Milestones in Oculofacial Plastic and Reconstructive Surgery: The Discovery of the \textit{Levator Palpebrae Superioris} and Its Subsequent History

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\textbf{Purpose:} This review aims to substantiate attributions of priority for the discovery and first description of the \textit{levator palpebrae superioris} (LPS) muscle to Matteo Realdo Colombo (Columbus) (1516–1559), and to describe the history of this muscle from ancient to modern times.

\textbf{Methods:} Relevant chapters on eyelid and eye muscles in Colombo’s \textit{De re anatomica} (1559) were translated, and the work was further analyzed from a historical perspective. Literature on the anatomy of human eyelid and orbital striated muscles was reviewed from the publication of the \textit{Fabrica} (1543) by Andreas Vesalius (1514–1564) through modern times. The discovery of the LPS was viewed in relation to other milestones along the road that led to the establishment of the subspecialty of oculofacial and orbital plastic surgery.

\textbf{Results:} The first description of the LPS appeared in \textit{De re anatomica} (1559) by Colombo who correctly identified the LPS as a retractor of the (upper) eyelid and the orbicularis oculi as its protractor. The current lack of recognition of the priority of Colombo’s description of the LPS stemmed from his lifelong rivalries with other anatomists, improved descriptions of the orbital muscles by Gabriele Falloppio (1523–1562) that soon followed, and historical controversies over other anatomical discoveries.

\textbf{Conclusions:} Colombo discovered the LPS and described the antagonistic functions of retractors and protractors of the eyelid, just a portion of his broader contributions to anatomy. Colombo’s discoveries of such ophthalmologic and oculofacial plastic surgical importance should be added to the ongoing reappraisals of Colombo by medical historians.

\textit{(Ophthalmic Plast Reconstr Surg} 2021;37:312–319)
attainments very different estimates have been formed.”15 The first line comes Realdus Columbus (1516–1559), of whose influence, “a very junior and poorly paid position,” 25 which was then emphasized at the university under Marcantonio de’ Passeri [Genoa] (1491–1563). Colombo’s transition to being a student of medicine served as an appropriate entrée to a future academic career. He remained a philosopher although deemphasizing abstract and spiritual Platonic notions in favor of more empirical Aristotelian and Alexandrian methods. As a student of medicine and anatomy, he was a classmate of the anti-Aristotelian philosopher, Bernardino Telesio (1509–1588),26 and of the English scholar and Galenist, John Caius (1510–1573), the second founder of Gonville and Caius College of Cambridge with whom he competed for students. 27,28 Caius had a falling out with Vesalius over disputes about Galen’s methodology and mundane philological issues.

Colombo’s friendship with Vesalius, like that of Caius, would likewise turn sour. Before Colombo suffered the same fate, he had been a favorite of Vesalius, chosen as the assistant for public dissections in 1541. Harvey Cushing (1869–1939) identified Colombo in the foreground of the famous frontispiece of the Fabrica—the bearded man standing prominently in the foreground of the frontispiece to the right of the dissecting table, staring at the dog stepping on his foot and raising his index finger as if to give a warning.29 O’Malley suggested this individual represents Marcantonio de’ Passeri [Genua] mentioned above.30 The individual appears to be balding though not

and Vesalius that endured beyond their lifetimes. In the shadow of the heroic figure of Vesalius, and poisoned by mutual animus, the trail to Colombo’s ophthalmologic discoveries became obscured. Negative characterizations crept into the narrative as did the unfounded charge of Colombo’s “plagiarism” for his independent discovery of the pulmonary circulation. Charles Singer (1876–1960) erroneously suggested that Colombo’s omission of illustrations from De re anatomica was in “opposition” to Vesalius’ emphasis upon them.14 Elsewhere, in a review of the “Vesalian” school of Renaissance anatomy, he noted, “In the first line comes Realus Columbus (1516–1559), of whose attainments very different estimates have been formed.”15

A recent reappraisal of Colombo places him in an enlightened role as a key figure in the “revival of Alexandrian anatomy.”31 (Supplemental Digital Content 3, available at http://links.lww.com/IOP/A275: Colombo—The true heir of Alexandrian vivisection?) Others besmirch his reputation with accusations of animal cruelty,17 hedonism,18 or misogyny.19 Still others have romanticized his life in tales of fiction that range from the truth.20 A review Colombo’s life, contributions, and his intersections with contemporaries are important points from which to begin clarifying how these different estimates were formed.

