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# Jacques Daviel: The Invention of Modern Cataract Surgery

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## Introduction

Jacques Daviel's development of cataract extraction was the culmination of observations and insights by others that spanned many centuries. The location of the lens in the eye and the function of the lens in vision puzzled the physicians and scholars of antiquity and medieval times. Even more elusive was an understanding of the true identity of the lens's dark twin, the cataract. It was not until these mysteries were finally resolved in the seventeenth and eighteenth centuries that a reasonably safe and effective solution to cure the vision loss caused by cataract could be sought. This, in turn, required a surgeon with unique knowledge, experience, skill and ingenuity. These traits were found in the French surgeon Jacques Daviel (1693–1762) (Fig. 1), who, in a landmark advance in the history of ophthalmology, presented his new method of cataract extraction to the French Academy of Surgery on the 13th of April, 1752.

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## Understanding the Anatomy of the eye

According to Stephen L. Polyak, a prominent neuroanatomist and fine historian [1], the first authentic scientific description of the eye dates back to the Hellenistic period (323–212 BCE) and is attributed to Herophilos (344–280 BCE) [2]. Polyak states that Hippocrates (460–377 BCE) did not know of the existence of the lens. Aristotle (c.384–322 BCE) concluded that the lens was a postmortem artifact resulting from the accumulation of phlegm [3]. Celsus (first century A.D.) describes the crystalline lens as consisting of a 'humor' or liquid, resembling the white of an egg with an anterior space ('locus vacuus') between its front surface and the pupil [4] and labelled it the vital organ of vision. This latter concept persisted until the seventeenth century when the Swiss physician, Felix Plater (1536–1614) and subsequently the German mathematician and astronomer, Johannes Kepler (1571–1630) demonstrated that the lens served to refract light, and that the essential sensitive organ of vision was the retina.

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## Appreciating the True Nature of the Cataract

The physicians and surgeons of antiquity labored under the misconception that a cataract was a veil or humor that flowed down into the space between

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**Fig. 1** The standard portrait of Jacques Daviel at the height of his fame. Taken from: Albert DM, Edwards DD, eds. *History of Ophthalmology* Cambridge, Mass., Blackwell Science, 1996

the lens and the pupil, where it solidified, forming a suffusion or cataract. Jacques Daviel vividly described the consequences of this mistaken concept: “The ancients who had always considered the cataract as a membrane, devised means of removing it that conformed to their opinions. Some used round needles to roll up this imaginary membrane like a ribbon; others invented extremely pointed needles so as to cause less damage to the sclera; some used cutting needles to sever the threads they believed attached the cataract to the ciliary processes; finally, Freytagius (town surgeon of Zurich) devised a kind of spring forceps terminating in needles, with which he proposed to extract the membranous cataract from the eye” [5].

The ancients, likely going back to the Babylonians and the Code of Hammurabi (1800 BCE); Suśruta (about 600 BCE) and early Chinese, also knew how to “couch” or decline cataracts (Fig. 2). Galen recorded that a Greek physician, “dislodged the cataract into another place where it was less disturbing [6]”. During the middle ages, various Arabian oculists used a hollow needle to aspirate the soft congenital cataract [7], but couching remained for centuries the principal surgical treatment of cataracts.

The realization that the cataract was in fact the clouded or opaque lens did not occur until the

seventeenth century when the first post-mortem examinations of cataractous lenses were performed, by Werner Rolfinck (1599–1673) in 1656, and Michel Brisseau (1676–1743) in 1707, a half century later [8]. Brisseau, in the preface of his book, *Traite de la Cataracte et du Glaucoma* (Paris, Houry, p.v), described a soldier whose cataract he couched. The soldier subsequently died and Brisseau dissected his eye and extracted the lens, giving conclusive proof of the true nature of cataract. In 1707, Antoine Maitre Jan (1650–1725) independently published his findings of examination of the lens from a deceased cataract patient in his *Traite des Maladies des Yeux* and he also discovered the onion-like layered structure of the lens.

