

DOMINIQUE ANEL AND THE SMALL LACHRYMAL SYRINGE

by

JOHN PRICE

DOMINIQUE ANEL was a French surgeon who lived between 1679 and 1730, the exact date of his death being unknown and variously reported. He was a pupil of the celebrated French surgeons J. L. Petit (1674–1750) who invented the tourniquet, and George Mareschal (1658–1736) First Surgeon to the French King and Inspector of Surgery at the Charité Hospital, Paris.

Anel made three original contributions to medical literature in addition to reporting a number of interesting cases. First, he invented a method of treating aneurysm by proximal ligation of the diseased artery, without incising the vessel. Second, he developed a suction syringe with a triangular-tipped and wide-mouthed cannula in an attempt to replace the current and unpleasant practice of human 'lip service' for the treatment of deep puncture war wounds. This was used to treat infected sinuses and to facilitate drainage of abscesses, tissues, and cavities in addition to aspiration of haematomata and was one of the earliest aspirating syringes. Third, his main and perhaps most important work was a pioneer effort in the treatment of diseases of the lachrymal duct. His reports of this are found in a collection of short papers and correspondence relating thereto in the British Museum. They are bound together in a tract volume of 'Anel's Medical Tracts', being the only known copy in Britain.

Hoiris (1932) has summarized the details of Anel's life and given an account of his ophthalmic work itemizing French bibliography. He reproduced the two more important of Anel's original papers, *Observation singulière sur la fistule lacrimale* and *Nouvelle, et très exacte [sic] description anatomique du conduit lacrimale*, in the original French, because of the rarity of copies.

De Moulin (1955) has also written of Anel's life and given details of the first two aspects of his work. He referred only briefly, however, to the ophthalmic work which is the subject of this paper. There are no other significant references in recent medical literature relating to Anel's work, and there is very little in English about it.

ANEL'S MEDICAL TRACTS (B.M. 1186, H 1–6)

This is a collection of papers and correspondence relating to Anel's ophthalmic work. Bibliographical references to the original papers are confusing, and a study of the British Museum volume clarifies the story.

Anel's original paper, *Observation singulière sur la fistule lacrimale* was printed in April 1713 by Jean Baptiste Cionico, of Genoa, and presented to the Royal Academy of Science in Paris. Forty written comments were received by Anel from various medical centres in Europe—so that at least forty original Cionico copies were produced. Criticism by Francesco Signorotti of Anel and his work was so strong that Anel felt obliged to reply to these criticisms. This is revealed in a letter dated 16 August

Dominique Anel and the Small Lachrymal Syringe

1713 to Dr. G. M. Lancisi—First Physician to His Holiness the Pope. Anel engaged three printers and produced a volume entitled *Nouvelle méthode de guérir les fistules lacrimales*, a work in three parts: (1) Introductions: a reprint of *Observations singulière sur la fistule lacrimale*: and *Nouvelle, et très exaste description anatomique du conduit lachrymale*, with correspondence; printed by Pierre Joseph Zappate of Turin at the beginning of September 1713. (2) Criticisms by Francesco Signorotti of Anel and his work with correspondence relating thereto; printer's name not stated. (3) Correspondence criticizing and relative to Signorotti's attitude to Anel; printed by Jean Francis Daresse and Jean Radix.

Later in 1714, Anel followed up these publications with *Suite de la nouvelle méthode de guérir les fistules lacrimales ou discours apologetique*, also printed by Daresse and Radix which is in the nature of an apologia.

The British Museum copy of Anel's Medical Tracts consists of: (1) the original Cionico publication of *Observations singulière . . .*; (2) the volume *Nouvelle méthode . . .* containing the Zappate reprint of *Observation singulière . . .* and *Nouvelle . . . description anatomique . . .*; (3) *Suite de la Nouvelle méthode . . .*

Hoiris reproduced the Zappate reprint believing that the original paper was not isolated; and, because it was the only copy in Paris, was very rare.

The National Library of Medicine in Washington also contains a Zappate copy of Anel's work. Other copies in Turin were lost in fires at the Biblioteca Nazionale. Anel's Medical Tracts are printed in eighteenth-century French and Italian, some of which latter are deemed by Hoiris to be difficult to translate. However, the two important and relevant papers are contained in *Nouvelle méthode . . .* and are easily translated.

Observation singulière . . . gives a fascinating description of how Anel's lachrymal instruments and operations resulted from ingenuity following his observations based on reason, experience and curiosity. His view of lachrymal tract pathology is given and then is described how Monsieur l'Abbé Fieschi came to consult him and how Anel puzzled over the pathology, considering the case to be unusual. He describes his observations thus: 'I elevated upwards the superior eyelid . . . where is to be found the superior lachrymal point, and by compressing the lachrymal sac, I can see the matter . . . squirt just as water does when it is compressed by the piston of a little syringe.'

He utilized his experience of treating surgical sinus and fistula—'I thought of trying if it would be possible to introduce a little silver sound by the lachrymal point' to explore 'the depth of the sinus' and suddenly found himself not able to find a sinus, but able to pass the sound through to the nose. He then projected another operation, namely, that of trying 'to introduce medicaments by means of a little syringe of which the cannula was very fine and capable of being introduced by the lachrymal points.' He was able to put into practice all that he had imagined and he describes beautifully, and simply, the success and good fortune of his endeavours. The second paper *Nouvelle et très exaste description . . .* is an anatomical description of the lachrymal tract in detail, but this is inaccurate in that the origin of lachrymal secretions and tears is misunderstood.

It was during his sojourn in Genoa in 1713, that Anel successfully treated M.

l'Abbé Fieschi of 'Bilateral lachrymal fistulae'; this was followed by another outstanding cure of 'the most serene Duchess of Savoy'—great-grandmother of Louis XV—with a lachrymal infection, by means of a 'new, safer, and more gentle method of treatment'.

For the purpose of treating these two patients, and others with infection and obstruction of the lachrymal tract and its sequelae—e.g. fistula, he designed his own probes, and utilized an anatomical syringe in current practice for irrigating the lachrymal tract, devising special pipes (or cannulae) that were fine enough to enter the lachrymal puncta or fistula orifice. Thus were the first lachrymal probes, syringe and cannulae evolved and Anel's name came quickly to be associated with the instruments used. Anel's small syringe was the first syringe to be specifically named. It has survived with modification for 250 years, and has held pride of place in survival over about a dozen other named lachrymal syringes that have evolved from it. The pipes have remained either gold or silver for all of this time and continue to be so made; and the hubs for fastening the pipes to the syringe mount have been improved from time to time. The probes have likewise been improved and varied by time and experience. Moreover, the evolution of this small syringe and its pipes has played a direct part in the evolution of the hypodermic and other small syringes and needles, for which insufficient credit has been given in the historical literature of the syringe.

THE SYRINGE IN HISTORY

Syringes of various types have been used by different civilizations for different purposes. The ingenuity of anatomists seems to have preceded that of surgeons throughout the centuries, and technical improvements evolved in the dissecting room have later found a place in surgery. Galen injected cerebral vessels with a syringe; Leonardo de Vinci injected the cerebral ventricles with wax; Harvey used a syringe for injecting vessels with dye for anatomical demonstration, reporting this in 1628, and the art of injecting blood vessels came into general use after this. De Graaf (1705) likewise used an anatomical syringe which was to set a pattern for later syringes.

In medical practice, sinuses and fistulae have long been investigated by probes and syringes and treated by astringent or caustic solutions injected with a syringe. Syringes were also used for rectal, vaginal and urethral irrigation. Ambroise Paré (1634) used a *pyoulcos* or matter-drawer for cleaning out ears, and reported that Galen had also used a *pyoulcos* (Fig. 1). Dionis (1714) a famous French surgeon of Anel's vintage, also used a *pyoulque* or *tirepus* for irrigating chest wall sinuses.

