

William Budd and typhoid fever

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William Budd (Figure 1) was an English country doctor whose observations on typhoid fever had far-reaching consequences. He was born in 1811 into a strongly medical family. His father was a doctor in North Tawton, Devon, and also a naval surgeon in the war with France in 1794; seven of the ten sons studied medicine. William was initially apprenticed to his father, and then spent four years in Paris, where he came under the influence of Pierre Louis, the anatomical pathologist and clinical investigator (and father of evidence-based medicine¹). Louis took a special interest in the gastroenteritic illness known as putrid fever, and noted that the Peyer's patches of the small intestine showed inflammation and ulceration, coupled with enlargement of the mesenteric lymph nodes². Budd was also impressed by the work of Bretonneau, a French country doctor who reported an outbreak of similar disease in a military school in Tours³. The students who perished in this outbreak likewise proved to have ulcerated Peyer's patches; moreover, the surviving students who were sent home communicated the disease to some of their attendants. It was his experiences in France that sparked Budd's interest in how the disease was spread⁴. In England the condition was commonly known as typhoid fever because of certain resemblances to typhus, although the two conditions were sometimes confused. The disease was characterized by sudden onset of fever, headache and nausea, commonly accompanied by diarrhoea or constipation. The causal bacterium, *Salmonella typhi*, was ultimately identified in 1880.

OBSERVATIONS IN THE TAW VALLEY

Leaving Paris, Budd proceeded to Edinburgh, where in 1838 he gained an MD and Gold Medal for a study on acute rheumatism. He then served briefly at the naval hospital, HMS *Dreadnought*, where he himself experienced a near fatal attack of typhoid fever. On return to the Taw Valley he soon found an opportunity to pursue his interest, when typhoid fever broke out in a village of 1300 people where most of the patients were under his care:

'At first the people involved did not seem to have connections. However the fourth case, a sawyer, removed to his home nine miles off, soon as he began to droop. Two days after his return home he was laid up with fever



Figure 1 Portrait of William Budd (J B Black, London, 1867).
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of which he died at the end of 5 weeks. Ten days after his death his two children were also laid up with fever and both had it severely. The widow remained well'.

Budd continued,

'The case of the other sawyer (the sixth of the epidemic) who left the village when he felt the first symptoms of fever and went through the disease at his own home nearly nine miles off, is still more instructive. A friend who visited this man when he was at his worst, and was called upon to assist him in the bed, . . . at the end of 10 days was seized with rigor which was followed by typhoid fever of long duration . . . This person now

became a new source of contagion. Before he was convalescent, two of his children were laid up with fever, and also a brother, living at some distance, but who had repeatedly visited him⁴.

In 1839 Budd unsuccessfully submitted an essay that included this information to a medical competition. It was titled 'The investigation of the sources of the common continued fevers of Great Britain and Ireland, and the ascertaining of the circumstances which may have a tendency to render them communicable from one person to another'.

THE BRISTOL YEARS

In 1842 Budd settled in Bristol where he became physician to St Peter's Hospital and to the Bristol Royal Infirmary. In 1847, as a general practitioner, he visited a patient with fever in Richmond Terrace, Clifton, a suburb of the city. He diagnosed the fever as typhoid and soon realized that there was a minor epidemic among the homes of Richmond Terrace; of 34 households, 13 experienced at least one case of fever. The only thing the 13 houses had in common was the use of a well; the 21 without fever had different water supplies. He hypothesized that the disease was being spread by water; and in 1849, when he became responsible for the water supplies in Bristol, he concluded that cholera was spread from person to person in similar fashion. In consequence the Bristol water supplies were improved⁴.

It was not until 1859 that Budd's observations on typhoid in the Taw Valley finally emerged in *The Lancet*, under the title 'On Intestinal Fever'⁵. Much of the support for his notion of person-to-person spread came from fellow country doctors. One of these, William Cook from Worcester, described in *The Lancet* how he had traced a 'little epidemic in a country place where the houses are widely apart' very similar to the North Tawton one of 1839 and argued that such cases were not at all rare⁶. Another country doctor reported tracing an epidemic from a girl's school into homes in his practice and from the children through the families⁷. The battle lines were now drawn, between the contagionists, who believed in person-to person spread, and the anticontagionists, who favoured the notion of miasma—acquisition of disease via bad air or bad drainage. Budd concluded,

'If my own experience in this matter may be trusted, the immense majority of country practitioners are, as regards the species of fever, decided contagionists. I believe that it is also true that an equally large majority of those who practise in large towns, and in London especially, as chief

of large towns, are as decided anticontagionists. And if the former should prove to be right, the credit must no doubt be given, not to superior insight on their part but to their possession of a better point of view'⁴.

In the summer of 1863 enteric (typhoid) fever broke out at the Convent of the Good Shepherd in Arno's Court, near Bristol. This incident was described in Budd's later work *Typhoid Fever*, and its reviewer in the *British Medical Journal* noted that Budd recorded that a previous inmate of the reformatory had reattended, after several months in a town twenty miles away, 'with the fever upon her'. Six weeks after her return the first case of enteric fever occurred in the convent and by March 'more than fifty of the inmates had been stricken, three had already died, and two more, including the chaplain, were lying at the point of death'. Budd maintained that the outbreak, in an establishment in which hitherto no single case of typhoid fever had ever occurred, gave the lie to the doctrine that typhoid fever is the result of bad drainage only, and is not in any way contagious⁸. He also recorded, in *The Lancet*, his views about an outbreak of fever at the Clergy Orphan School, in St John's Wood, London. In this outbreak necropsies had shown the characteristic intestinal ulcerations of typhoid fever. He wrote 'If it be certain that the intestinal discharges of this fever are the principal means of propagating the disease, it is no less certain that by subjecting the discharge on their issue from the body to the action of powerful disinfectants, they may be deprived of this property'⁹.

