

Arthur Swayne Underwood MRCS, LDS Eng. (1854-1916), dental Surgeon, dental educationalist, academic and comparative odontologist.

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Abstract

Arthur Swayne Underwood (1854-1916) was an exceptional dental surgeon and odontologist. His contribution to dental education and research is largely forgotten, but he published important papers on dental caries and enamel structure and no less than five textbooks over twenty-two years, some running to several editions. Many of his family, dental friends and age-mates were, like him, of a broad artistic and creative inclination. This was as important to him as the joy of discovering new things through his research. He was influential in establishing the early dental curriculum in UK universities and in promoting dental research alongside improvements in clinical dental surgery.

Keywords: Arthur Swayne Underwood, Dental education, Early caries research, King's College London, Royal Dental Hospital.

Introduction: The Underwood family and their creative circle of friends

Arthur Swayne Underwood was born on 18th January 1854 and died on 2nd December 1916 aged 63¹. His father, Thomas Underwood (1819-1900) was a leading London dentist, who along with Sir John Tomes (1815-1895) and others of the Dental Reform Committee, successfully campaigned for the legal regulation of dentistry to restrict its practice to registered practitioners only through the Dentists Act of 1878^{2,3,4}. In May 1880, along with Sir John Tomes, Thomas Underwood was one of six other signatories to the original Memorandum and Articles of Association of the British Dental Association⁵. Thomas Underwood was also one of the original clinical staff members at the Dental Hospital of London² that opened in December 1858 in Soho Square (but which then moved to Leicester Square in 1874^{3,6}). Arthur Swayne Underwood's elder brother, Thomas Francis Ken Underwood MRCS LDS (1849-1910), known as Ken, was also a dentist. He had risen to become the second Dean of the Dental Hospital of London in 1876^{2,3}, but then left the dental profession in 1886 to enter the Church and eventually chose to live a quieter life with his sister Margaret Underwood in the village of Kilndown, Sussex^{2,7}. Both sons of the Underwood family, followed their father and practiced dentistry at 11 Bedford Square, London WC1, until 1878 when Arthur Swayne Underwood re-registered the practice at 26 Wimpole Street, London W1.

It was Ken Underwood, while dean of the Dental school of London, who pushed for the LDS curriculum to begin with a "*preliminary examination in the Arts*", so that "*... the dental profession shall consist beyond doubt of persons who have received such teaching as shall enable them to mix in society on the same level as members of the other learned professions generally*"⁸. Born into this family of dentists, Arthur Swayne Underwood (1854-1916), like his father and elder brother before him, was deeply committed to ensuring an educationally independent future for the dental profession. But he was also an academic and a scientist and had his own broader interests beyond dentistry. Arthur had a passion for art, for painting, sketching and for music and was even involved in compiling the Chinese section of William Chaffers 1897 edition of '*Marks and monograms on European and oriental pottery and porcelain*'^{1,2,9,10}. He shared these interests with other dental friends. Sir Charles

Sissmore Tomes (1846-1928), both his friend and mentor and another son of a great dental pioneer, Sir John Tomes, besides his career as a dentist and dental histologist, exhibited his paintings at the Royal Academy under the name Charles Sissmore¹¹. Another dental histologist friend of the same generation, John Howard Mummery (1847-1926), was greatly admired for his skills as a draughtsman and watercolour painter¹². Arthur's wife, Edith Margaret, whom he married in 1885, came from yet another creative and artistic family. Edith was the third daughter of Alfred Bell, son of a farm worker from Devon who rose to become a renowned designer of stained glass, and who with John Clayton eventually founded the company Clayton and Bell, still famous today for their Victorian and Edwardian stained-glass windows¹⁰. Perhaps predicably, Arthur and Edith's son, Arthur Bayford Guy Underwood, also eventually became a dentist qualifying first in medicine in 1910, and then LDS RCS Eng. in 1913, before joining the Royal Navy as a surgeon during World War 1 but then later returning to the family dental practice at 26 Wimpole Street¹⁰.



Figure 1. Portrait of Arthur Swayne Underwood (1854-1916), MRCS, LDS, painted in 1915 by Isaac Cooke (1846-1922) in the collection of the Royal Society of Medicine, London.