At least five examples of seventeenth-century French syringes are to be seen in the Museum of the Wellcome Institute of the History of Medicine, two of which are relevant to this discussion. They originated from the Hamonic collection in France. They are very similar and dated from the period of Louis XIII (1610–1640) and Louis XIV (1643–1714) (Fig. 2). Both syringes are piston syringes made of a silver alloy of a dull brass colour. The barrels are ornamentally engraved and characterized by three rings surrounding the barrel giving four finger spaces for grip purposes. They resemble other historical syringes, for these grip rings were a feature and are seen on the barrels of syringes in books and prints of the seventeenth century, but eighteenth- and nineteenth-century pictures show a reduction in the number of rings.

Dominique Anel and the Small Lachrymal Syringe

The piston rods of both are of solid metal with a round knob at the thumb end, and have a screw cap with crude milled edge for fastening to the proximal end of the barrel. The plungers are of different types—the earlier model is made of waxed linen stretched and tied over a simple cylindrical metal frame made to fit the barrel, the later consists of wound thread possibly covering a more solid frame. There is no suggestion of graduation marks on these syringes, and there can be no doubt that they were used for irrigation purposes. The cannula attachments for use with these syringes were known as pipes. The earlier model is characterized by the pipe crudely screwing into a female orifice in a small mount at the bottom of the barrel—the pipe being then held firmly in place by a round overriding locking nut which screws on to the exterior of the mount.

In the later model, the pipe is more skilfully made to fit directly into the mount, but again a round locking nut is used to hold the pipe firmly in place.

THE SMALL ANEL SYRINGE

The use of a syringe and pipes for investigating and treating diseases of the lachrymal ducts was described by Anel in 1713. It is not known whether Anel's original works contained line drawings. Certainly there is none in the volume studied, nor in Hoiris' reproduction and French translation of Anel's work. But two works, Heister (1743) and James (1745), contain almost identical line drawings of an Anel syringe (Fig. 3)—together with descriptions of their use. These drawings almost certainly represent the nearest reproduction of the syringe that Anel used. Moreover, in construction the syringe appears very closely to resemble in all visible detail the two seventeenth-century syringes described above, from the Wellcome Collection. The similarity is striking, including the grip rings and the pipe which screws into the mount being held in place by a locking nut. The only differences would appear to be the small calibre and size of the syringe and pipes, a square locking nut and the absence of ornamental engraving. These differences can all be related to a reduction in size of the syringe for the particular purpose of its construction—indeed if all the instruments in these volumes are drawn to full scale, as seems to be the case, then Anel's syringe has been reduced to about one-third of the size of the two other seventeenth-century syringes in the Wellcome Collection.

The evolution of this small syringe can be traced by reference to dictionaries, monographs, textbooks of surgery and successive surgical-instrument catalogues—Brambilla (1781), Knauer (1796), Savigny (1798), Rudtorffer (1820), Seerig (1838), Blasius (1839), J. F. Charrière (1844) and J. Charrière (1856). Between 1860 and 1914 the standard surgical catalogues, including Arnold, Weiss, Maw, Down, Allen & Hanbury in England, Collin from France, Dewitt & Hertz from Berlin, Tieman, Hernstein, Ford, Aloe & Co. from U.S.A. and Matsumoto from Japan, all give Anel's syringe pride of place.

The catalogues published between 1918 and 1939 all contain modern patterns of Anel's syringe, as do the immediate post-1945 series; but now in the 1960 decade, Anel's syringe is disappearing. Modern ophthalmic surgeons are using current types of non-specific syringe for lachrymal duct irrigation. But Anel's gold and silver pipes continue to be made, although not necessarily so named. Fistulae from the duct are

now unusual and are treated by excision, so that Anel's specific pipe for use in fistula irrigation can be considered obsolete at last. Similarly Anel's pattern of probe with its bulbous tip and eye at the proximal end has given way to the modern type of probe to be used after dilation of the lachrymal punctum.

EPIPHORA AND FISTULA LACHRYMALIS

'Fistula' has long been accepted as a surgical entity, and treatment over the centuries before 1700 seems to have been standard for all forms of the condition. Indeed it can be said that little or no specialization in management had taken place. Differentiation of non-specific fistula from sinus was recognized and in the diagnosis, probes and syringes were used. Treatment consisted of astringent injections and irrigations; probes broke down concretions, and tents were inserted to dilate fibrosed orifices and channel the treatment. The cautery was used in an attempt to burn away excessive granulation tissue and in cases of lachrymal fistula to create a new orifice through bone into the nose. But a stout heart was needed for the more radical forms of this latter treatment and patients such as the Duchess of Savoy refused it. Attempts were made to reduce local oedema by compresses, assisted by saline aperients and mild diuretics. Great skill was in fact being used, having regard to the lack of anatomical and technical knowledge.

Culpeper (1696) in a short dissertation 'on Fistula' gives three main treatments, which probably are typical of popular general practice in his time. They comprise: (1) various astringents made of herbs and dung, or ashes of dog's head; (2) tents anointed with miscellaneous concoctions; (3) tents of lead inserted and removed intermittently which cleared and cured fistulae.

La Vauguion in 1699 was Intendant of the Royal Hospitals about Paris and gives current therapy for lachrymal fistulae at that time which is no different in substance. He does, however, add that treatment by pressing once a day over the affected part often saves operation, and refers to the use of probes after incision of the lachrymal 'tumour', and of syringing the fistulous orifice.

Between about 1700 and 1900, i.e. for the next two centuries, specialization gradually became apparent. Textbooks of surgery and medical dictionaries classify fistulae according to site, revealing increasing knowledge of anal, urethral, vesico-vaginal and lachrymal fistulae. This knowledge and experience was acquired by general surgeons with special interest and good fortune in their endeavours. Several of these wrote monographs on epiphora and fistula lachrymalis.

But in the middle of the nineteenth century ophthalmic specialists were emerging, and by 1900 surgical textbooks omitted discussion of the lachrymal fistulae because it was no longer within the province of the general surgeon. The specialty was established and treatment could only be found in ophthalmic textbooks.

Lachrymal anatomy and 'fistulae' were certainly known to the ancients. The 'passage of tears' was known and observed by Galen (134–201) and Vegetius (fifth century). Vesalius described the lachrymal system; Fallopius (1562) was well aware of the 'passage of tears' and had observed the purulent discharge upon which latter surgeons made a diagnosis of fistula lachrymalis.

But it was not until 1702, in the writings of Georg Ernst Stahl of Halle, that the

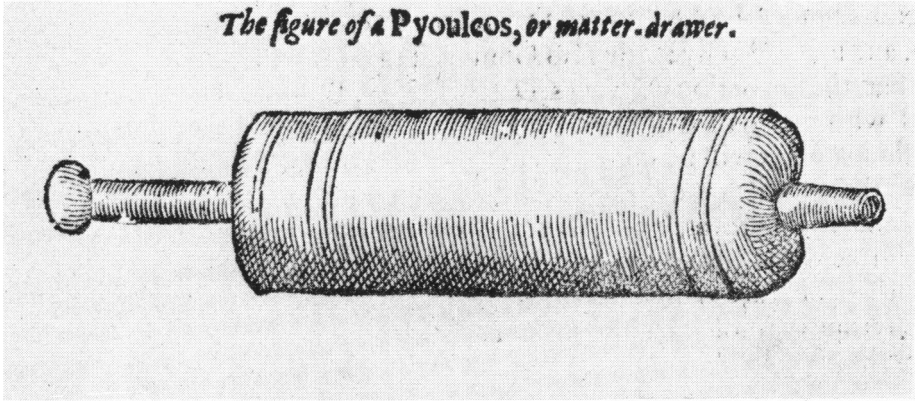


Figure 1.
Seventeenth-century ear syringe or pyoukos. From A. Paré, *The Workes . . .*, 1634.

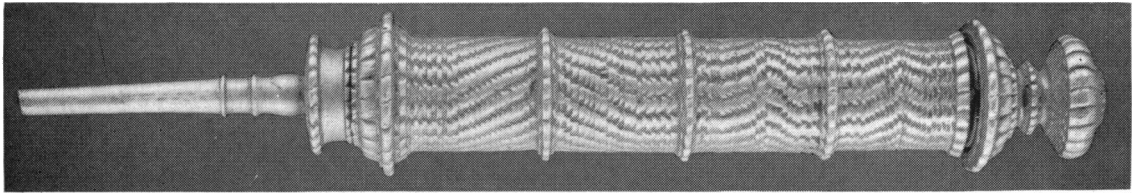


Figure 2.
Seventeenth-century irrigating syringe. From the Wellcome Collection.