Soon after, there appeared reports on three successful lens extractions in living patients whose lenses were subluxed into the anterior chamber: two operations by Charles de St. Yves (1667–1736) in 1707 and 1716 and another by the noted surgeon Jean Louis Petit (1674–1760) in 1708. The surgeon Jean Méry (1645–1723) proposed to the august Paris Academy of Science in 1707 that they sanction extraction as a method for treating cataract. “Extraction seems to be as safe as couching; it may be even less risky,” Méry stated. “The aqueous reforms easily. The cornea does not have any blood vessels and therefore does not become affected with inflammations”. However, the Academy showed little interest in the new procedure [9]. Thus, by the time Daviel started his studies to become a surgeon, the anatomy of the eye, the location of the lens and the true nature of the cataract were understood by the leading surgeons of France. Indeed cataract extractions *had been* performed. But as with so many other great ideas in science and medicine, cataract extraction awaited someone to “convince the world” of its value and claim the title of its inventor. Jacques Daviel was the individual destined to accomplish this.

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### Jacques Daviel: Early Years

Daviel was born in La Barre, Normandy, a village about 60 miles from Rouen, in August 1693, the exact day being now uncertain. It is said he

**Fig. 2** Rembrandt's depiction of the scene in the Apocrypha in which Tobias, assisted by an angel, cures the cataract of his father Tobit. Courtesy of: The Cleveland Museum of Art, Cleveland, OH. (<http://clemusart.com>); purchase from the J. H. Wade Fund

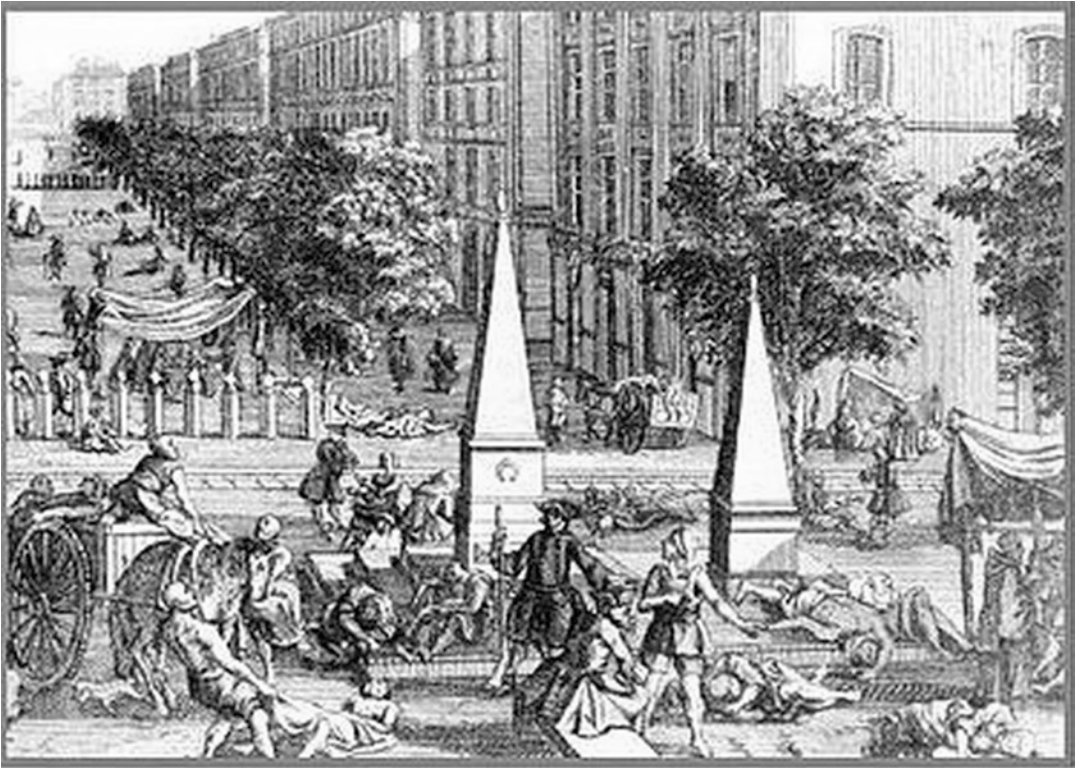


declared his intention to be a surgeon as a boy when he assisted the village surgeon in reducing the fractured leg of a peasant. His parents were of modest means, and following the death of his father, he was apprenticed to his uncle, Dr. Sallou, a surgeon in Rouen. In 1713, when Daviel was 20 years old, he became an assistant surgeon in the French Army, stationed in military hospitals in Flanders and elsewhere, and eventually serving as an assistant to Xavier Bouquot at the Hotel-Dieu in Paris. Notable to this appointment was the fact that the Hotel-Dieu was the only public institution in Paris where the dissection of cadavers was permitted.