**COLOMBO AND HIS CONTEMPORARIES:**

Matteo Realdo Colombo, the son of an apothecary, Antonio Colombo, was born in Cremona around 1516. The cited dates for his birth range between 1510 and 1520 but, by inference from the dates of his career milestones, his birth year must be near the midpoint of that interval.21 Around 1529–1533, Colombo went to study liberal arts in Milan. After Realdo had finished these studies, his father took a position as druggist to the Venetian surgeon, Giovanni Antonio Lonigo. Realdo joined his father in Venice and, from around 1533 to 1540, Colombo served as this surgeon’s apprentice and likely observed postmortem examinations when Venice became the center of an epidemic of influenza (“malignant pleurisy”) in 1535. Reverberating echoes of that particular winter in Venice have a tragically familiar ring to a world afflicted by the current coronavirus (COVID-19) global pandemic, as those afflicted with that strain of influenza were prone to die within three to six days.22 Lonigo and the physician Francesco Frigimelica (1491–1559) who together examined at least two bodies postmortem, learned that “inflammation of the substance of the lungs may be combined with pleurisy.”23 In 1536, Lonigo served as the public dissector in Padua for Paolo Colombo (probably Realdo Colombo’s uncle) who was the chair of surgery that year, the immediate predecessor of Vesalius (chair in 1537–1543).24 Years later, in the introduction to De re anatomica, Colombo affectionately recalled his apprenticeship to “Ioanni Antonio PLATO, known as Lonigo,” the capitalized sobriquet alluding to the surgeon’s frequent reference to Plato in his lectures. The lectures undoubtedly included Plato’s teleological descriptions of the human body in service to the soul, divided into three natural regions: the head, housing the immortal soul; the upper thorax as the seat of the mortal soul; and the lower (subdiaphragmatic) body, as a “manger” for the animalistic or lowest soul.

In 1540, Colombo left Venice and his apprenticeship with Lonigo and went to Padua. He served as a lecturer in Aristotelian philosophy, “a very junior and poorly paid position,”25 which was then emphasized at the university under Marcantonio de’ Passeri [Genoa] (1491–1563). Colombo’s transition to being a student of medicine served as an appropriate entrée to a future academic career. He remained a philosopher although deemphasizing abstract and spiritual Platonic notions in favor of more empirical Aristotelian and Alexandrian methods. As a student of medicine and anatomy, he was a classmate of the anti-Aristotelian philosopher, Bernardino Telesio (1509–1588), and of the English scholar and Galenist, John Caius (1510–1573), the second founder of Gonville and Caius College of Cambridge with whom he competed for students.27,28 Caius had a falling out with Vesalius over disputes about Galen’s methodology and mundane philological issues.

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![Image](https://example.com/image.png)
yet completely bald. The antique garb evokes Aristotle or an heir to his philosophy and methods.

Before the falling out between Vesalius and Colombo, the Senate of Venice intervened to deny Colombo’s university appointment to its second chair of surgery, probably upon an appeal by Vesalius. This was the chair that Vesalius simultaneously held along with the first, with pecuniary benefits from both positions.31 Perhaps Colombo was not so sad to see his teacher leave Padua in 1542, to publish the Fabrica in Basel, and to seek a position in the court of Emperor Charles V (1500–1558). At that time, Colombo dutifully assumed Vesalius’ teaching duties lecturing and dissecting in public. Before his departure to England in the summer of 1543, John Caius was among those who watched Colombo’s dissections.2 Later in 1543, Colombo received a formal but temporary appointment as a chair of anatomy and a permanent appointment to one of the two chairs of surgery.

Colombo’s second teaching appointment was at the newly reopened Studio of Pisa (1545–1547), resulting in a loftier salary and the prestige of the patronage of the Duke of Tuscany, Cosimo I de’ Medici (1519–1574). Vesalius had performed a public dissection in Pisa at its reopening in 1543 but, according to Colombo’s student, Juan Valverde de Hamusco (1525–1587), Colombo likewise visited Pisa to perform dissections in 1544, the second academic year of the studio. While Vesalius may have been Cosimo’s first choice for the position of chair of anatomy and surgery, Colombo was a highly desirable second choice. He was given the authority to use the text of his own choosing.32 Perhaps, he used the Fabrica to point out its errors. Upon permanently departing Pisa, he was replaced by Gabriele Falloppio.