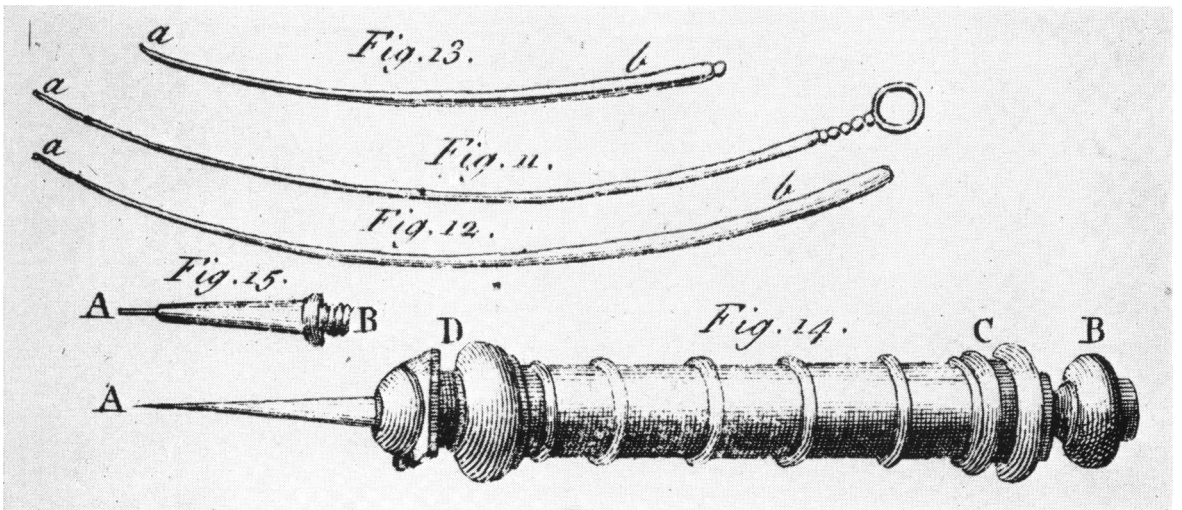


Figure 3.
Anel's syringe and probes. From R. James, *A Medicinal Dictionary*, 1745

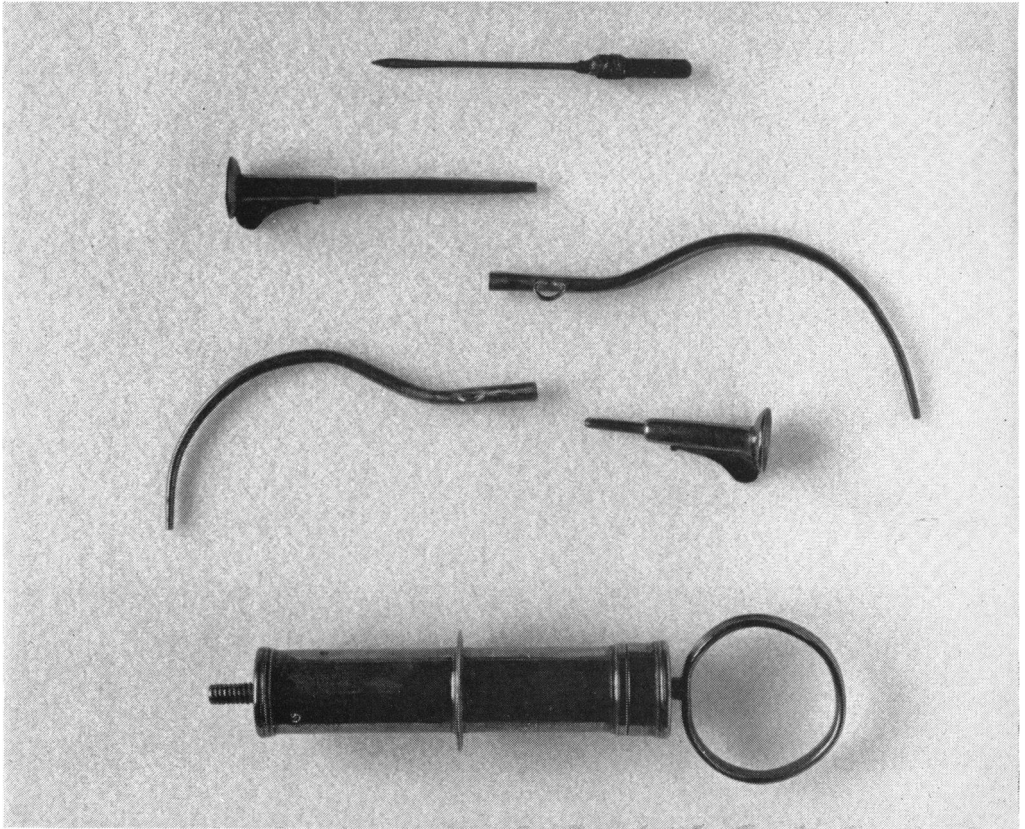


Figure 4.

La Fôret syringe and pipes, early nineteenth century, for retrograde syringing of the lachrymal duct from the nose. From the Wellcome Collection.

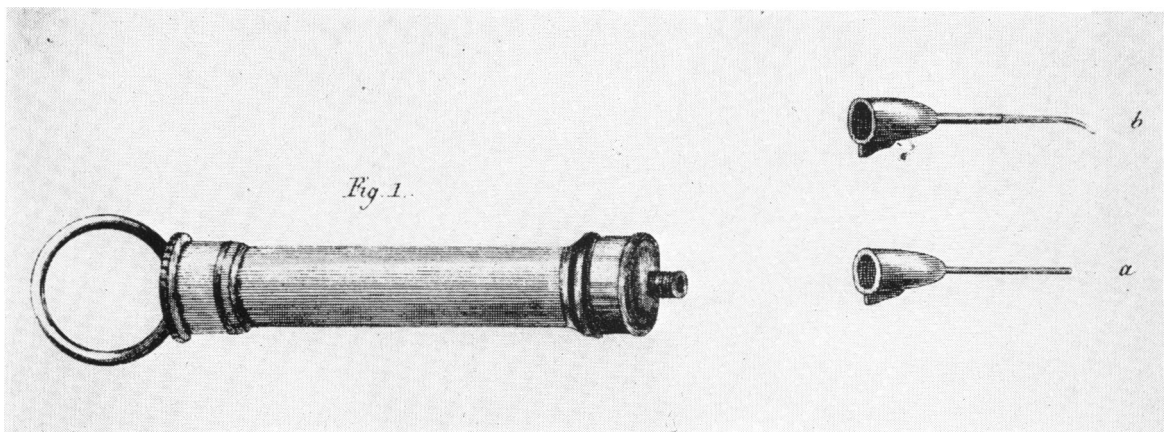


Figure 5.

Anel's syringe and pipes, late eighteenth century. From J. H. Savigny, *Collection of Engravings representing the most modern . . . Instruments used in . . . Surgery*, 1798.



Figure 6.
Anel's syringe and pipes, early nineteenth century. From the Wellcome collection.

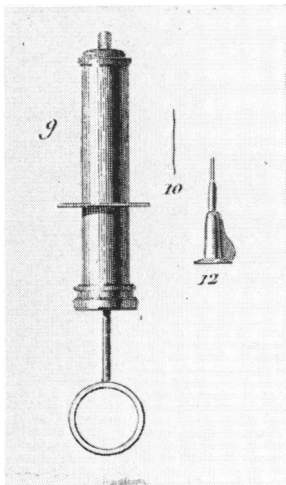


Figure 7.
Anel's syringe and pipe.
From A. A. L. M. Velpeau,
*Nuovi Elementi di Medicina
Operatoria*, 1833–36.