In 1720, the last significant outbreak of bubonic plague in Europe, occurred in southern France and killed approximately 100,000 people

in Marseille (Fig. 3) and the surrounding provinces [10]. In October of that year, Daviel, who was still in the military, volunteered to join a team of Parisian physicians as an “epidemic surgeon” and served in Salon-de-Provence. The discovery of plague bacillus was still 74 years in the future. To Daviel’s credit, in addition to his courage, energy and compassion in treating infected patients, Daviel oversaw the isolation of these patients and used an aromatic antiseptic agent, with which he attempted to suppress the spread of the fleas carried by rats that are the vector of the disease. For his efforts Daviel gained recognition as a local hero and that appreciation eventually extended to the regents ruling France in the name of Louis XV (Fig. 4), then still a child. Daviel was awarded the Cross of Saint Roch and





**Fig. 3** Marseille at the time of the plague. Taken from: [https://en.wikipedia.org/wiki/Great\\_Plague\\_of\\_Marseille#/media/File:Gravure\\_peste\\_-\\_Quartier\\_Belsunce.JPG](https://en.wikipedia.org/wiki/Great_Plague_of_Marseille#/media/File:Gravure_peste_-_Quartier_Belsunce.JPG)

other honors from the city of Marseille, and this distinction and respect served him well for the rest of his career and, as will be seen, facilitated his work on cataract extraction.

Two years into his service in the Marseilles area, he met and married Annette, the daughter of a prominent “master surgeon”, Dr. Joseph Felix, and the “several thousand pounds worth of gold Louis (French coins)” included in the bride’s dowry gave Daviel a degree of independence that allowed him to concentrate on areas of surgery of particular interest [11].

In 1722, the city officials in Marseilles appointed Daviel to the rank of master surgeon. Sixteen years later (1738), he again received royal recognition with his further elevation to Royal Demonstrator of Anatomy and Surgery at the Hotel-Dieu in Marseilles, where he taught public courses in anatomy and surgery at Marseilles’ Hotel-Dieu (Fig. 5). Daviel continued to practice surgery in Marseilles until 1746, when he moved to Paris.

### Daviel’s Life as a Cataract Surgeon

In 1733, the 40-year-old general surgeon, Jacques Daviel, performed his first operation for cataract. It was a couching procedure and the result was excellent [12] (Fig. 6). The following year, Daviel decided to devote himself entirely to eye surgery, and the basis for this decision has been speculated on by his biographers. The consensus appears to be that a major factor in this decision was the visit to Marseilles in 1734 by the surgeon-turned-traveling oculist, the “Chevalier” John Taylor. At the time in England and the Continent, couching and other eye surgery was done both by regularly trained surgeons, but even more frequently, by irregularly trained itinerant oculists. Taylor, famed as a skilled eye surgeon, but notorious for his exaggeration and self-promotion, was the eye surgeon to George II, the Pope, and a number of European royal families. He was a charismatic and flamboyant figure, and he trav-

**Fig. 4** King Louis XV of France, Daviel's patron and supporter. Taken from: [https://en.wikipedia.org/wiki/Louis\\_XV\\_of\\_France](https://en.wikipedia.org/wiki/Louis_XV_of_France)



eled throughout Europe in a coach covered with images of eyes [13]. The two men are believed to have met, and Daviel, who was said to have been increasingly interested in eye diseases since 1728 [11], decided to follow Taylor's example of limiting his practice to the eye.

To be successful in couching cataracts demanded speed and considerable skill, and Daviel became a master of this procedure in short order. His status in Marseilles and his protection by Louis XV allowed him to circumvent the social and religious restrictions that limited the use of cadavers for practice surgery in France in

the eighteenth century. By gaining his experience from cadaver surgery, Daviel avoided the necessity of learning from live patients through trial and error. His famous contemporary and rival as a cataract surgeon, Baron Michael Johann Baptist de Wenzel of Lorraine, discussed the latter method: "On being complimented for his dexterity, the celebrated de Wenzel acknowledged he had lost a hat-full of eyes before he learned to extract" [14].

