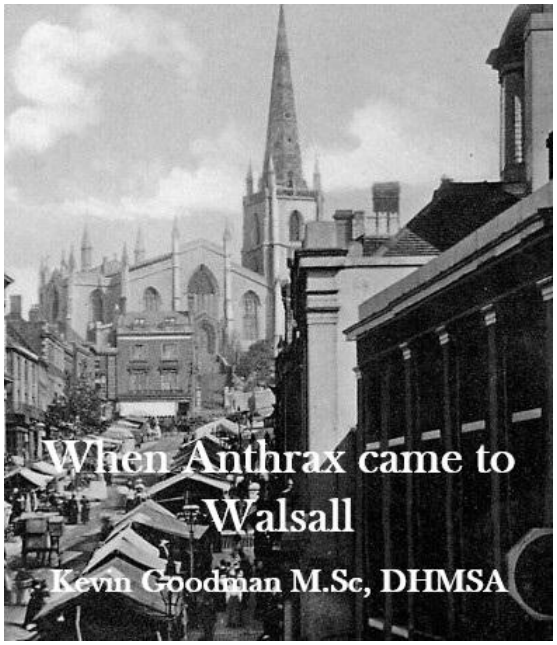

Anthrax is a serious, high-contagious infection caused by *Bacillus anthracis,* a spore-forming bacterium, which naturally occurs in soil and affects animals, both livestock and wild. Once in the body, the spores form toxins that destroy tissues. Humans can get infected through contact with infected animals or their products, but it does not spread from person to person. anthrax spores can enter the body through cuts or scrapes on the skin, from eating infected meat or breathing in the anthrax spores. It can - albeit rarely - be transmitted from someone who has an anthrax skin sore. The skin, or cutaneous, form presents with a small blister with surrounding swelling that often turns into a painless ulcer with a black centre, surrounded by pustules; the intestinal form with diarrhoea (which may contain blood), abdominal pains, nausea, and vomiting and the inhalation form with fever, chest pain, and shortness of breath. Rapid treatment with antibiotics can cure most anthrax infections, although inhaled anthrax is more difficult to treat and can be fatal[1].

Above: Anthrax ulcer
(Centre for disease control and prevention)

Descriptions of anthrax begin in antiquity. The Greek physician Hippocrates, originated the term "*anthrax*" (from the Greek word for "*coal*") to describe the characteristic black skin lesions, observed in humans and animals[2]. The best ancient account was by the Roman poet Virgil (70BC-19BC), he described an unknown disease afflicting cows, sheep, and horses: "*A terrible plague once sprang up there… not only destroying one flock after another, but killing animals of all kinds. Nor did the victims die an easy and uncomplicated death*." Virgil also observed the mysterious disease could be transmitted to humans through animal hides: "*The pelts of diseased animals were useless, and neither water nor fire could cleanse the taint from their flesh… If anyone wore garments made from tainted wool, his limbs were soon attacked by inflamed papules and a foul exudate, and if he delayed too long to remove the material, a violent inflammation consumed the parts it had touched*."[3] Ancient Indian literature described painful carbuncles that could be transmitted from domesticated animals to

[1] Levin, R.E. (2014) Anthrax: History, Biology, Global Distribution, Clinical Aspects, Immunology, and Molecular Biology. Bentham Science Publishers
[2] Guichard A, Nizet V, Bier E. (2012) New insights into the biological effects of anthrax toxins: linking cellular to organismal responses. *Microbes Infect.14(2)*:97-118.
[3] Dirckx J.H. (1981) Virgil on anthrax. *The American Journal of Dermatopathology*, ;3(2):191-6.

humans as early as 500 BC[4]. It has been theorised the fifth plague in the book of Exodus in the Bible, when cattle were cut down by a mysterious plague, may have been an early description of anthrax[5]. By the 19th century, anthrax posed a major economic challenge across Europe with horses, cattle, and sheep being vulnerable, as were those who worked with them and their products such as wool and animal hides[6]. The rise of anthrax in the United Kingdom became noticeable during the late 1840s, among workers in the woollen mills of Bradford, which affected those who opened bales and sorted imported wools. Its nickname is "*Woolsorters' Disease*"[7]