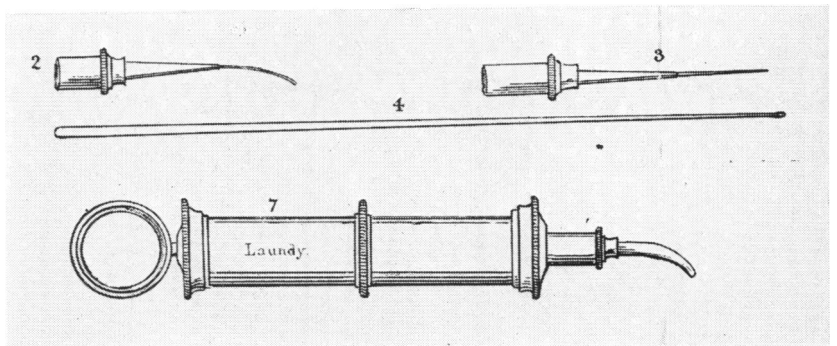


Figure 8.
Anel's syringe and pipes, with probe, by Laundry. From J. Morgan, *Lectures on
Diseases of the Eye*, 1839.

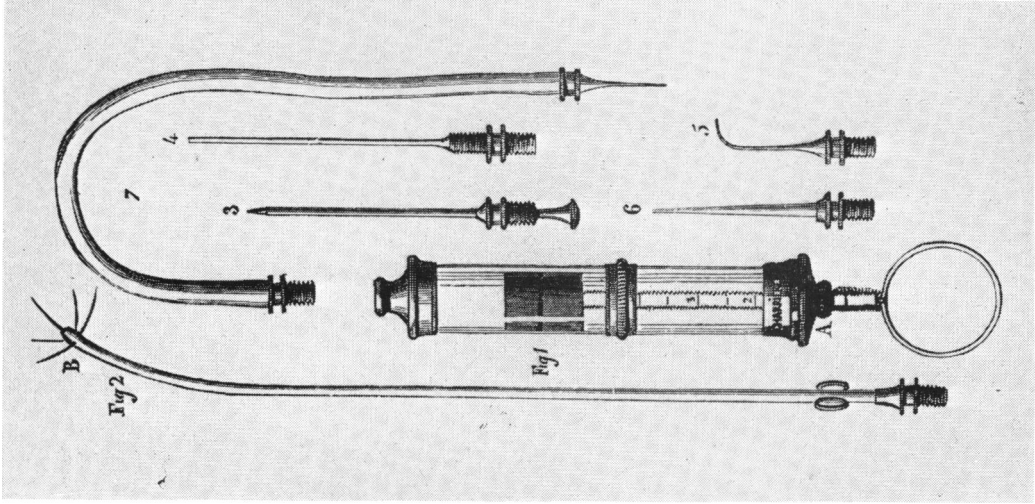


Figure 11. Multi-purpose syringe, by J. Charrière for Pravaz (1861), with (5 and 6) cannulae for lachrymal duct syringing, and (3) for injecting ferric perchloride. From J. Charrière, *Notices sur les Instruments de Chirurgie*, 1856.

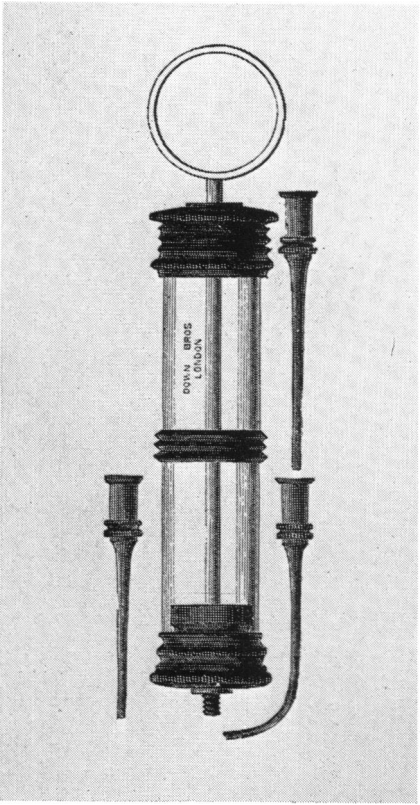


Figure 9. Anel's syringe, made of glass and vulcanite. From Down Bros., *Catalogue of Surgical Instruments*, 1914.

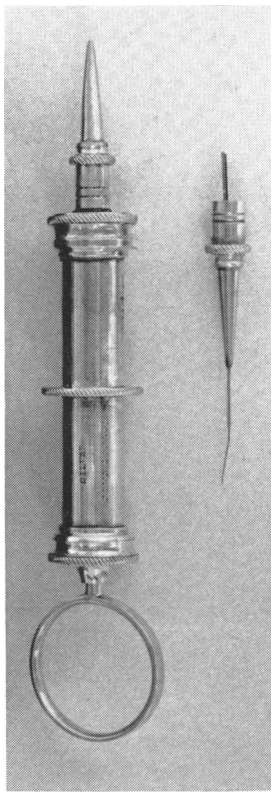


Figure 10. Anel's syringe, early twentieth century, made of silver. By Down Bros. From the Wellcome Collection.

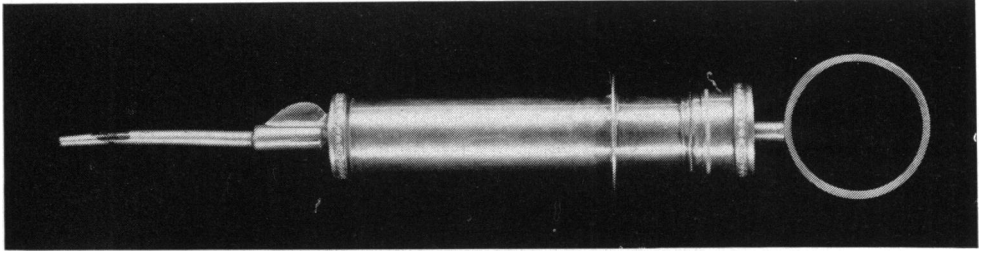


Figure 12.
Urethral syringe, early nineteenth century. From the Wellcome Collection.

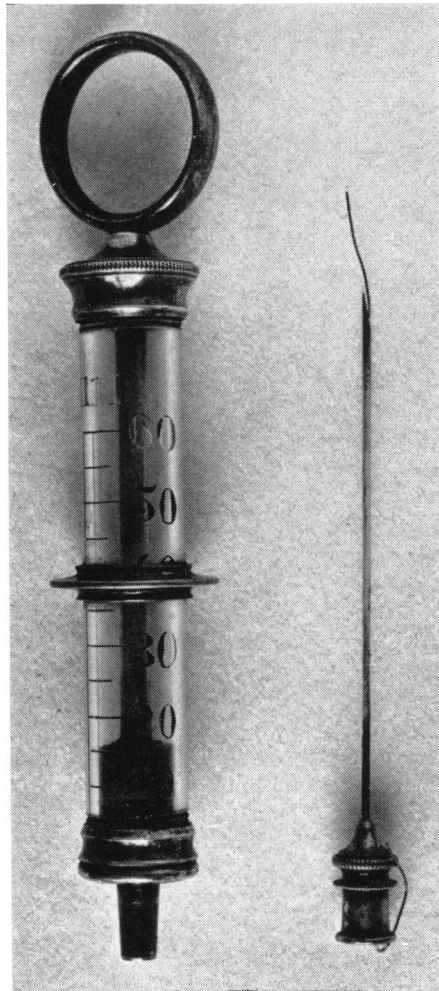


Figure 13.
Serum syringe and needle, by Arnold (1890).
From the Wellcome Collection.

Dominique Anel and the Small Lachrymal Syringe

gross pathological manifestations were shown to be a result of inflammation of the lachrymal channels, and not of the subcutaneous tissues. These took three forms: acute hydropsis, chronic hydropsis, or ulceration (i.e. with a fistula). Heister (1743) tells us, 'this part has been explained at length by Anel and by Meibom' (1666), and continues, 'Physicians and Surgeons had a wrong notion of the Nature and Treatment of this disorder till the beginning of this [eighteenth] century.'

James (1745) stated 'The authority and example of Anel about the year 1712 resulted in the cure of recent *Fistulae*, not least those without caries or callus, without the knife, terebra or cautery, where formerly they knew no other way of proceeding.' As Sorsby (1933) was to add 200 years later, 'Anel was a lone voice in the wilderness.'