For the next 13 years, from 1734 to 1747, Daviel specialized in couching cataracts and his reputation for dexterity and relative success with





Christophe MOUSTIER vidit - 2005

**Fig. 5** Hotel-Dieu in Marseille

this procedure spread throughout Europe. In eighteenth century Europe, members of nobility, as well as other wealthy patients who needed surgery, expected the surgeon to travel to them, reflecting the relatively low status and prestige of the surgical profession. To satisfy requests for his services Daviel undertook “grand tours” through southern France, Spain and Portugal, and subsequently through Italy, Germany and Belgium. During his absences from Marseilles, his progress and successes were reported in *the Courier D’Avignon*, the most widely read newspaper in Provence. These appeared in the form of 29 unsigned articles, which his biographers attribute to Daviel himself, a man “far from adverse to publicity.” These articles provide details of his itineraries, time-tables, lodgings where he could be found, as well as the number and results of the surgeries he performed. In addition to the patients who previously requested his consultation and surgery, he clearly invited the public to take advantage of his availability. Thus, at the end of his initial 16 months of travel through southern France and the Iberian Peninsula, he could report (writing in the third person) in the August 1737 issue of *Courrier d’Avignon*: “He had done over



Départ. Chirurg. Tom. II. GUNZ. DE SUFFUSION. NATUR. ET CURAT. pag. 148.

**Fig. 6** Contemporary illustration of a couching procedure. Taken from: Gunz De suffusion. Natur. et curat pag. 148 Lausanne: Bousquet, 1755

2000 operations on patients 30, 40, 60 up to 90 years old, among them blind patients between 15 and 54 years of age. He even had the satisfaction of curing several persons, blind since birth, who, after the operation could discern objects shown them.” Daviel was received by the King and royal family in both Spain and Portugal and operated on members of royalty, the aristocracy and on their servants [8].

By 1740, his ability as a coucher had earned him honors, among which was an appointment as a corresponding member of the Royal Academy in Paris. In 1746, at the age of 53, Daviel was selected surgeon-oculist to King Louis XV, prompting him to move to Paris. Although his reputation and success were largely based on his skill in couching cataracts, at about that time he declared, in a letter to a friend, that despite his success, he was far from satisfied with the cataract surgery of that day [12].

### **Daviel Describes and Promotes Extraction of Cataracts**

Daviel was well acquainted with the earlier publications of Brisseau, Maitre Jan, St. Yves and Petit, relevant to cataract extraction, and also knew of Méry’s unsuccessful attempt to gain the endorsement of the Paris Academy of Sciences for the operation. Yet, it was not until almost 40 years after these earlier events had transpired, that Daviel, on the basis of his own similar first-hand observations, gradually changed his orientation from couching to extraction of cataracts. Critical in bringing him to make this change were two complicated couching procedures.

In 1745, just prior to moving to Paris, Daviel performed a couching procedure on Brother Felix, a hermit in Eguilles in Provence. He engaged the lens on a sharp needle and the lens broke into fragments, several of which passed into the anterior chamber which then filled with blood. Using a semi-curved needle and a small scissor, he opened the cornea and removed the lens fragments, following the procedure Petit had described in 1708. Although Brother Felix could immediately distinguish objects presented

to him, the eye soon became infected and was lost [5] (p. 339).

Daviel responded to this disaster by designing a blunt instrument—rather than the usual sharp needles—with which he continued to depress cataracts. Of greater importance was his stated resolve to bring a new “great idea” for cataract surgery he was developing to a “certainty by continuing to work daily on the eyes of cadavers” [12].

The second, but more crucial, case that brought Daviel’s cataract extraction technique into existence occurred 2 years later, on April 8, 1747. The patient was M. Garion, a wig maker, and the operation was clearly described by Daviel himself: “I begin with the left eye whose cataract seemed more mature and yet I was not able to depress it. The pupil appeared cloudy after the operation and the patient saw absolutely nothing. I then proceeded to the right eye and had just as much trouble. Having failed in every maneuver to push down the cataract in this eye, I decided to open up the cornea, as I had done with the hermit. I widened the aperture, then I raised the cornea with small forceps, inserted my small spatula through the pupil and extracted from the posterior chamber of the eye the whole lens, divided and broken into several pieces during my initial procedure. After this extraction, a part of the vitreous humor oozed out: it had been disrupted by the first operation but, despite this inconvenience, the patient discerned objects well. The operation had no harmful sequelae and, after some time, the patient was cured” [5] (p. 343). Daviel concluded “I decided henceforth to operate for cataract exclusively by the extraction of the crystalline lens” [5] (p. 343).

