

The life and travels to Australia of Francis Aston

Kevin Downard traces the life and times of Francis Aston, inventor of the mass spectrograph.

Young Aston

Francis William Aston's life was clearly influenced by his roots and early childhood. He was born on 1 September 1877, the third child of five, to William and Fanny Charlotte (nee Hollis) Aston in Camomile Green on the edge of the town of Harborne near Birmingham. An 1881 census shows William to be 12 years older than his wife, and that Francis' sisters and brother were named Kate, Henry (four and two years older respectively), Mary and Helen.¹ Harborne was a centre for nailmaking in the late 1800s, with nails fabricated from iron supplied in part from local businesses operated by the town's wealthier residents. Nailmaking was often performed on the nailmaker's own property, and nails were transported to Birmingham in exchange for more raw material. Aston's father was active in the trade and is listed in the 1881 census as a metal broker.^{1,2} His mother was also close to the metal industry, being the youngest daughter of Isaac Hollis, a gunmaker and founder of what is now the Birmingham Small Arms (BSA) group of companies.²

Together, the Aston's lived in a large house known locally as 'Tennal', on Church lane at one end of Tennal road, then backed by small local farms. The family was of some means because the home occupied a large block of land and they enjoyed the benefit of servants Sarah Tanner and Annie Knowles. Tennal Hall also stood on Tennal Road but should not be confused with the Aston's home that was reportedly demolished in the 1960s.³ Here, the young Francis constructed his first

'laboratory' and acquired glass-blowing skills, fabricated electrical coils, and prepared fireworks that were launched with much enthusiasm during annual displays. Despite several siblings, it is clear the young Francis was often content to amuse himself, a trait he carried into his later years of research, where he mostly worked alone. One particularly popular activity was the construction of tissue paper balloons that he would send off with self-addressed postcards.² These were sometimes returned from far away, complete with details of their find. His ingenuity and interest in the scientific and mechanical, combined with an interest in people outside of his own surrounds, set the stage for Aston's future scientific career and travels.

Aston was initially schooled by Emily Tonks and was enrolled in Harborne Vicarage School from 1889. The vicarage school was run by Eliza Roberts, the wife of the Reverend Edward Roberts from the local St Peters Church. Figure 1 is a photograph showing some of the students at the school around 1890. Although the names of the boys have not been recorded with the photo, the boy standing sixth from the right, and a little aloof from the others, bears a strong resemblance to Francis Aston in his later life. In September 1891, Aston transferred to Malvern College to complete his high school studies and it was here that he began to demonstrate his abilities in chemistry, physics and mathematics. He and his brother Henry returned to his old school in 1892 to attend a memorial to Mrs Roberts where both contributed a

guinea (about 20 shillings or one pound) to her memorial fund.³

In 1894, Francis entered Mason College in Birmingham, which from 1900 became part of the University of Birmingham. Mason College was established in 1875 with £180 000 by Sir Josiah Mason, who had made his fortune by designing the machine-slit nib of the fountain pen. By 1893 the college had 556 students. At Mason, Francis was taught chemistry by Percy Faraday Frankland and physics by John Henry Poynting.⁴ He graduated with a Bachelor of Science degree in 1898, specialising in organic chemistry, and was awarded the Forster Scholarship to work with Frankland on optical rotation, which resulted in a joint publication of 1901.⁵

Aston left college in 1900 to work for three years in nearby Wolverhampton at the local W. Butler and Co. Springfield brewery. He continued, however, to work privately on his research in a disused loft in his father's house. Here, he created discharges within glass test tubes using a fabricated induction coil, which was capable of producing a spark of several inches in length. In 1903, he returned to the then University of Birmingham as an associate to continue his research discharge work in high vacuum in the physics department.⁶ In this and his future research, Aston preferred experimentally based discoveries over mathematical or theoretical pursuits and performed most of his research alone. He published several

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Figure 1. Some of the students of the Harborne Vicarage School in 1890. The boy sixth from the right resembles a young Francis Aston. Source: Harborne Public Library.

articles in the *Proceedings of the Royal Society* during this time of his experiments in so-called cathode dark space.⁷

Aston travels the world

In 1908, Francis was left substantial monies from his father's estate. Now 30, he used this to take a world trip visiting Ceylon, Burma, Australia, New Zealand, the USA and Canada.^{2,8} This was the first time he had set sail to Australia, now a young federal Commonwealth under a constitution that came into effect on 1 January 1901. A former Scottish miner and union leader, and one of the founders of the Queensland state Labor party, Andrew Fisher was elected Prime Minister of Australia in 1908. Some 2400 square kilometres in the Yass–Canberra valley were set aside that year for the Australian Capital Territory (ACT). The first Australian rugby team, the Wallabies, set sail

on the steamship *SS Omrah* to tour the UK, Ireland and North America, winning 32 of their 38 matches. The team competed in the 1908 Olympic Games, which was moved to London after the eruption of Mount Vesuvius near Rome forced the host city to withdraw. Aston, a keen sportsman who cycled, swam, skied, and played both tennis and golf, must have been in his element and was surely glued to radio broadcasts of the results. Adventure was also in the air in 1908, with Australian Douglas Mawson setting off to be among the first party to reach the South Pole in Antarctica in January of 1909. Travel was about to become easier for the masses too, with the first production model T Ford rolling off the assembly line in the USA in 1908. Aston's activities in Australia, however, are unknown.