It was indeed Dominique Anel who made the greatest practical contribution in his papers of 1713. He described the pathological anatomy, although his ideas of pure anatomy were not altogether correct. His treatment revolutionized accepted teaching on this subject and initiated a chain of new ideas. These appeared and re-appeared over the next two and a half centuries and culminated in the standard techniques of modern times.

Diagnosis was simple and depended upon the presence or absence of purulent discharge at the great or inner canthus or from the nose, which was considered to be the distinguishing feature of lachrymal 'fistula'. Pus from the puncta was considered by Anel (1713), James (1745) and Heister (1768) to come from an ulcer of the lachrymal sac called an 'imperfect fistula', but when a true fistula between sac and external skin gave way to a purulent discharge, this was a 'perfect fistula'; when bone was involved, it was called a 'compound fistula'. But it was the presence of pus that was paramount—Fallopian had thought this, and the eighteenth-century surgeons, Anel, Woolhouse (1724), and Heister concurred and perpetuated the definition.

Anel's (1713) technique necessitated first, the use of a very fine probe which he passed into the upper punctum, through the sac into the nasal duct and down to the nose; this separated the walls of the duct or broke down adhesions. This was followed by syringing through the lower punctum, using his own small syringe. The pipe for punctum irrigation was fine enough to be introduced without the necessity for dilation or incision; he used a second pipe for the same purpose where possible, or when treating 'perfect fistula'.

The syringe would appear to have been designed for irrigation only. It was held in the fingers of both hands and does not appear to have been intended for pressure syringing. Certainly Heister states that 'the liquor is forc'd through the Punctum, into the nasal Duct and nose'. But his use of the word 'forc'd' does not imply that force was part of the technique, although use of pressure syringing is a feature in the evolution of the technique. It is probable that the tip of the pipe being so fine as to be admissible into the lower lachrymal punctum without dilation, some pressure on the plunger was necessary to inject and this was interpreted as the 'use of force'. Anel repeated the probing and syringing in a conservative and systematic manner until lachrymal duct patency seemed assured. Anel's works are accompanied by a collection of correspondence between Anel and various authorities from all the major faculties in Europe who recounted their experiences. It is noted that of these, thirty-seven were in favour and only three against the technique. French and conti-

mental surgeons, however, argued long and loud about the new treatment. Garengeot (1720) failed to master Anel's technique and was against it. Schobinger (1730) likewise found that the method required too much industry and dexterity. But Heister (1743) was an advocate wholeheartedly and had used it on over a hundred occasions. He was equally enthusiastic in 1769. St. Yves (1723) the celebrated French oculist liked the method. La Fôret (1753) developed the technique of probing and syringing the duct from the nasal end—he used a modified Anel syringe and fashioned curved cannulae or algalae to pass into the nose. This method had its advocates for the next 150 years, but many failed to master the technique (Fig. 4). Boissier de Sauvages (1787) stated that lachrymal duct obstruction could be cured by Anel's method, but the cure was made more perfect by the technique of Méjan of Montpellier—in which a silver wire probe was passed through the duct and out of the nose; thread was then pulled through the duct by means of the eye in the probe—this thread being left in place for a month; he used a 'detersive ointment' and followed this by syringing with Anel's syringe using lime-water or Goulard's (1773) vegeto-mineral water (an aqueous solution of lead).

It was obvious, however, that some of the surgeons were having difficulty. Perhaps they were not choosing their cases correctly, perhaps the fine probes and syringe cannulae used by Anel were not easily obtainable by other surgeons. Nevertheless, the well-known surgeons accepted the use of probe and syringe as part of the new armamentarium. It became established in the eighteenth century that epiphora and early sepsis due to blockage of the lachrymal tract could be relieved by Anel's probe and syringe, but there was no doubt that the more chronic and complicated cases usually required additional measures—styles, indwelling cannulae and dacrycystorhinostomy by current techniques.

English surgeons of the eighteenth century were very slow to accept this new technique. This may have resulted from inadequate communication and the hazards of travel to Paris as well as from their inability to speak French. Certainly Anel's papers printed in French and Italian have never been translated into English.

Anel's technique 'was given great applause and is still used, but is of dubious value when pus is present.' So stated Samuel Sharpe who epitomized the English attitude to Anel's method in the eighteenth century. Sharpe of Guy's Hospital produced ten editions of his *Treatise of Operations in Surgery* between 1738 and 1782. He was of unchanged opinion in his tenth edition and could 'not understand that the force of water does any good', but he did use the probe and syringe for early cases, but was not favourably inclined toward them. He used the probe to break down concretions, and thought that Anel's success was due predominantly to the compress and 'the balsamics' that he used, but was quoting from Heister as his authority; Pott (1758) and (1775) described the use of Anel's probes, and also referred to the surgeons of the French Academy who tried to wash out the lachrymal duct from below, using Anel's syringe. This was a reference to La Fôret's (1753) retrograde syringing of the duct through the nose. But he favoured the technique of Méjan of Montpellier, who used probes (sometimes made of lead) which were passed completely through the duct, with the eye threaded with catgut.

Warner (1775) syringed but was not enthusiastic. Blizard (1780) elaborated the

Dominique Anel and the Small Lachrymal Syringe

idea of 'forced syringing' with a special mercury syringe. This was a pipe with a long glass tube used for injecting small quantities of mercury into lymphatics instead of water forced with a syringe. It was in fact constructed like a burette and the pressure was enforced by gravity feed. This use of mercury was later to influence the development of glass barrels, because mercury attacked the silver when it was used in Anel's syringe. Bell (1783) at Edinburgh made the excuse that there were no probes or syringes small enough in Edinburgh for his purpose, but he was using the syringe in 1786.

Ware (1818) seems to have been the first English surgeon to arouse any enthusiasm. He went to Paris in 1791 and came home converted, after learning that French surgeons, particularly Grandjean and Arrachart were still using Anel's syringe. Ware ordered a small silver syringe and pipes of different sizes to be made by Mr. Pepys of Poultry, London.*

He had noted that puncta were of different sizes—some so small as not to admit a bristle, and so he dilated the orifice to 'admit the pipes of Anel'. He furthermore made a study of the lachrymal tract post-mortem and noted that the commonest sites of constriction were at the lower end of the duct as had been noted by La Fôret (1753). Ware, however, emphasized that gentleness was necessary and thought that the intention of syringing was not to wash any matter from the lachrymal tract. This is a reference to the use of a liquid to force the tract open. Ware even obstructed the upper punctum with his finger to assist pressure.

But after Ware, English surgeons in the early nineteenth century came to accept the value of the method, and surgical catalogues showed that the syringes were being made and purchased. About thirty specimens are preserved in the Wellcome Institute, all dating from the later eighteenth century onwards. But the treatment of other than simple cases of epiphora was evolving with the development of styles and cannulae; these were, however, supplemented by routine syringing with Anel's syringe using Anel's pipes or La Fôret's retrograde pipes according to the skill and fancy of the surgeon. MacKenzie (1819) used the probe and syringe in early cases, but noted that this treatment was ineffective 'when discharge was discoloured'.

Travers (1820) likewise used a technique similar to Anel's; he dilated the punctum with a common pin before probing and syringed in all stages of the disease. Samuel Cooper (1819) accepted syringing automatically but later (1825) found it useful only in early cases, preferring an indwelling cannula for the older problems. Averill (1825) was not enthusiastic and Astley Cooper (1835) found the syringe inadequate, and useful only in lachrymal gleet. Morgan (1839) came to prefer syringing from the nasal end of the duct as described by La Fôret (1753) and Tyrrell (1840) used Anel's syringe but was not impressed with its use.

Dunglison's *Dictionary of Medical Science* (1857) refers to the use of Anel's syringe. Bowman (1857) accepted syringing as routine treatment but was famous for his modification of Anel's probes. He also emphasized the difficulties—'there is no subject in the whole range of surgery which has been more troublesome to our

*A cutler's and surgical instrument business flourished at 111 Bishopsgate, London, under John Pepys (eighth generation in Pepys' Genealogy—d. 1760) and at Poultry, London under William Hasledene Pepys (ninth generation), William Hasledene Pepys (tenth generation) and Robert Pepys (eleventh generation) until Poultry was demolished in 1863 for improvements in the city.

predecessors'.

