

# Waller—pioneer of electrocardiography

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In the history of electrocardiography, Einthoven dominates the published papers, and the contribution of A. D. Waller, who first recorded the electrocardiogram in man with surface electrodes (Waller, 1887; Einthoven, 1912), is often ignored. This is an omission which ought to be remedied.

Augustus Desiré Waller used his full name in order to distinguish himself from his eminent father, Augustus Volney Waller, remembered for his work on nerve degeneration. Waller senior worked in Paris and his son was born in 1856 and educated there until his father's death in 1870. The widow and son then moved to Scotland and he studied medicine in Aberdeen and Edinburgh. Following his father's interest in physiology, he took an appointment in 1883 as lecturer at the School of Medicine for Women in London and, the following year, was also appointed lecturer in physiology at St Mary's Hospital, Paddington. He married one of his students, the daughter of Sir George Palmer (of Huntley and Palmer biscuit fame), and was greeted at his next St Mary's lecture by a blackboard inscribed 'Waller takes the biscuit'. With characteristic humour, Waller added 'and the tin as well'.

At St Mary's his laboratory in the original medical school has changed function many times, but the building still stands, and adjacent to his area is the newly named Waller Cardio Pulmonary Unit. In 1887 he started work on the electrical activity of the heart which was already well known from studies on the exposed heart, but he sought to demonstrate cardiac potentials from the limbs of intact animals and from man. This experiment was successful and it was published in the *Journal of Physiology* (Waller, 1887); in this he described the use of the Lippman capillary electrometer to record the first 'electrogram' from both animals and man. In the paper of 1887, surface electrodes were strapped to the front and back of the chest, and in a paper of 1888, he used saline jars in which the extremities were immersed. A light beam interrupted by the mercury column of the Lippman electrometer enabled photographic records to be made on plates mounted on slowly moving toy train wagons (Fig. 1, 2, and 3).

In his address in 1888 he elaborated on his studies which also proved that contraction of the heart was not a simultaneous process but showed initiation at the apex and termination at the base.

In an informal address at St Mary's in 1915, Waller reminisced about his pioneer work. 'I studied the hearts of all sorts of animals . . . and one fine day after leading off from the exposed heart of a decapitated cat to study the cardiogram by aid of a Lippman electrometer, it occurred to me that it ought to be possible to use the limbs as electrodes and thus lead off from the heart to the electrometer without exposing the heart, i.e. from the intact and normal organ. Obviously man was the most convenient animal to use so I dipped my right hand and left foot into a couple of basins of salt solution, which were connected with the two poles of the electrometer and at once had the pleasure of seeing the mercury column pulsate with the pulsation of the heart. . . . This first demonstration was made in St Mary's laboratory in May 1887 and demonstrated there to many physiologists and among others, to my friend Professor Einthoven of Leiden. . . . During the summer of that year, I made a complete survey of all sorts of leads from the hands and feet and mouth!'

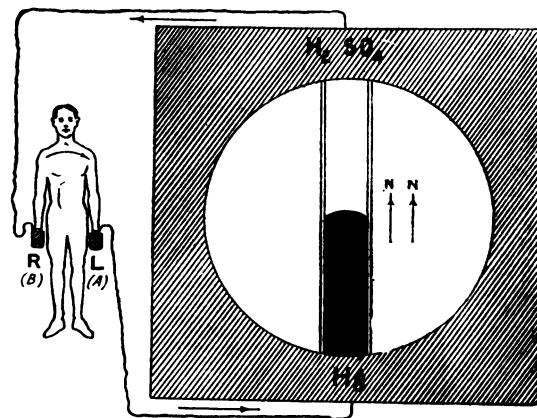


Fig. 1 Diagram of the connection between patient and Lippman electrometer.

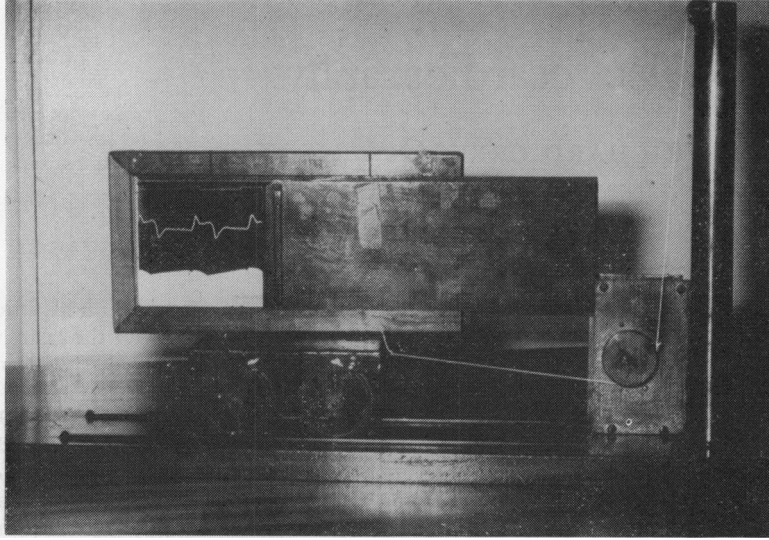


Fig. 2 Toy train wagon carrying photographic plate.

These studies were demonstrated before the Royal Society who soon made him a Fellow at the early age of 35.

The capillary electrometer could be used to demonstrate the electrical activity of the heart, but the response of the instrument was too slow for further analysis and useful clinical records were only achieved with the development of the quartz fibre galvanometer (see the historical papers in the *Journal of Physiology*: Adrian *et al.*, 1976; Besterman *et al.*, 1976; Campbell and Pelli, 1976).