Back in Cambridge, Aston joined the recently knighted Sir Joseph John Thomson at the Cavendish

Laboratory as an assistant. Here, Aston built several mass spectrographs, successors of the cathode ray tubes used for studying positive ions. Considerable energy was spent ensuring a good vacuum in these devices. In 1911, in a note in the journal *Nature*, Aston reports on a method to detect leaks: 'An apparatus of mine involving seven distinct and complex sealing-wax joints recently developed a microscopic leak ... (and) it occurred to me that extremely sensitive nature of the discharge in air changing colour when in the presence of carbon compounds might be used to advantage. I therefore wiped each joint over with a small pad of cotton-wool soaked in petrol, keeping the discharge going meanwhile, and the instant the real offender was reached – the discharge turned abruptly from red to blue.'⁹

From these early vacuum experiments, Aston's mass spectrographs

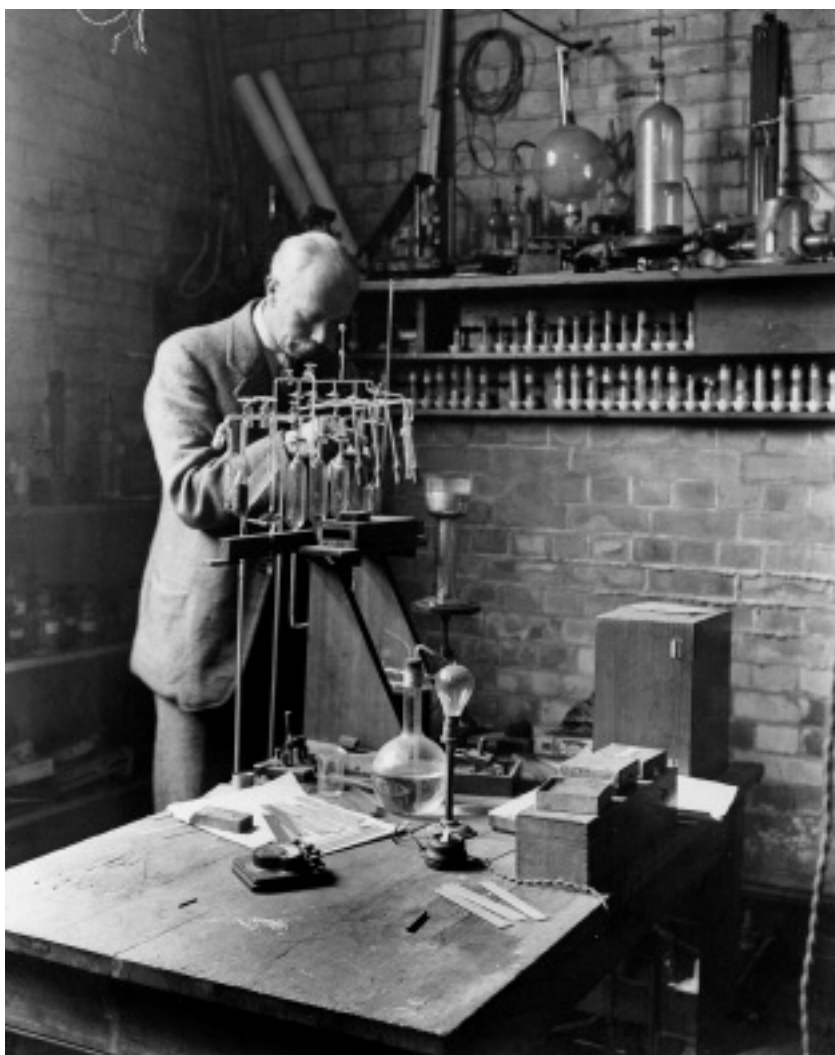


Figure 2. Aston working at the Cavendish laboratory, Cambridge University, fractionating samples of rare gases for analysis in his mass spectrograph, c. 1914. Source: Science and Society Picture Library UK.

were used to identify isotopes for many of the more common elements (Fig. 2), which preoccupied the remainder of his career. He spent the rest of his life in Cambridge, notwithstanding a period of service at the Royal Aircraft Establishment, Farnborough, during World War I, and many excursions abroad, including a return to Australia in 1938.