Walton (1863) likewise emphasized what had been happening through the past 150 years when he wrote 'I know of no more common mistake in ophthalmic surgery than for a false passage to be made in attempt to open the nasal duct and to probe it'. This was echoed nearly a century later by Duke Elder (1952) 'In chronic disease, probes are to be most carefully used, and with the utmost care and gentleness. Pressure syringing is as dangerous, and syringing after probing is a still more stupid procedure'. Nevertheless, both Walton and Duke Elder used Anel's syringe for early cases. Watson (1892) used a modified Anel syringe for washing out the sac in chronic dacrocystitis. Finally, in the latter half of the nineteenth and in the twentieth century, probing and syringing of the naso-lachrymal duct became established unequivocally in the management of disease of this organ. Each decade of the twentieth century has, however, seen a change from the metal Anel syringe to the ordinary non-specific metal and glass, or all glass, or plastic syringe; so that since 1950 Anel's syringe has been replaced by a lachrymal syringe of non-specific character, or the common small syringe.

THE EVOLUTION OF ANEL'S SMALL SYRINGE

Anel (1713) gave interesting historical details of the origin of his instruments. He utilized a 'petite seringue anglaise' similar to those used for injecting lymphatics. Hoiris (1932) interprets this as meaning merely a metal syringe but perhaps it can be inferred as a reference to the quality of the metal used for making the syringe which was imported from England. Anel refers to the difficulty of finding a craftsman to make a 'tuyau' or cannula fine enough for his purpose. He names M. Jean Baptiste Dieulafes Orpheuse François who made them for him perfectly after having applied 'beaucoup de soin'.

Anel measured the size of lachrymal puncta with a hog's bristle, and experimented with Orpheuse using a drawer-plate, until he had made half-a-dozen fine bulbous tipped probes that he could use to explore the lachrymal sac for the sinuses or 'blind fistulae' from which he thought came the pus that ultimately escaped from the puncta. He inspected the finish of his probes with a magnifying glass and tested them on his tongue to ensure perfection of surface.

Heister (1743) and James (1745) give the first known line drawings of the syringe and in describing its use state that 'the injection should be made using the syringe of Anel, or one like it'. It was obviously characterized by the finger rings on the barrel to facilitate holding; its use was by a clumsy two-handed technique.

The Diderot *Armamentarium Chirurgicis* (1777) of Paris, the catalogues of Brambilla (1781) and Knaur (1796) of Vienna, and the Savigny catalogue (1798) of London, clearly show that in these three cities in the latter half of the eighteenth century the piston has been given a thumb ring and the barrel was smooth. The fitting of a thumb ring facilitated filling by suction and permitted single-handed grip of the syringe. The pipes screwed on to the mount and were given a fin to assist locking. No locking nut was now necessary. All catalogues show similar drawings which suggest that a common pattern of instrument construction was evolving (Figs. 5 and 6).

Dominique Anel and the Small Lachrymal Syringe

The Rudtoffer (1820) catalogue, also from Vienna, shows that the pattern of the syringe and pipes was being maintained, but by now one grip ring reappears near the centre of the barrel. Blasius (1839) of Halle, Berlin, pictures the Anel-Jungken syringe, the barrel of which is now made of glass, and construction details of the plunger are given. Pipes of Anel and La Fôret are shown, with some elaborate variation of the grip fins for fastening. Velpeau (1836) of Milan gives similar pictures showing that the basic pattern of early nineteenth-century Anel's syringe, pipes and cannula were in use in Italy (Fig. 7). Seerig (1838) of Breslau shows two typical Anel syringes, one of very early nineteenth-century pattern with variations of pipes, and a later model—a little more elaborately made.

Morgan (1839) shows a picture of a lachrymal syringe designed by Laundry. The Laundry catalogue of instruments (1795) quotes a price of two guineas for a set of instruments for irrigating the lachrymal duct, but does not illustrate it. The Laundry pattern of Morgan (Fig. 8) was now more advanced and was a design which was to survive the next 100 years, at least in all except the mount. The barrel is symmetrical, with a grip ring half way along. The cap and mount ends of the barrel are characterized by grip rings of equal and similar size to that in the centre. All these rings have a fine milled edge. The piston has a thumb ring. The pipes are male fitting into a female orifice at the end of the barrel, there being no true mount. The pipes have a single milled edge to facilitate grip and fastening. Brambilla (1780) and Savigny (1798) both show a milled edge on their anatomy pipes. Savigny (1798) had used a cross bar on his anatomy pipes for ease of tying the pipe in a vessel but he found that an equally satisfactory tie could be achieved if a milled edge, instead of a bar, was incorporated to prevent the thread from slipping. This was more convenient in tissue spaces and also led to the use of a milled edge for grip purposes. Laundry in his design of Anel's syringe shows for the first time a milled edge on the pipes and grip rings of the barrel.

J. F. Charrière (1843) in an extract from his 1842 catalogue, had developed little syringes in pewter, glass, bone, and ivory. He had in 1841 produced his plunger of leather of 'double parachute' design (i.e. two everted leather washers), and about this time also, the hollow piston rod. There were no new developments in Anel's syringe since 1839, nor were there in the 1844 catalogue—but both referred to Anel's syringe, which was considered the standard lachrymal syringe. J. Charrière (1856), his son, announced that a glass-barrelled Anel syringe had been exhibited by him in 1855; this had four guard rods along the outside of the barrel, the ends of which were protected by two buffalo-leather washers. The plunger was of leather of the 'double parachute' design invented by his father. Gaujot (1869), Arnold (1873 and 1875) show a standard later nineteenth-century pattern, similar to Laundry's, but the screw-thread mount reappeared and the pipes with a fine milled edge screw on the washered mount.

Leiter (1875), however, had introduced vulcanite into syringe construction to reduce cost. Arnold (1900 and later), Down (1904) and Harris (1909) list Anel's syringe made of glass and vulcanite (Fig. 9) with a screw mount and later with replacement of the screw mount by a plain mount. But vulcanite pipes were too crudely tipped to be practical and this design did not hold its place.

Meanwhile, glass-barrelled syringes had been evolving ever since Blizard's glass mercury syringe and the Anel-Jungken syringe listed by Blasius (1839). Charrière the elder (1843) produced small syringes made entirely of glass, and his son (1856) listed Anel's syringe with glass barrel guarded by four rods of metal or wood. Maw, Son & Thompson in their 1891 catalogue show an almost identically guarded syringe which they list as useful for injecting small quantities of fluid, and the pipes are identical with Anel's pattern. The use of glass barrels increased in popularity, for Walton (1863) commented that 'Anel's syringes were ordinarily made of glass' and all late nineteenth-century catalogues list Anel's syringe made with glass barrels. About this time Carl Schneider, working for Luer in Paris, was producing his own small all-glass syringe that bears the Luer name—this came to be used with Anel's pipes and is quoted as 'Anel's syringe by Luer'.

In the twentieth century Anel's syringe has been advanced by the improvement of materials for the construction of both barrel and plunger. Plungers, other than in all-glass syringes, have evolved from waxed linen thread, and wound thread or tow, to cork; and thread or tow wound over cork, to leather, and the elder Charrière's 'double parachute', itself later reinforced with thread to prevent plunger leakage, or with an oil chamber (Arnold) to lubricate the leather. At the end of the nineteenth century rubber and asbestos were tried, but in the first decade of the twentieth century came the introduction of the stainless steel plungers—at first with, and later without a slip ring. Whereas, before the plastic disposable syringe with rubber plunger made its appearance, ceramic plungers were replacing stainless steel, it is doubtful whether an Anel syringe was ever made with a ceramic plunger.

Barrels of the standard Anel syringe continued to be made of silver and the finest stainless steel, and the hubs of the pipes likewise, with gold or silver pipes—the instrument was sold in a morocco leather box lined with plush velvet. Because of continental copies all English-made syringes were stamped with the maker's name, and pride of place in the catalogues was given to Anel's pattern. All others followed, and were not necessarily sold in a box (Fig. 10). There were variations: of glass, with metal or vulcanite furniture consisting of mount ring, grip ring half way along, and cap with ring; variations of size and of strength of materials in construction; two finger rings were added to the cap of the barrel to facilitate grip in place of the centre ring—none of these variations was to evolve as superior to the metal syringe except the all-glass barrel which enabled the operator to see the fluid being injected. Indeed, Anel's syringe has at last disappeared from the instrument trolley because the common type of standard glass or plastic disposable syringe has evolved so perfectly in construction that a specific type of lachrymal syringe is now no longer necessary.