Education and clinical career

Arthur studied at Kings College London where he was the Warneford Scholar in 1872¹⁰. He went on to study medicine at Kings College Hospital where he obtained his MRCS in 1877 aged just 23 years old. A year later he completed his dental studies and obtained his LDS in 1878 at the then Dental Hospital of London in Leicester Square where his clinical appointments began. From there, between 1882-1884, he continued his clinical career as surgeon at the West London Hospital on the Hammersmith Road, (formerly this building had been the Fulham and Hammersmith General Dispensary and still exists but is

now converted to exclusive office accommodation). In 1884 Arthur was appointed professor of dental anatomy and physiology at Kings College London and at the same time appointed professor of dental surgery at King's College and dental surgeon to King's College Hospital, aged then just 30 years old¹⁰. Besides this, between 1887-1896, Arthur was also lecturer in dental anatomy at the Dental School of the Dental Hospital of London in Leicester square, succeeding Sir Charles Sissmore Tomes to this position^{2, 10}. Later in his career, during World War 1, from its opening in 1915 and up until the time of his death in 1916, Arthur was dental surgeon to the King George Military Hospital, on Stamford Street, Waterloo, London SE1¹³. Originally built as a warehouse for H.M. Stationary Office this large building was commandeered as a Red Cross military hospital, chosen for being close to Waterloo Station and for being able to facilitate the discrete transport of wounded soldiers through the existing underground tunnels that connected it to the station. At its height it was the largest military hospital in Britain with 1,850 beds and treated an average of 2,356 patients a month. The World War 1 Memorial at St John's Church, on Waterloo Road just around the corner from Stamford Street, commemorates all those who died in the hospital¹³.

Charles Tomes² remembered that while at the Dental Hospital of London, from about 1889 to 1890, Arthur, together with his clinical colleagues, David Hepburn, Morton Alfred Smale (who had become the third Dean of the Dental Hospital in 1884³) and E. Lloyd-Williams (lecturer in dental mechanics), devised a scheme to provide certain patients, judged to be 'deserving cases', with dentures for a nominal charge. This scheme apparently met with considerable opposition from their clinical colleagues, but despite this for almost four years they devoted Tuesday evenings to selecting which patients should benefit from the many applications received².

Dental educationalist and prolific author of textbooks for students

That Arthur Swayne Underwood was dedicated to dental education is evidenced both by the number of textbooks he wrote and by the breadth of dentally related subjects he wrote about. In the preface to his comparative odontology book in 1903 he wrote¹⁴; "*In all cases my object has been to interest the student in the first place and to instruct in the second, for it is my experience that once a student is interested in a subject its study is no longer a toil, but a delight, and the facts and details become as much part of his daily equipment as his hat and his umbrella.*" In 1881 he published "*Surgery for Dental Students*" with W.H. Allen & Co, London¹⁵. He later published a subsequent edition of this book in 1912 co-authored with his son, Bayford Underwood, and renamed it "*A handbook on surgery intended for junior dental and medical students*" but this time with a different publisher John Bale, Sons and Danielsson Ltd, London¹⁶. In the preface they hoped that a book on general surgery might go some way to preventing '*a narrow purview of the subject*' among students.

Then in 1885 he published "*Notes on anaesthetics: with an appendix containing illustrative cases and engravings of anaesthetics apparatus*" with Caludius Ash and Sons, London¹⁷. The engravings are indeed of wonderful quality and in themselves are an archive of the equipment in use at the time. However, parts of this book make difficult reading today, (for example, pages 35-36 - see the online version available through the Wellcome Collection¹⁷). The description of what we would now call 'stages of general anaesthesia' are an alarming reminder of the 'state of the art' in 1885. For the second edition of this book published in 1893, Arthur again found an expert co-author. This time his co-author was C. Carter Braine FRCS (1860-1937), anaesthetist at Charing Cross Hospital and at the Royal Dental Hospital¹⁸.

From the 1880s onwards, a new series of books, ‘*The student’s aids series*’, was published by Baillière, Tindall and Cox of London, Edinburgh and Glasgow. Largely aimed at medical and dental students they ranged in price from 1s. 6d. to 4s. 6d. The titles covered 30 or more subjects as diverse as anatomy, botany, chemistry, sanitary science, analytical geometry, and zoology – as well as each of the clinical medical and dental specialties that all students were required to study at that time. The series was described by the publisher as ‘*Specially designed to assist students in committing to memory and grouping the subjects upon which they are to be examined.*’ The Edinburgh Medical Journal is quoted in the description of the series as regarding them, ‘*As aids, not substitutes, these little books afford the means of refreshing the memory, and of economising time*’.

And so hot on the heels of his second book, “*Notes on anaesthetics*’ in 1885, Arthur published “*Aids to Dental Surgery*” in 1887¹⁹. Once more he chose to co-author the second edition in 1907 with a fellow dental surgeon, this time Douglas Gabell, MRCS, LRCP, LDS²⁰, who went on to publish further editions of this book after Arthur’s death in 1916. A further book in this series, “*Aids to dental histology*”²¹, was published in 1892, price two shillings, with an expanded second edition ten years later in 1902 written under a new title, “*Aids to Dental Anatomy and Physiology*”²². Many of the observations made in this book were novel and were later cited in the classic dental anatomy textbook that was first published in 1919, three years after Arthur’s death in 1916, and written by his friend and fellow dental surgeon the histologist, John Howard Mummery CBE, FRCS, DSc, LDS (1847-1926)^{12, 23}.