Christmas in Australia, 1938

Aston visited Australia aboard the SS *Otranto* in 1938. This second *Otranto* vessel was built for the P&O Line and had her maiden voyage from London (Tilbury) to Brisbane on 9 January 1926. The route took in the following ports: London, Gibraltar, Naples, Port Said, Suez, Colombo and Fremantle, Adelaide,

Melbourne, Sydney and, from 1919, Brisbane, Australia. Upon the outbreak of World War II, the ship was enlisted in the war effort and was ordered back to Sydney, where it was painted a battleship grey, fitted with guns and sailed to Britain carrying army and navy personnel.

National Australian Archives records show Aston disembarked the *Otranto* in Brisbane on 20 December 1938, accompanied by his regular travelling companion, sister Helen. Aston had sailed from Britain as one of a delegation of about 75 scientists who took part in the silver jubilee of the Indian Science Congress held in January in Calcutta. Here, he was awarded both an honorary degree from Calcutta University and received a medal from the Congress association. The delegation was to be

led by New Zealander Ernest Rutherford until his sudden death in Cambridge the year prior. Physicist Sir James Hopwood Jeans took Rutherford's place.

After disembarking the ship in Brisbane in Australia's sunshine state of Queensland, the trail of Francis Aston goes cold. There are no formal records of Francis Aston meeting with the Royal Society of Queensland or those in other states. Nor is there any record of Aston giving a lecture to the Australian Chemical Institute (now the Royal Australian Chemical Institute) in the institute's proceedings of 1938–1939. A possible motivation for Aston's travels to Australia was to attend the Science Congress of the Australian and New Zealand Association for the Advancement of Science (ANZAAS) in Canberra, held 11–18 January 1939. Yet there is no record of him in the conference program, a surprising omission if he did attend, given he was then a Nobel laureate.

The Science Congress was attended by 1050 ANZAAS members as well as some official guests from England, including novelist Herbert George (H.G.) Wells. Famous for his many works of science fiction, national archives show Wells arrived in Australia at Fremantle aboard the *Comorin* ahead of the meeting on 27 December 1938. Hammond reports¹⁰ that Wells flew on via Adelaide after a brief welcome dinner in Perth. After the Canberra meeting, Wells gave a radio address titled 'Utopias', broadcast to the Australian public on 19 January 1939. In his address, Wells referred to Australian scientists as utopians:

That is why I am here in Australia talking to you. I came here to learn what I could from the Australian and New Zealand Association for the Advancement of Science, which has just been meeting at Canberra. All the men and women in that Association ... are Utopians. They believe that this world of ours can only be put in order and kept in order by the perpetual refreshment of scientific thought. They believe as firmly as any human beings have ever

believed, that swords can be beaten into plough-shares
and spears into pruning-hooks, that nation need not lift
up its hand against nation, nor should they learn war any
more.

Francis Aston was likely listening to the broadcast, but apparently the Australian Government were not. Australians were sent to war later that year.

If Aston did remain in Brisbane, whom did he visit? A search of the archives of the University of Queensland has failed to uncover his movements. Thomas Parnell Jr has no recollection of a visit by Aston with his father,¹¹ then professor of physics at the University of Queensland from 1919 to 1948, despite meetings with other overseas scientists. The Astronomical Association of Queensland, formed in 1927, also has no record of a visit by Aston despite his documented interest in astronomy.² There is also no record of communication between Aston and Ian Wark, who was establishing the CSIR Division of Industrial Chemistry in Melbourne at the time, despite Wark's earlier correspondence with Aston while a post-graduate student in England.⁸

Perhaps Aston's visit to Australia was purely a holiday with his sister and they had no contact with the scientific community. His arrival did coincide with a four-day cricket match between Queensland and South Australia in Brisbane from 7 January in which the legendary Don

Bradman scored 138 runs. Were the Astons in the stands? We may never know.

This was Aston's last trip abroad. His final scientific article published in *Nature* in 1939 was to defend his measurement of the isotopic mass of ^{12}C .¹² He returned to England, survived World War II and died suddenly of undisclosed causes on 20 November 1945, aged 68. Under the terms of his will, he left a sizeable portion of his estate to those institutions that educated him and supported his research, including the University of Birmingham, the Cavendish Laboratory and Trinity College.²

Acknowledgments

The author is grateful to the Harborne Public Library and particularly Wendy Carter for providing information used in this article. This includes the photo of students of the Harborne Vicarage School sourced from the Don Wright Collection. He also extends his thanks to local Harborne historian Andrea Barnes, Rosanne Walker of the Basser Library of the Australian Academy of Science, archivists Julia Mant and Megan Lyneman of the universities of Sydney and Queensland respectively, Thomas Parnell Jr, the royal societies of New South Wales, Queensland and Western Australia, the Astronomical Society of Queensland, and Rob Birtles of CSIRO Archives.

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