One may wonder why Daviel resolved to replace couching with “planned” extracapsular extraction, largely on the basis of these two complicated couching procedures. Could he not have reserved extraction for instances where the cataract was displaced into the anterior chamber, as had occurred with the hermit and the wig maker? Certainly, in the absence of anesthesia, couching was quicker and less painful. Moreover, with its small corneal opening—in the absence of asepsis—couching probably carried less risk of infection. As performed in eighteenth century France,

it appears the final visual results from the two procedures were not much different, even for Daviel. Consequently, one might suspect that Daviel was influenced by the novelty and difficulty of extracting, and accepted the challenges extraction offered for him to display his great surgical virtuosity and lay claim to extraction's invention.

Shortly thereafter, Daviel carried out his first "planned" cataract extraction (Fig. 7). The patient was a woman on whom he deliberately opened the cornea and removed the cataractous lens from its normal position behind the iris. The operation went well, and "in 15 days, the patient had recovered."

In his work on both living patients and on cadavers, Daviel continued to refine his techniques and design new instruments specifically to carry out the surgical maneuvers he required (Fig. 8). By 1752, he had operated by extraction on 206 eyes with cataracts and reported good results in 182 cases—an impressive 88% success rate. This is all the more remarkable when it is considered that the surgery was done without

asepsis or anesthesia in patients bound to a chair and restrained by Daviel's assistants.

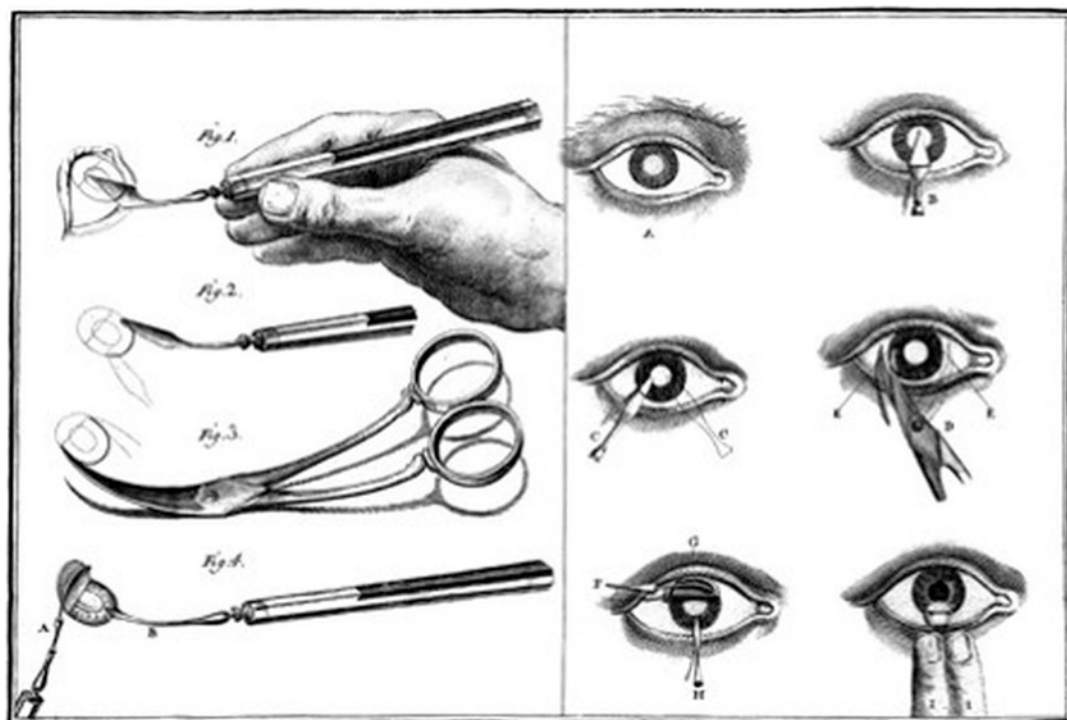
Daviel was now prepared to present his new method to the Royal Academy of Surgery, a more pragmatic body than the Academy of Science, and this occurred in 1752. The Academy, as Daviel expected, carried out a thorough process of peer review, examining relevant documents, identifying patients and having local surgeons review and attest to their results. Then, the following year, three outstanding surgeons undertook Daviel's operation on 19 elderly soldiers with cataracts selected at the Hotel Royal des Invalides, the veterans' hospital in Paris. Of the 38 eyes operated on, 14 eyes had "good vision", 10 retained their previous vision, and 14 had reduced vision. While these results did not match Daviel's, they were apparently superior to what was expected with couching, and Daviel's paper was published in the Academy's proceedings [5].