Similarly Anel's pipes have been modified in shape and style of hub, as described, but the materials used for pipe construction have always remained gold or silver—a soft metal to avoid risk of damage to the fine lachrymal mucosa. Lang tried to introduce a bulbous tip to prevent regurgitation alongside the pipe, in addition to angulating the pipe. But a simple, straight gold or silver cannula mounted on a conventional hub for use with a Record, Luer all-glass, or plastic disposable syringe has evolved as the standard lachrymal syringe. Anel's gold or silver cannula is the only original item which still survives today.

Dominique Anel and the Small Lachrymal Syringe

Anel's probes were originally very fine, bulbous tipped, and curved. Variations in design have been used—with eyes, for passing thread; with bends and curves, for right and left handed use as designed by Bowman; and with variations of grip. However, the standard type of probe that is used today is the simple bulbous-tipped silver variety that Anel used—the only difference being that today the punctum would almost certainly be dilated before probing with a larger probe than Anel devised.

Thus have Anel's instruments evolved—Anel's small metal syringe was to survive 250 years and to outlive a number of variations before being itself overtaken by the efficiency of the common small syringe. This is the measure of its quality—that this little instrument, so precise and so strong for its need, should have established and held its place for so long in the therapy of lachrymal duct disease by irrigation. Its passing into history cannot be permitted without acknowledgement of the part it has played in syringe evolution.

THE INFLUENCE OF ANEL'S SYRINGE ON SMALL SYRINGE CONSTRUCTION

Anel's syringe was the first lachrymal syringe and one of the earliest small syringes evolved. Eighteenth- and nineteenth-century surgical instrument makers obviously gave great thought to its development. It was required to be sturdy, easy to handle—but yet an instrument of precision, made of the finest materials because of the delicate parts being treated. No doubt, improvement in syringes and pipes in general would be reflected in development of Anel's syringe—thus in the later eighteenth century, all the smaller syringes including Anel's were fitted with a thumb ring on the proximal end of the piston. Whereas Anel's syringe retained the thumb ring in its evolution to facilitate precise handling, this particular feature came to be omitted selectively from other syringes. Likewise, whereas in later seventeenth- and early eighteenth-century syringes three or four grip rings were a feature of barrels, they came to be omitted in the later eighteenth century when the thumb ring appeared on the piston and barrels became smooth. But in the early nineteenth century a central grip ring reappeared in Anel's and later, selectively, in other small syringes. Anel's syringe, being a small precise instrument, every facet of its construction was studied and utilized in other small syringes.

Much experience was acquired in mount construction—whether a screw thread was needed for the pipe, or whether a male or female union—certainly all were tried with Anel's syringe before any other small syringe, other than perhaps anatomy syringes.

Corrosive effects had been noted with metal syringes so that other available materials were sought; this effect, combined with the need to visualize the fluid being injected, stimulated the need for glass barrels in the early decades of the nineteenth century. This brought problems of union of metal with glass and, after vulcanite was invented in 1843, attempts were made later to utilize this material in the furniture and cannulae. The evolution of plungers (v.s.) through the eighteenth and nineteenth centuries can be traced by reference to the various ideas incorporated in Anel's syringe. By the time small syringes were evolving more widely in the mid-nineteenth century, the need for improved plungers was apparent and Maison Charrière provided this

with the 'double parachute'. But the Charrières—father and son—were active in other ways, and exerted a great influence. The former, exhibiting in successive exhibitions between 1834 and 1851—the last being the Great Exhibition in London, had produced small syringes with a capacity graduation mark in the early 1840s. His son exhibited in Paris in 1855, producing an Anel syringe with the barrel guarded with metal rods, from which the guarded glass barrel was to emerge. Both father and son produced syringes for Pravaz. The famous Pravaz syringe was an ordinary small syringe with a special screw thread piston rod adapted to inject ferric perchloride by slow drip into a naevus—it was only one of several specific small syringes, including Anel's, made by Charrière the elder. The idea of a screw piston was certainly well known to Charrière and was not new in the Pravaz syringe. The only new features in the Pravaz syringe were the flat double fin on the piston for turning, and the use of a syringe with a cannula bearing a needle point. Indeed in 1861, the younger Charrière made a graduated all-purpose syringe for Pravaz—with a glass barrel, of Anel's pattern, and with six special cannulae, including two for lachrymal syringing, and one for injecting ferric perchloride (Fig. 11).

It has been claimed that Anel's syringe was used for subcutaneous injection. Kane (1880) quoted that Taylor and Washington claimed to have given morphia by injection in 1839 by using a small Anel syringe, inserting the nozzle into a lancet incision. This was a variation of the Lafargue (1836) technique and is a reasonable claim. Eulenberg (1867) likewise stated that one of the Langenbecks (? C. S. M.) had injected medicaments subcutaneously with a fine eye syringe. Furthermore, Schwidetzky (1944) asserted that Pravaz founded his technique on an inspired variation of the Anel lachrymal syringe, and this is a reasonable assertion. It would be hard to believe that enterprising surgeons of the late eighteenth and early nineteenth centuries would not have tried to experiment in this way with a syringe so well made and tried. Certainly the evolution of Anel's syringe paved the way for other syringes—the guarded glass barrel started by a variation of the Anel.

The similarity between treatment of lachrymal duct and urethral disease often quoted in ophthalmic literature was bound to influence urethral syringe-making, and there is in the Wellcome Collection a urethral syringe modified from Anel's pattern (Fig. 12). Charrière's later urethral syringes resemble the Anel syringe in construction. The Thiersch cancer-cell transplanting syringe by Arnold is identical with a glass barrel Anel syringe. Furthermore, serum syringes of the 1890s resemble Anel's syringe (Fig. 13). Thus was the experience acquired in the evolution of Anel's syringe reflected in the development of other small syringes. This influence continued into the twentieth century and is clearly manifest in the many variations of small syringes whether hypodermic, aspirating, anaesthetic, urethral or any other that have been made by surgical instrument-makers.

Honour is due to Anel for his enterprise.

ADDENDA

1. GARENGEOT (1725) in a *New Tract on the Most Useful Surgical Instruments*, gives a line drawing of an Anel syringe of advanced design, describing the syringe and pipes in detail with measurements.

Dominique Anel and the Small Lachrymal Syringe

- MEDD (1828) refers in the treatment of hydrophobia to the intravenous injection of tartar emetic dissolved in warm water using an Anel syringe.

ACKNOWLEDGEMENTS

Grateful thanks are due to Dr. Joan Mathias (née Chappell) who kindly sent a vulcanite and glass syringe to the writer, which syringe started this study; and to the staff of the Wellcome Institute of the History of Medicine, London, for much help and kindness in many ways. Miss Penny Cates, B.A., checked the translations.