A PREVENTIVE STRATEGY

He became an enthusiast for disinfection. The most powerful disinfectant at the time was chloride of lime. Chlorine had been discovered in 1774 and its bleaching power was documented in the mid 1780s. In the process, chlorine was released; and, to avoid its unpleasant effects the astute Charles Macintosh (inventor of the raincoat) suggested passing the gas through lime. The resultant chloride of lime or bleaching powder, he subsequently felt, could be used against the spread of disease, and in 1804 he wrote to the War Office with a proposal for its use amongst troops¹⁰. The War Office was not interested. When in 1869 Budd devised a placard for placement in areas of epidemics, it recommended liberal use of disinfectants including chloride of lime into drains and privies and advised that the hands of the attendants should be frequently washed with disinfectant solutions. Also, 'all the drains should be flushed twice daily with the abovementioned solution of carbolic acid, or with a solution of Green Vitriol'. But his control strategy gave

at least equal emphasis to clean drinking water and well-functioning drains.

THE OPPOSITION

Budd did not put his views before the profession until 1857–60 when he published a series of papers in *The Lancet*, afterwards embodied in his work *Typhoid Fever* in 1873. He had long since taught them in the Bristol Medical School. During the depressing period of opposition that he encountered, he gained support from fellow country doctors; otherwise one of his few admirers was Sir Thomas Watson, who reckoned his investigations to be of priceless value¹¹. Budd maintained that, in both typhoid fever and cholera, the contagious matter was in the dejecta. He is credited, through application of his preventive methods, with having greatly reduced the spread of cholera in Bristol. Before Budd's regime, in 1849, a cholera epidemic spread widely and killed nearly 2000 citizens out of 140 000; in 1866 cholera spread very little and the death toll was 29.

Budd had the ill luck to find himself chronologically between two epidemiological paradigms—the era of sanitary statistics with its paradigm, miasma, and the era of infectious disease epidemiology with its germ theory¹². In the early years miasma prevailed, and in 1848, when cholera revisited London, the London Metropolitan Commission, dominated by Edwin Chadwick, was confident that the disease spread through the gases rising from putrid matter rather than by contagion or infected water. The Commission therefore organized the flushing of the public sewers into the Thames, which made the epidemic worse by contaminating the drinking water. The Corporation then appointed London's first Medical Officer of Health, John Simon. When cholera returned in 1854, very few of those who died were dwellers in the City. This was because Simon had cleaned up the City, whose water supply no longer came from the Thames.

Simon was influenced by research done by William Budd, on cholera in Bristol, and by John Snow who (it seems independently) in 1849 had suggested that cholera was spread by the swallowing of its living organism in drinking water. In 1854 Snow found that most of the 500 people who died in Soho from the cholera took their water from the famous Broad (now Broadhurst) Street pump while users of the local wells escaped. Once the pump was sealed off the outbreak subsided. Simon did a larger study comparing water supplies from Dutton and Battersea and obtained similar results¹³.

Budd's main work, *Typhoid Fever*, was published in 1873 long after his original rural observations in North Tawton. In it he declared that 'the sewer has been looked upon as the

actual and primary source of the disease, while the infected man has been altogether lost sight of'. The *British Medical Journal* reviewer was impressed by the story of the two sawyers with typhoid in North Tawton and the girl returning to St Arno's convent. However, this commentary also noted the view of Dr Charles Murchison at the time, that many cases had had an independent origin. Another criticism was that no one had found the genesis of epidemics of enteric fever. The reviewer quoted Dr Maclagan of Dundee who believed that enteric fever occurred spontaneously. An epidemic in an isolated farmhouse was attributed to altered positioning of a drain, because the 'possibility of importation of the disease seemed excluded: all the servants and residents had been there for some months at least: no one had been in any locality in which the fever existed, and no one had visited the place who was in the least degree likely to have brought the infection with them'. The concept of the symptom-free carrier had clearly not dawned on anyone, Budd included. The conclusion of the reviewer was that 'though we hesitate to subscribe to the whole of Dr. Budd's proposition, we think he has proved that enteric fever sometimes arises from contagion.'⁸

BUDD'S ACHIEVEMENT

In 1873 Budd's health broke down and he was compelled to withdraw from professional work. He died in 1880—the year in which the typhoid bacillus was isolated. His extensive learning, his great practical knowledge of disease and the clarity of his mental vision had made him a leader of professional thought and activity¹⁴. All these achievements in human ecology occurred while Budd was a rural and provincial city general practitioner. According to Murrell¹⁵ general practitioners have four main tasks—to manage undifferentiated illness, to manage long-term and continuing illness in the community, to offer a health prevention service and to offer an advocacy service to the patient. For the thinking general practitioner he added a fifth task—to study the interaction of human beings with themselves, with living organisms and within their shared environments. This is the task of human ecology.

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