In 1903 Waller became professor at the newly founded Physiological Laboratory of the University of London housed in the Imperial Institute, and shortly afterwards became one of the first two consulting physicians to the National Hospital for Diseases of the Heart where he employed the Einthoven string galvanometer electrocardiography extensively.

After Waller's death, Sir Thomas Lewis wrote (Cope, 1973) of him, 'His early work on electrophysiology was extensive, thorough and is well known. He was the first to obtain a human electrocardiogram; this has been the main, though by no means his sole contribution to the science of experimental machines. The discovery long preceded the introduction of the string galvanometer and was the more remarkable in that it was accomplished in the eighties'. Einthoven (1912) himself credited Waller with the first electrocardiogram.

We have been unable to trace any descendants of Waller alive today but his daughter was professor of physics at the Royal Free Hospital Medical School and first drew the attention of one of us (EB) to the apparent neglect of her father, which she amplified in a letter to the *British Medical Journal* (Waller, 1950). In this, she quoted from Sir Thomas Lewis who stated that Einthoven credited Waller with the

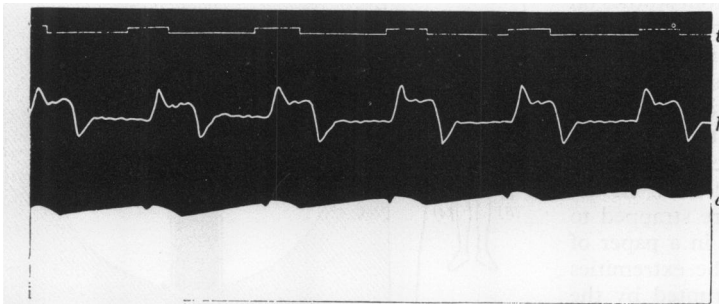


FIG. 1. Man. Heart led off to electrometer from front and back of chest (front to Hg; back to  $H_2SO_4$ ).

e.e. electrometer. h.h. cardiograph. t.t. time in seconds.

From *Journal of Physiology* (1887), 8, 229.

Fig. 3 Recording from man with time scale at top, pulse tracing in centre, and electrogram at bottom.

first use of the term electrocardiogram, and also gave a third valuable reference to Waller's original address at St Mary's Hospital Medical School, from the *British Medical Journal* of 1888. One of Waller's sisters, Camelia, emigrated to New Zealand with her husband William Edwards. A female descendant, Dorothy Perry, subsequently married Dr A. C. Hayton of New Plymouth, New Zealand, who has records of a visit by Waller to Auckland in 1914, together with various Walleriana, and is still searching for details of Waller's forebears.

Apart from his cardiographic interest, Waller published a textbook in 1891 *An Introduction to Human Physiology*, a comprehensive work of over 600 pages. In addition, in a different field, he first tried to measure anaesthetic gases used in operations with special reference to chloroform, following several deaths from its use, and his experimental apparatus for this is still in Professor Cresse's department; his cardiographic recordings, toy trains, etc., are housed in the Waller Cardio Pulmonary Unit.

Our scant knowledge of Waller (Fig. 4) as a person is derived, in part, from Professor Halliburton's



Fig. 4 Waller and Jimmy.

obituary for the Royal Society, and this is but rudimentary: 'He was short in stature with an "intelligent" face and small pointed yellow beard. His voice was clear and slow. He lectured from October to December and confined his subjects to muscle and nerve'. The other reminiscence by Robert Marshall suggested a certain unconventionality: 'Waller presented a very different appearance from that of our physicians, who were always soberly garbed in frock coats or morning coats and silk hats. He was a short stocky man, very light on his feet. His grey beard and double-breasted blue jacket make him look exactly like a skipper in the Merchant Navy. Like Sir Winston, he seemed to be habitually smoking cigars, and was invariably followed by his bulldog, Jimmy, who also had a Churchillian quality and had the distinction of having had a question asked about him in the House of Commons:

Q. 'At a conversazione of the Royal Society at Burlington House on May 12th last, a bulldog was cruelly treated when a leather strap with sharp nails was wound around his neck and his feet were immersed in glass jars containing salts in solution, and the jars in turn were connected with wires to galvanometers. Such a cruel procedure should surely be dealt with under the "Cruelty to Animals Act" of 1876?'

A. 'The dog in question wore a leather collar ornamented with brass studs, and he was placed to stand in water to which some sodium chloride had been added, or in other words, common salt. If my honourable friend had ever paddled in the sea, he will appreciate fully the sensation obtained thereby from this simple pleasurable experience!'

Waller was also renowned for his unfailing success in demonstrations and public experiments, to the delight of his students. He was treasurer of the Physiological Society for 25 years, and he was in the chair in 1890 when the committee resolved not to have a president. One of his interests outside work was motoring, and he was an early devotee of the car. On fairly frequent trips to Paris, he shipped his car from Southampton to Le Havre to enjoy the drive to the French capital.

He lived in St John's Wood where he maintained a small laboratory in which his ever interested wife assisted him in most of his work. Her death probably contributed to his, which occurred shortly afterwards.

He died on 11 March 1922 after two strokes. He left three sons and a daughter, all unmarried, and no direct descendants can be found. In 1924 Einthoven was awarded the Nobel Prize for Medicine. Waller had died in 1922 and so would not have been eligible for a joint award.

The late Sir Zachary Cope was responsible for the

initiative to commemorate Waller in St Mary's. This has taken the form of a permanent display of his recordings and apparatus in the unit named after him. We also echo Sir Zachary's sentiments that the omission of Waller's name from the Dictionary of National Biography is inexplicable.

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