Perhaps the most impressive of Arthur Swayne Underwood’s books was his last and most substantial book, “*Studies in Comparative Odontology*” first published in 1903, again with Baillière, Tindall and Cox¹⁴. From his early years as a student Arthur had been fascinated with comparative dental anatomy and biology. It is not only the care with which complex terminology is explained, derived, and described for dental students, but his obvious grasp and enthusiasm for geology, taxonomy, evolutionary biology and of many underlying concepts, such as homology and analogy, that gives this book its unique perspective, and indeed makes it one of the most readable introductory books on comparative odontology even today. The illustrations for this book were mostly drawn by his wife Edith, with just a few that he admits that were drawn rather ‘diagrammatically’ by himself¹⁴. It is clear the book was both a scholarly and creative joint exercise. Comparative dental anatomy was a major component of the early dental curriculum, first for the Licence in Dental Surgery and later for the degree in dental surgery²⁴, and this book was likely intended to help define the content of that curriculum.

Research, administration and professional accolades

It follows that one so heavily involved in publishing textbooks for dental students would also be keenly involved in examining. In his obituary it was noted that he was a “*great advocate for the maintenance of a high standard of dental education and as a highly efficient examiner he inspired confidence in the candidate by his considerate manner and had a happy knack of securing a satisfactory estimate of the amount of their knowledge*”. He served on the board of examiners in dental surgery at The Royal College of Surgeons from 1900 to 1910, after which in 1911 he was appointed Inspector of Dental Examinations in the UK on behalf of the General Medical Council, and from 1913 until his death in 1916 he acted as external examiner at the University of Bristol¹⁰.

Theories about the aetiology of dental caries go back thousands of years²⁵ from the belief that worms destroyed tooth tissues, or that internal inflammation or chemical processes dissolved tooth tissues away, but it was a seminal paper read by Underwood and Milles in 1881^{26, 27} at the International Medical Congress held in London that first concluded dental caries was most likely due to demineralisation by organic acids produced by bacteria. This experimental work alone would have gone a long way to securing Arthur Swayne Underwood's appointment to the chair of dental anatomy and physiology at Kings College London in 1884. Louis Pasteur had discovered bacteria can ferment sugars into lactic acid and Emil Magitot had demonstrated that the fermentation products of sugars could dissolve away tooth tissues²⁵. However, it was Underwood and Milles (1881)^{26, 27} who first confirmed the presence of both rod-shaped bacilli and spherical cocci within carious dentine tubules and who then carried out experiments to show that only the most generalised and uniform kind of demineralisation of teeth occurred in aseptic closed flasks containing meat, saliva and various acid solutions. They pointed out that this did not resemble the more localised origins and characteristic sub-surface progression of naturally occurring carious lesions in the mouth that was first described histologically by Joseph Linderer in 1837²⁸. Later studies by Willoughby Miller, first through the results of his doctoral thesis research in Berlin²⁹ and then through the comprehensive description of this work in his landmark book³⁰, both confirmed the previous findings of Underwood and Milles²⁷ and acknowledged that their findings had underpinned Willoughby's own important research on dental caries^{29, 30}.

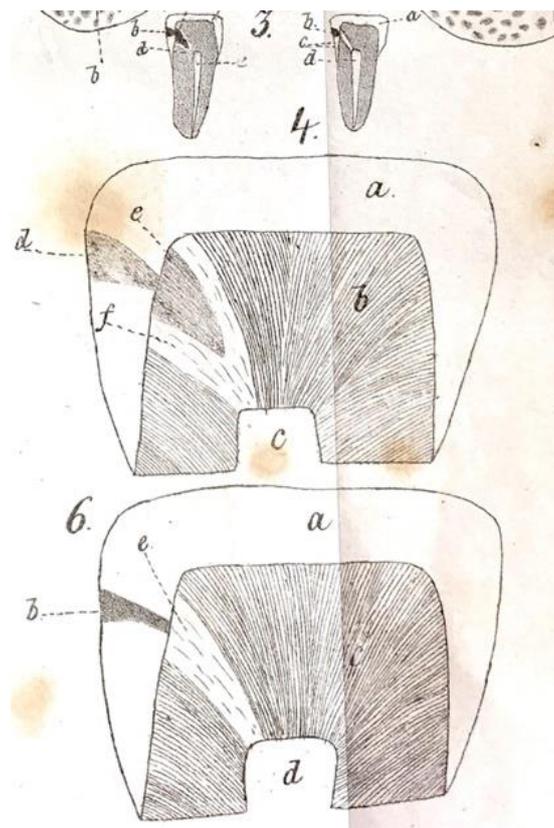


Figure 2. Part of the original figure (Tab XIII) from Linderer and Linderer (1837), illustrating the characteristic microscopic progression of the carious lesion in enamel and dentine. Both father (1771-1840) and son (1809-1879) were general dental practitioners in Berlin, but it was the son, Joseph Linderer, who pioneered the early descriptions of dental histology and histopathology, while still a dental student, in the lab of great anatomist Johannes Muller (1801-1858). Reproduced here courtesy of the Royal Society of Medicine Library, London.