During the 19th century, anthrax contributed to major medical developments. The German physician and microbiologist Robert Koch's (1843-1910), first identified *B.anthracis* as causing anthrax and it served as the prototype for his postulates regarding the causation of infectious disease: (i) A pathogen must be found in abundance in all organisms suffering from the disease but should not be found in healthy organisms; (ii) the pathogen must be isolated from a diseased organism and grown in pure culture; (iii) The cultured microorganism should cause disease when introduced into a healthy organism and (iv) the pathogen must be re-isolated from the inoculated, diseased experimental host and identified as being identical to the original pathogen[8]. The first vaccine containing live organisms was a veterinary anthrax vaccine developed by the French microbiologist Louis Pasteur (1822-1895) in 1881[9].

As observed, those who worked with animal products, such as hide and leather were vulnerable. The British government was aware of this. The following warning appeared in newspapers across the country in 1887[10]:

NOTICE ISSUED BY THE PRIVY COUNCIL

DANGER OF HANDLING CARCASES OF ANIMALS DEAD OF ANTHRAX (SPLENIC FEVER)

Several cases of serious, and some of fatal infection have occurred in persons who have been employed in cutting up carcases of animals dead of Anthrax, and it is important that the public should be made aware of this source of danger to human life.

It is well known that the blood in Anthrax, and all parts of the body containing blood, are highly infective; and persons who have any abrasions, however slight, on their hands or arms, should carefully avoid touching any portion of the carcases of animals of which have died of this disease, or been slaughtered while suffering from it. The same care is required in dealing with fodder, litter, manure, or other things which may be contaminated with the blood of diseased animals.

Carcases of animals dead of Anthrax should be buried entire, without being skinned or cut, and be well covered with quicklime, and not less than six feet of earth.

Walsall, in Staffordshire, was a major leather production area from the Middle Ages to the 20th century, and -

[4] Jones S.D. (2010). *Death in a Small Package: A short history of anthrax*. Johns Hopkins University Press
[5] Swiderski R, M. (2004) *Anthrax: A history*. McFarland.
[6] Jones S.D. (2010) op cit
[7] Jones S.D. (2010) op cit
[8] Inglis TJ (2007). "Principia aetiologica: taking causality beyond Koch's postulates". *Journal of Medical Microbiology*. *56 (11)*: 1419–1422
[9] Jones S.D. (2010) op cit
[10] p.1, *Staffordshire Sentinel*, 19th March 1887

possibly - the centre of the saddlery trade internationally[11].

In December 1897, Alfred Griffin (27) a bridle cutter of 18 Margaret Street, Walsall, died from anthrax. He was employed by George Sheldon, a wholesale bridle-cutter of Bath Street, Walsall. He had worked for Sheldon for 14 years and was responsible for cutting and preparing the leather straps for stitching by the girls in the workshop[12].

Griffin had visited Dr John Joseph Lynch's surgery on December 6th with a sore on his lip, Lynch applied carbolic acid, an antiseptic and cauterising agent to it. The following day, the Doctor was summoned Griffin's home. He found the flesh around his patient's sore had become raised and inflamed, extending up his cheek, and the glands in his neck had become swollen. On December 8th, Griffin had taken to his bed. Large, inflamed pustules had developed around the sore; his glands and one side of his face had become enlarged and felt hard to the touch; his flesh had become dark. Eventually his internal organs began to fail. Lynch sought a second opinion from Professor Otto Kauffmann of Queens Hospital, Birmingham, who agreed it was anthrax. Griffin died on December 15th.

Due to the circumstances of the death, an inquest was held at the New Inn, Blue Lane, Walsall, on December 16th. There was a mystery regarding how he had contracted anthrax. Before his death, Dr. Lynch testified that Griffin did not

Above: Cover and page from George Sheldon's 1916 catalogue.