REFERENCES

- ALLEN and HANBURY, *Catalogue of Surgical Instruments*, London, 1902.
- ALOE, A. S. & Co., *Surgical Instrument Catalogue*, 4th ed., 1887.
- ANEL, D., *Observation singulière sur la Fistule lacrimale*, Gennes, Cionoco, 1713.
- Idem.*, *Nouvelle Méthode de guérir les Fistules lacrimales*, Turin, Zappate, 1713.
- Idem.*, *Suite de la nouvelle Méthode de guérir les Fistules lacrimales*, Turin, 1714.
- ARNOLD & SONS, *Catalogues of Surgical Instruments*, London, 1873–1904.
- AVERILL, C., *A Short Treatise on Operative Surgery*, 2nd ed., London, Jackson, 1825.
- BELL, B., *System of Surgery*, Edinburgh, C. Elliot, 1783–88.
- Idem.*, *System of Surgery*, 2nd ed., Edinburgh, C. Elliot, 1785–88.
- BLASIUS, E., *Catalogue of Surgical Instruments*, Berlin, Herbig, 1839.
- BLIZARD (1780) Quoted by Savigny (v.i.), Ware (1790) (v.i.), and Cooper, S. (1849).
- BOWMAN, W., 'On the treatment of lacrymal obstructions', *Reports of the Royal London Ophthalmic Hospital*, 1857, 1, 10.
- BRAMBILLA, G. A., *Instrumentarium Chirurgicum Viennense*, Vienna, M. A. Schmidt, 1780.
- CHARRIÈRE, J., *Notices sur les Instruments . . . de Chirurgie . . . présentées . . . par Charrière fils*, 2nd ed., Paris, Plon, 1856.
- CHARRIÈRE, J.F., *Extrait du Catalogue de la Maison Charrière*, Paris, 1844.
- COLLIN, *Catalogue of Surgical Instruments*, Paris, 1908.
- COOPER, A., *Lectures on the Principles and Practice of Surgery*, 8th ed., London, E. Portwine, 1835.
- COOPER, S., *The First Lines of the Practice of Surgery*, 4th ed., vol. 1, London, Longman, 1819.
- Idem.*, *A Dictionary of Practical Surgery*, 5th ed., London, Longman, 1825.
- COXETER, *Catalogue of Surgical Instruments*, London, 1870.
- CULPEPER, N., *School of Physick*, 3rd ed., London, R. Bently, 1696.
- DE MOULIN, D., 'Dominique Anel and his operation for aneurysm', *Bull. Hist. Med.*, 1960, 34, 498.
- DEWITT & HERTZ, *Catalogues of Surgical Instruments*, Berlin, 1891–1909.
- DIDEROT, D., *Armamentarium Chirurgicale*, Paris, 1777.
- DIONIS, P., *Cours d'Opérations de Chirurgie*, 2nd ed., Paris, C. M. d'Houry, 1714.
- DOWN BROS., *Catalogues of Surgical Instruments*, London, 1885–1906.
- DUKE ELDER, SIR STEWART, *Textbook of Ophthalmology*, vol. 5, London, Kimpton, 1952.
- DUNGLISON, R., *Dictionary of Medical Science*, 1857.
- EULENBERG, A., *Die hypodermatische Injection der Arzneimittel*, 2nd ed., Berlin, 1867.
- FALLOPIUS, G., *Observationes Anatomicae*, Paris, B. Turrisanus, 1562.
- GARENGEOT, R. J. C., *A Treatise of Chirurgical Operations*, trans. from the French, and rev. by Mr. St. André, London, T. Woodward, 1720.
- Idem.*, *Nouveau Traité des Instruments de Chirurgie les plus utiles*, Paris, 1725.
- GAUJOT, G., *Arsenal de la Chirurgie contemporaine*, vol. 1, Paris, J. B. Baillièrre, 1869.
- GOULARD, T., *A Treatise on the Effect of the Use of Lead*, trans. by G. Arnaud, London, P. Elmsly, 1773.
- HARRIS, P., *Surgical Catalogues*, 1904 and 1909.
- HEISTER, L., *A General System of Surgery*, English trans., London, W. Innys, 1743.
- Idem.*, *A General System of Surgery*, Eng. trans., 8th ed., London, J. Whiston, 1769.
- HERNSTEIN, *Surgical Catalogue*, U.S.A., 1870.

- HOTRIS, S., *Anel, sa Vie, son Oeuvre ophthalmologique*, Paris, 1932.
- JAMES, R., *A Medicinal Dictionary*, vols 2 and 3, London, T. Osborne, 1745.
- KANE, H. H., *Hypodermic Injection of Morphia, Its Dangers and Advantages*, New York, 1880. (Quoted by Schwidetzky—v.i.).
- KNAUR, T., *Selectus instrumentorum chirurgicorum*, Vienna, Vid. Alberti, 1796.
- LA FOREST, M. de, 'Nouvelle méthode de traiter les maladies du sac lacrymal, nommées communément, fistules lacrymales', *Mém. Acad. r. Chir.*, 1753, 2, 175.
- LAUNDY, S. I., *Catalogue of Surgical Instruments*, London, 1795.
- LA VAUGUION, M. de, *The Compleat Body of Chirurgical Operations . . . done into English*, London, H. Bonwick, 1699.
- LEITER, J., 'Description of "Leiter's hypodermic syringe"', *Brit. med. J.*, 1875, ii, 674.
- MACKENZIE, W., *An Essay on the Diseases of the Excreting parts of the Lachrymal Organs*, London, Longman, 1819.
- MATSUMOTO, *Surgical Instrument Catalogue*, Japan, 1901.
- MAW, S. & SONS, *Illustrated Catalogue of Surgical Instruments*, London, S. Maw, 1866–1907.
- MAW, SON & THOMPSON, *Surgeon's Instruments*, London, 1891.
- MEDD, J., *Lancet*, 1828, ii, 221.
- MORGAN, J., *Lectures on Diseases of the Eye*, London, S. Highley, 1839.
- PARÉ, A., *The Workes . . .*, translated by T. Johnson, London, T. Cotes & R. Young, 1634.
- POTT, P., *Observations on that Disorder . . . commonly called Fistula Lachrymalis*, London, Hitch & Hawes, 1758.
- Idem.*, *The Chirurgical Works*, London, L. Hawes, 1771.
- RUDTORFFER, F. X., *Tabulae Armamentarii Chirurgici Selecti*, Vienna, The author, 1820.
- SAUVAGES DE LA CROIX, F. BOISSIER DE, *Nosologia methodica oculorum*, trans. by G. Wallis, 1787.
- SAVIGNY, J. H., *Collection of Engravings representing the most modern . . . Instruments used in . . . Surgery*, London, T. Bensley, 1798.
- SCHOBINGER, J. H., *De Fistula lachrymali*, Basle, 1730.
- SCHWIDETZSKY, O., 'History of needles and syringes', *Curr. Res. Anesth. Analg.*, 1944, 23, 34.
- SEERIG, A. W. H., *Armamentarium chirurgicum*, Breslau, A. Gosohorsky, [1835]–1838.
- SHARP, S., *A Treatise on the Operations of Surgery*, London, J. Brotherton, 1739.
- Idem.*, *A Treatise on the Operations of Surgery*, 10th ed., London, G. Robinson, 1782.
- SORSBY, A., *A Short History of Ophthalmology*, London, J. Bale & Danielsson, 1933.
- STAHL, G. E., *De Fistula Lachrymali*, Berlin, 1702.
- ST. YVES, C. DE, *Nouveau Traité des Maladies des Yeux*, Paris, P. A. Le Mercier, 1723.
- TIEMANN, G. & Co., *Catalogue of Surgical Instruments*, New York, 1889.
- TRAVERS, B., *A Synopsis of the Diseases of the Eye*, London, Longman, 1820.
- TYRRELL, F., *A Practical Work on the Diseases of the Eye*, London, Churchill, 1840.
- VELPEAU, A. A. L. M., *Nuovi Elementi di Medicina Operatoria*, Milan, G. Truffi, 1833–36.
- WALTON, H., 'Diseases of the lachrymal duct attended by stricture: treatment', *Brit. med. J.*, 1863, i, 344.
- WARE, J., *Observations on the Treatment of the Epiphora, or Watery Eye: and on the Fistula Lacrymalis*, new ed., ed. by his son N. Ware, London, T. & G. Underwood, 1818.
- WARNER, J., *A Description of the Human Eye*, London, L. Davis, 1773.
- Idem.*, *A Description of the Human Eye*, 2nd ed., London, L. Davis, 1775.
- WATHEN, J., *Epiphora and Fistula Lachrymalis*, 2nd ed., London, C. Dilly, 1792.
- WATSON, W. S., *The Anatomy and Diseases of the Lachrymal Passages*, London, H. K. Lewis, 1892.
- WEISS, J., *Catalogue of Surgical Instruments*, 3rd ed., London, 1901.
- WOOLHOUSE, J. T., *Definitiones ophthalmicae*, in his unpublished manuscript (early 18th century) entitled 'Traité des maladies de l'oeil', now in the Library of the Royal College of Surgeons of England.