (1999) "Biological Warfare Against Crops", *Scientific American* **280**(6) pp. 62-67.

Sample Questions

1. Compare and contrast the British and Japanese biological warfare programmes of the 1930s and 1940s.
2. The role of major scientists has always been critical in the foundation and development of offensive biological warfare programmes. Discuss.
3. Why did the British come to the view that biological weapons were many times more potent than any chemical weapons agent they had available during World War II?
4. Why has anthrax been selected as a biological weapons agent in all the offensive biological weapons programmes we know of in the historical record?

References

(Slide 1)

Geissler, E., and van Courtland Moon, J. (2001) *Biological and Toxin Weapons Research, Development and Use from the Middle Ages to 1945* (SIPRI Chemical & Biological Warfare Studies No. 18). Oxford: Oxford University Press.

(Slide 2)

Dando, M. R. (2006) *Bioterror and Biowarfare: A Beginner's Guide*. Oxford: One World.

(Slide 3)

Centre d'Etudes du Bouchet (CEB), Vert-le-Petit, Commission de Prophylaxie veterinaire contre la guerre modern, proces-verbal no 3, reunion du 10 fevrier 1949 a l'etat-major de la defense nationale [Commission for Veterinary Prophylaxis against Modern Warfare, Minutes no. 3, meeting of 10 Feb. 1949at the National Defence Headquarters] pp. 3-4

Cited at p. 87 Lepick, O. (1999) 'French activities related to biological warfare, 1919- 45',. In: Geissler, E. and van Courtland Moon, J. E. (eds.) *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*. SIPRI Chemical & Biological Warfare Studies, no.18. Oxford: Oxford University Press. pp. 70-90.

(Slide 4)

Balmer, B. (2001) *Britain and Biological Warfare: Expert Advice and Science Policy, 1930- 65*, New York: Palgrave Macmillan.

Carter, G. B., and Pearson, G. S (2001). 'British Biological Warfare and Biological Defense:1925-45', in Geissler, E., and van Courtland Moon, J. (eds.) *Biological and Toxin Weapons*

Research, Development and Use from the Middle Ages to 1945 (SIPRI Chemical & Biological Warfare Studies No. 18). Oxford: Oxford University Press. pp. 168-189.

(Slide 5)

Guillemin, J. (2007) *Biological Weapons: From the Invention of State-Sponsored Programs to Contemporary Bioterrorism*, New York: Columbia University Press.

(Slide 6)

Avery, D. (1999) 'Canadian Biological and Toxin Warfare Research, Development and Planning', in Geissler, E., and van Courtland Moon, J. (Eds.), *Biological and Toxin Weapons*

Research, Development and Use from the Middle Ages to 1945 (SIPRI Chemical & Biological Warfare Studies No. 18). Oxford: Oxford University Press. pp. 190-214 at p. 197

(Slide 7)

Hammond, P. M., and Carter, G. (2002) *From Biological Warfare To Healthcare: Porton Down 1940-2000*, New York: Palgrave Macmillan.

(Slide 10)

Center for Disease Control and Prevention (2006) 'History of Bioterrorism: Anthrax', *Podcasts at the CDC* [Online] CDC [retrieved on 15 June 2009]. Available from <http://www2a.cdc.gov/podcasts/player.asp?f=1#>

(Slide 12)

Harris, S. (2002) *Factories of Death: Japanese Biological Warfare 1932-45 and the American Cover-up*, London: Routledge

Williams, P., and Wallace, D. (1989) *Unit 731: The Japanese Army's Secret of Secrets*, London: Hodder & Stoughton

(Slide 16)

Harris, S (1999) 'The Japanese biological warfare programme: an overview', In: Geissler, E. and van Courtland Moon, J. E. (eds.) *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*. SIPRI Chemical & Biological Warfare Studies, no.18. Oxford: Oxford University Press. pp.127-152

(Slide 17)

The unpublished manuscript *The Historical Report of the War Research Office, November 1944 Final*. pp. 18-40.

Cited at p. 219 in van Courtland Moon, J. E. (1999) 'US biological warfare planning and preparedness: the dilemmas of policy', In: Geissler, E. and van Courtland Moon,

J. E. (eds.) *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*. SIPRI Chemical & Biological Warfare Studies, no.18. Oxford: Oxford University Press. pp. 215- 254

(Slide 20)

Whitby, S. (2002) *Biological Warfare against Crops*, New York: Palgrave Macmillan.

Rogers, P., Whitby, M., Dando, M. (1999) "Biological Warfare Against Crops", *Scientific American* 280(6) pp. 62-67.

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