# Experiment 1

This terrifying experiment involved researchers applying VX (a nerve agent) to the backs of a number of guinea pigs in order to see how well a chemical worked in stopping the effects of VX. The chemical, BChE, is known as a bioscavenger which is something that can bind to a nerve agent to stop it from working.

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| Species involved | Guinea pigs |
| No of animals | 32 - in two different types of experiment |
| Weapon being tested | VX, which was made at Porton Down |
| Chemical's known effects | A low dose of VX has been described as causing blurred vision, drooling, excessive sweating, eye pain, nausea, vomiting and other symptoms. A large dose can cause fits, a loss of consciousness, paralysis and a failure to breathe. These symptoms can lead to death. |
| Used against humans? | Developed in the UK in the early 1950s, it is thought that VX was used in the 1980s during the Iran-Iraq war. |
| What happened to the animals? | • On arrival, they had devices implanted to record their temperatures and signs of recovery, etc.<br>• Days later, surgery was performed to insert a cannula either into an artery or vein in the neck, depending on what was going to happen to the guinea pigs next. (A cannula allows access to blood vessels so that substances can be given or blood samples taken.)<br>• In 'most cases', it was then at least 5 days before the guinea pigs were poisoned with VX.<br>• Eight animals were used to study how VX reacts in the body.<br>• 24 guinea pigs were used in the BChE studies. The cannula in these guinea pigs left their bodies between their shoulder blades. They were permanently 'tethered' after surgery. (Tethering involves the animal being permanently connected to a pump, via tubing.)<br>• VX was made at Porton Down and applied to a clipped area on the guinea pig, in front of their cannula, towards their heads.<br>• The animals were given a dose of VX which was higher than that required to kill them.<br>• Once obvious signs of poisoning were seen, the guinea pigs received an injection of three drugs into their thigh.<br>• The animals were then split into four groups and given more drugs, at different times, or none. |

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| | • The animals were observed, continuously, for 8 hours after dosing and at 'regular intervals' for up to 2 days.<br>• The guinea pigs were observed and given a score for signs of poisoning and their temperature. The higher the score, the worse the condition of the animal. A score of 31 meant the animal was dead. The descriptions of the scores given to the animals are truly chilling:<br>  ○ Substantial incapacitation – no meaningful voluntary movement – 9 points<br>  ○ Moderate incapacitation – loss of function of hind legs, but still mobile – 6 points<br>  ○ Gasping – 3 points<br>  ○ Continuous tremor – 2 points<br>  ○ Production of tears – 2 points<br>  ○ Visible production of saliva – 2 points<br>  ○ Writhing – 1 point<br>  ○ Chewing – often rapid with no food in mouth – 1 point<br>• Animals were killed at the end of the study or when their body temperature was too low or they had lost a quarter of their bodyweight more than a day after being poisoned.<br>• Dead animals were dissected. |
| Symptoms described / number who died | • The survival rate was much higher in the groups of animals who were given the BChE. All the guinea pigs who did not receive BChE died within 10 hours of being poisoned.<br>• Symptoms were described as 'a loss of body posture, gait abnormalities, salivation and lachrymation' (see above).<br>• Some animals lost about 10% of their bodyweight. |
| Aim of the experiment | To see what effect BChE would have after animals were exposed to VX. BChE has been shown to work with various different nerve agents, if given before exposure, in various animals, including rodents, monkeys and minipigs. |

*Mann, T.M et al (2017) 'Bioscavenger is effective as a delayed therapeutic intervention following percutaneous VX poisoning in the guinea-pig', Toxicology Letters, doi: 10.1016/j.toxlet.2017.11.029*

# Experiment 2

Below is the summary of another experiment conducted at Porton Down. The aim of these experiments was to test the effects of a chemical called HI-6 DMS against the effects of VX applied to the skin of male guinea pigs.

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| Species involved | Guinea pigs – only males used. |
| No of animals | 37 were operated upon. Due to numerous issues, 29 were later poisoned. |
| Weapon being tested | VX, which was made at Porton Down |
| Chemical's known effects | A low dose of VX has been described as causing blurred vision, drooling, excessive sweating, eye pain, nausea, vomiting and other symptoms. A large dose can cause fits, a loss of consciousness, paralysis and a failure to breathe. These symptoms can lead to death. |
| Used against humans? | Developed in the UK in the early 1950s, it is thought that VX was used in the 1980s during the Iran-Iraq war. |
| What happened to the animals? | • Male guinea pigs were supplied by Envigo (Envigo was formerly HLS, but the authors incorrectly describe it as formerly Harlan)<br>• Upon arrival at 'the animal house' the animals had a chip inserted into their bodies to monitor their temperatures<br>• They were then housed alone<br>• Under anaesthetic, the animals had two tubes inserted, to allow substances to be given and blood to be taken.<br>• Several days later, the guinea pigs had VX applied to an area of skin on their backs which was clipped. The dose was 'expected to be lethal', without treatment.<br>• Each study day animals were assigned to one of three groups. There were eight animals in each group.<br>• Two or three guinea pigs were exposed to VX each day and the therapy started at the same time and given for 24 hours.<br>• 14 blood samples were taken from one cannula over 2 days.<br>• Animals were continuously observed for the first 6 hours and then 'periodically' until 48 hours had passed. |

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| | • All animals were killed after 48 hours. |
| Symptoms described / number who died | 37 male guinea pigs underwent surgery. Of these, three were killed during surgery, one animal was removed on 'veterinary advice' and four had blocked cannulas. This meant 29 animals were dosed and of these 5 were excluded as their cannulas failed or they, incredibly, were given the wrong amount of therapy. **This begs the question of why 37 animals underwent surgery, if 29 animals were deemed to be a sufficiently large number to gather data from the research. **<br>One group of animals, only given one drug, suffered particularly horrific symptoms. The authors state '_The atropine alone animals are not shown in this table because they did not survive until the end of the study_' and '_The conditions of animals treated with atropine alone continued to deteriorate throughout the study until death_'. The deaths were not instantaneous or quick – '_all animals which received atropine alone died between 2 and 6 h post-poisoning_'. Those animals in the other groups, who did survive until the end of the experiment, suffered 'tremor', 'secretions' and 'postural incapacitation'. |

*Whitmore, C. et al (2017) 'The efficacy of HI-6 DMS in a sustained infusion against percutaneous VX poisoning in the guinea pig', Toxicology Letters, doi: 10.1016/j.toxlet.2017.11.007*