Besides this major contribution to the study of dental caries, Arthur carried out an extensive comparative study on the development, anatomy and pathology of the maxillary antrum, making observations on some 40 modern human specimens and on many juvenile and adult great ape specimens at the Royal College of Surgeons³¹. The aim of this paper was part surgical and part anatomical, to describe the relationship between the growing floor and walls of the antrum and each of the developing deciduous and permanent tooth germs and later to the fully formed permanent tooth root apices. In so doing, he documented the normal anatomical boundaries of the maxillary antrum and the extent to which it may expand between and beyond the upper tooth roots in adults. This paper also reveals his genuine curiosity for anthropology and comparative anatomy, and in it he made several novel observations about the comparative anatomy of the nasolacrimal duct and the capacity of the maxillary antrum in relation to vocalisation in modern humans and great apes.

Thirty-two years later in 1913, at another International Medical Congress held in London, Arthur Swayne Underwood presented a joint paper on enamel composition with his dental colleague from Birmingham, Alfred W. Wellings LDS, BDS, together with co-authors J.G. Brodie and C. Lovatt Evans, both physiologists from University College London³². In this paper they demonstrated that enamel did indeed contain between 1% and 2% organic matter. Building on previous research³³ and still seeking to understand how caries can erode and destroy enamel, they went on to record the action of 'strong' acetic acid on enamel histological features observed over known intervals of time. Besides this, they described the distribution and effectiveness of different histological stains in revealing the specific microstructure of each of the dental tissues, including the enamel organ and the pulp³².

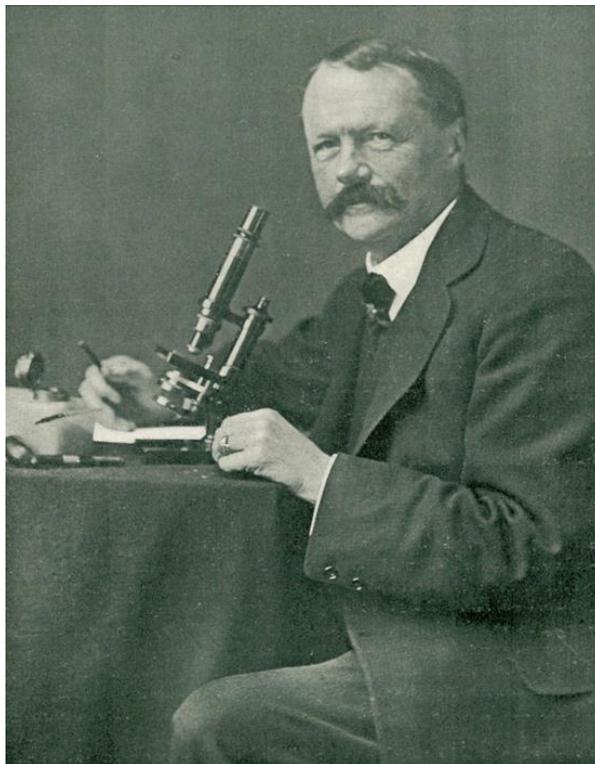


Figure 3. Photograph of Arthur Swayne Underwood MRCS, LDS, taken by Mr William Guy of Edinburgh and reproduced here from the obituary published in the British Dental Journal 37; 985-988 (1916).

Without a doubt Arthur Swayne Underwood derived great creative pleasure from his research and expressed this in the preface to his last book, *Studies in comparative odontology*¹⁴, when he wrote: “*I firmly believe that, next to doing an unselfish kindness, the act of discovering something yields the greatest and keenest and most lasting joy of which the human being is capable*”

As an active researcher, and as a dental educationalist, examiner and author of many dental textbooks, and as a clinician of considerable standing, Arthur Swayne Underwood made a huge contribution to dentistry. His academic stature was acknowledged and rewarded by the accolades he received in his lifetime. He served on the publishing committee and was editor of the *British Dental Journal* from 1886 to 1892, succeeding John Wreford Langmore and preceding Sir Frank Colyer^{1, 10, 34}. He then went on to be editor of the *British Journal of Dental Science*. For his scholarship and standing in the dental profession he was elected President of the Odontological Society 1903 to 1904, and then in 1908 he was awarded the prestigious John Tomes prize for research at the Royal College of Surgeons. Just two years before his death, he was elected President of the Anatomical Section of the International Dental Congress in 1914^{1, 10}.

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