[11] Glasson, M. (2003) *Walsall Leather Industry: The World's Saddlers*. The History Press.

[12] p.8, *Walsall Advertiser*, 18th December 1897.

remember putting any leather in his mouth, and none of his workmates, including the foreman, Henry Bromwich of Vicarage Steet, had ever seen the deceased put leather in his mouth. The jury concluded the cause of death was anthrax, but there was no evidence to show where he had contracted it. His wife, Mary Ellen Griffin, stated that her husband had been suffering weakness for about six months before – did this make him more vulnerable to infection? The coroner, Mr. T.H. Stanley, ordered Sheldon's workshop to be disinfected[13].

Under the Infectious Disease Notification Act (1889), anthrax was a notifiable disease. This meant the head of the family or the nearest relatives in charge of a patient suffering from an infectious disease, as well as every medical practitioner attending such a patient, was required to notify the district's medical officer of health. Failure to notify the medical officer would result in a fine. Walsall was fortunate if it only had a solitary case during this time, however, it is possible that cases may have gone unreported, especially prior to the Act of 1889.

Other areas of the West Midlands suffered outbreaks, especially those industries working with animal products: Worcester, with its glove industry, experienced several cases in the 1890's[14] as did Kidderminster, Worcestershire, a centre of carpet production between 1896 and 1916,[15].

Anthrax still exists but can be prevented using vaccines and treated with antibiotics [16]. The last major outbreak of anthrax in humans in the UK occurred between 2009 and 2012, among 127 people (119 in Scotland, 5 in England, and 1 in Wales), who injected contaminated heroin. The source of the anthrax was believed to have been dilution of the heroin with bone meal in Afghanistan. There were 14 deaths.[17]

Today, it is primarily known as bioweapon, first used in 1914 by the German army[18]. Its most recent use was in September 2001 in the US: letters containing anthrax spores were mailed to news media offices and to two senators, five people were killed and seventeen were infected, the main suspect, Dr. Bruce Edwards Ivins, a US government microbiologist, committed suicide before charges were filed[19].

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[13] *Walsall Advertiser*, 18th December 1897

[14] *Twentieth Annual Report of the Medical Officer of Health to the Urban sanitary authority of the City of Worcester*. Year 1893,

[15] Carter T. (2004) The dissemination of anthrax from imported wool: Kidderminster 1900–14. *Occupational and Environmental Medicine*.;61(2):103-7.

[16] Levin, R.E. (2014) op cit

[17] Price E.P., Seymour M.L., Sarovich D.S., Latham J., Wolken S.R., Mason J., Vincent G., Drees K.P., Beckstrom-Sternberg S.M., Phillippy A.M., Koren S., Okinaka R.T., Chung W.K., Schupp J.M., Wagner D.M., Vipond R., Foster J.T., Bergman N.H., Burans J., Pearson T., Brooks T., Keim P. (2012) Molecular epidemiologic investigation of an anthrax outbreak among heroin users, Europe. *Emerging Infectious Diseases*, 18(8):1307-13.

[18] Jones S.D. (2010) op cit

[19] Levin, R.E. (2014) *Anthrax: History, Biology, Global Distribution, Clinical Aspects, Immunology, and Molecular Biology.* Bentham Science Publishers,

Kevin Goodman M.Sc, DHMSA, is a medical and social historian specialising in the history of the Black Country. He is the author of several books upon the subject including *The Diggum Uppers: Body Snatching and Grave Robbing in the West Midlands* (2024) and *"Nothing reigns here but Want and Disease, Death and Desolation!": The Black Country During The 1832 Cholera Pandemic* (2023). He has appeared in television documentaries including *Ancient Autopsies* with Professor Suzannah Lipscomb and a series on the history of medicine and surgery for *History Hit* with Dan Snow. More details at https://www.timetravellingmedicineman.co.uk

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