Alvin A. Hubbell translated and summarized Daviel's description of his procedure as presented in Daviel's landmark 1752 paper as follows: "The operation which he [Daviel] had invented and



**Fig. 7** Daviel performing cataract extraction. Taken from: [http://www.daviddarling.info/encyclopedia/S/science\\_in\\_the\\_eighteenth\\_century.html](http://www.daviddarling.info/encyclopedia/S/science_in_the_eighteenth_century.html)





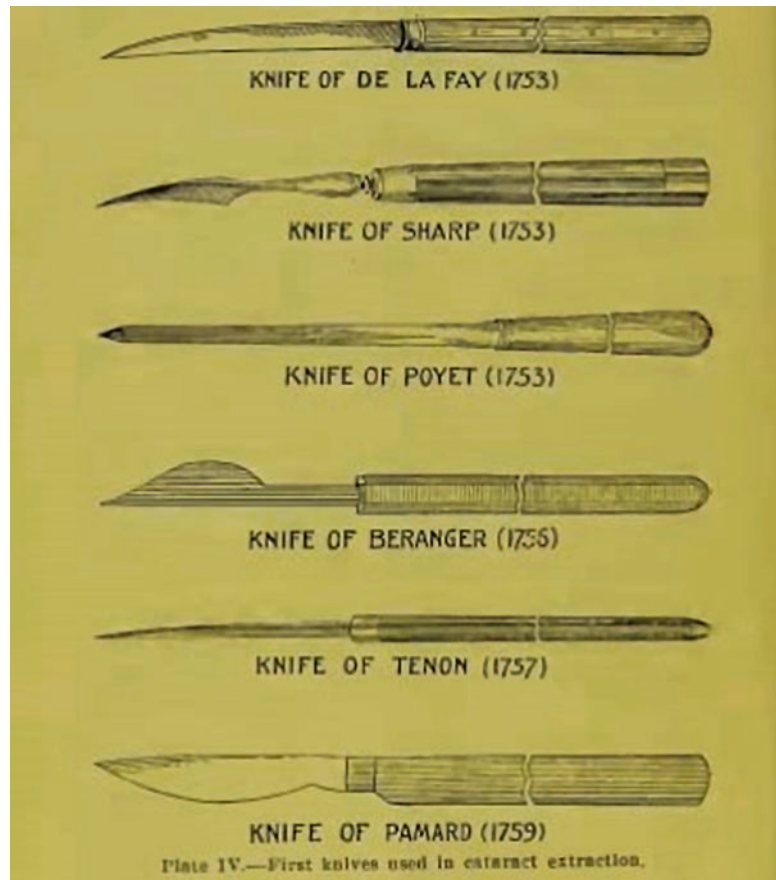
**Fig. 8** Daviel's cataract extraction technique using the instruments he designed. Taken from: Albert DM, Edwards DD, eds. *History of Ophthalmology* Cambridge, Mass., Blackwell Science, 1996

now made public consisted in incising the lower part of the cornea exactly at its junction with the sclera. He first made an opening into the anterior chamber at the extreme lower margin of the cornea with a myrtiform or triangular shaped knife, and then, after withdrawing this, he enlarged the incision on both sides with a narrow, blunt pointed, double-edged knife, as far as he easily could and finally when the cornea became too much relaxed to continue the incision he completed it to the extent desired with delicate scissors which were so curved on the flat and edge as to correspond to the curve of the corneo-scleral line. These, of course, were made right and left, and the blade to be introduced into the anterior chamber was blunt pointed. According to his memoir the incision was of equal extent on both sides of the cornea, and was carried to a point on each side 'a little above the pupil'. Having completed the incision he gently lifted up the corneal flap with a small spatula and incised the anterior capsule of the lens with the sharp-edged needle.

After doing this, he carried the spatula between the lens and the iris, 'so as to entirely loosen the cataract and facilitate its tissue.' After the cataract was delivered, the corneal flap was then allowed to fall into place. If the cataract happened to be soft and "glairy" or broken into pieces, the remnants were removed with a curette. The pupil might sometimes be disarranged by the passage of the lens, especially if it was large and hard, and it should then be readjusted. The corneal flap being accurately replaced, the eye was gently cleansed and covered with a small compress, over which plasters were applied and the whole was kept in place by a bandage without much pressure" [15]. Daviel's procedure was basically intended to be extracapsular. The French surgeon Georges De La Faye (1699–1781), in 1752, was the first to advocate intracapsular cataract extraction.

By 1756, Daviel's series had increased to 434 cataract procedures, of which 384 were "perfectly successful."

**Fig. 9** The Cataract Knives introduced by Jacques Daviel's rivals. Taken from: Hubbell AA. Jacques Daviel and the Beginnings of the Modern Operation of Extraction of Xataract. JAMA. 1902; XXXIX(4):177–185



Although, as the proverb states, necessity may have been the mother of invention, in the case of cataract extraction, the claimants to its paternity were many: Jean Baptiste Thurant, John Taylor, Georges de La Faye, Samuel Sharp, and others vied for credit, either personally or by proxy. However, Daviel's priority and the validity of his good results were clearly accepted by his peers.

In his later years, Daviel became increasingly intrigued by how congenitally blind persons perceived objects. He corresponded with the physiologist Albrecht von Haller regarding the subject. His findings were based on 22 cases of congenital cataract he had operated on.

Daviel staunchly defended his method of extracting cataract, and surgeons in Europe and England divided into those who preferred couch-

ing and those adapting extraction. This dispute continued until the end of the nineteenth century and was often termed the "hundred years war", by medical historians (Fig. 9).

Daviel eventually became a national hero. Louis XV took Daviel on a hunt and requested that he demonstrate his method of surgery on a slain stag. He became an internationally recognized figure and was the recipient of many additional honors, including membership in the Royal Society of London (1756) and the Royal Society of Sweden. The King created a Chair of Ophthalmology in Paris near the end of Daviel's life, unfortunately too late for Daviel to fill. In 1857, Daviel's son, Jacques Henri, training as a surgeon in Paris, published his medical thesis describing and explaining the superiority of his father's method.

**Fig. 10** Daviel's Tombstone. Taken from: <http://www.snof.org/encyclopedie/un-oculiste-aussi%C3%A8cle-des-lumi%C3%A8res-jacques-daviel> Graveyard of the parish St Hippolyte, in Grand Saconnex



Daviel's speech became impaired in 1762 and his health rapidly declined, apparently as a result of cancer of the larynx. His final paper on cataract extraction was read by a friend before the Royal Academy of Surgeons in April, 1762. Jacques Daviel died on September 30 of that year (Fig. 10).

## Conclusion

Jacques Daviel had the good fortune to come into prominence as surgeon at a time when the introduction of cataract extraction was ready to be added to the eye surgeon's armamentarium.

Although the idea was not original with Daviel, it required an innovative, highly skilled and prestigious surgeon to successfully convince a critical portion of the surgical world that this was an improvement on the centuries-old method of couching. Its importance in the restoration of vision, and its eventual safety as compared to couching, marked a profound advance in eye surgery. Although simple in concept, it is an operative procedure that requires considerable skill, which was possessed neither by the itinerant and irregularly trained oculist nor the regularly trained surgeons of the eighteenth century. To assure proper training, the Empress Maria Theresa established a Chair of Ophthalmology in





**Fig. 11** Georg Joseph Beer of Vienna, founder of the first European program training eye surgeons. Taken from: [https://en.wikipedia.org/wiki/Georg\\_Joseph\\_Beer](https://en.wikipedia.org/wiki/Georg_Joseph_Beer)

Vienna, filled by Joseph Beer (Fig. 11), and most major centers in Europe soon followed suit. This is thought by many to mark the start of “modern ophthalmology” on the Continent.

Daviel’s extraction of cataract continued to evolve after his death. Graefe’s linear incision did not gape as Daviel’s semi-circular incision tended to do, and the addition of iridectomy added to the operation’s safety. With the advent of Carl Koller’s cocaine anesthesia, Lister’s asepsis, and Henry Williard William’s corneal suture, extraction became accepted as the cataract operation of choice by the end of the nineteenth century. In more recent years, microscopic surgery, phacoemulsification, small sutureless incisions, and intraocular lenses have been important refinements. Perhaps, in this century, the next “Daviel” will be a visual scientist employing the technology of molecular biology to discover a non-surgical means to prevent or even reverse cataract formation.

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