The third and last of Colombo’s teaching appointments was his longest, over a decade at the Studio della Sapienza in Rome (1548–1559). This was the papal university reestablished by Leo X (1475–1519), the pope who had issued the Papal Bull of 1520 condemning Martin Luther (1483–1546). Colombo’s supply of cadavers to Michelangelo was part of a quid pro quo, having received a promise from Michelangelo to supply illustrations for his book. It was a promise that was not fulfilled.34 (Supplemental Digital Content 5, available at http://links.lww.com/IOP/A264: The relationship between Colombo and Michelangelo.)

Another issue of concern to Colombo was censorship by the Church that had adopted Galen’s writings as an official canon and scrutinized anti-Galenist writings with suspicion.35 Before Colombo, former Galenists turned anti-Galenists, had fallen into disfavor with the Catholic Church and the Reformed (“Calvinist”) Church, respectively, for reasons that likely extended beyond issues of anatomy: Vesalius by virtue of his service to Emperor Charles V whose troops had sacked Rome in 1527; Miguel de Villanueva [Michael Servetus] (1511–1553) by virtue of his anti-Trinitarian heresies and opposition to the Reformed Church of John Calvin (1509–1564). In Paris, though not simultaneously, Vesalius and Servetus had each assisted and learned dissection from their Galenist professor, Johann Winter [Guintier] (1505–1574).

Years after Colombo’s death, and even years after the death of William Harvey (1578–1657), Colombo became linked with a previous description of the pulmonary circulation in Servetus’ Christianismi restitutio (1553), a mainly theological work published six years before De re anatomica. This “linkage” was made (most now believe erroneously) by medical historians and biobibliographers in the nineteenth and twentieth centuries, based upon similarity of concepts between Servetus’ and Colombo’s respective works, and which were developed independently from the earlier, Medieval work of Ibn...
an-Nafis (1213–1288). As stated in the introduction, such accu-
soratory linkages may be repeated from one generation of histori-
ans to the next. Rather, conditions and the spirit of discovery in
Renaissance Europe were ripe for the independent discovery of
the pulmonary circulation and ultimately the general circulation
as well; its further elaboration by Colombo’s student, Andrea
Cesalpino (1519–1603) in *Questionum Peripateticarum*
(1571); and its elaboration and embrace by the scientific com-
unity with Harvey’s famous monograph, *De motu cordis*
(1628). (Supplemental Digital Content 6, available at [http://
links.lww.com/IOP/A265](http://links.lww.com/IOP/A265): The pulmonary circulation: Ibn an-
Nafis, Servetus, Colombo, Cesalpino, and Harvey.)

Like Harvey many years later, Colombo was concerned
about his reputation and legacy as a “discoverer” but also the
reaction of an entrenched Academia. Colombo was particularly
concerned with carefully planning an anti-Galenist work from
the heart of the Counter-Reformation. Galenists were still thriving
in Rome and in universities throughout Europe. The activities of
several Galenist contemporaries of Colombo who are especially
relevant from a biobibliographical standpoint include the follow-
ing: John Caius; Charles Estienne; Jacques Dubois [Sylvius]; Jean
Fernel; and Bartolomeo Eustachi [Eustachius]. (Supplemental
Digital Content 7, available at [http://links.lww.com/IOP/A266:
Galenist and non-Galenist contemporaries of Colombo].)

In May 1555, a new pope—a new patron for the Sapienza
and for Colombo—had ascended to the Throne of Saint Peter.
Pope Paul IV (1476–1559) was scholastically minded, a champion
of the Church.”37 In actuality, Colombo’s sons were confronted with
a separation of the subject matter from the main chapters on normal anatomy. Moes and O’Malley
stated, “Colombo recognized the desirability of subdividing the
field of anatomy which had grown immensely in a very few years” but also suggested that inclusion of the final Book 15
may have been a posthumous “afterthought” of his sons.18

Before his own death, Vesalius weighed in on the (now de-
cese) Colombo’s description of the LPS. After personally re-
cieving confirmation of Colombo’s discovery of the LPS from
Falloppio in 1561, Vesalius responded with a friendly letter that
was never delivered as Falloppio also died while the letter was en
route with an aristocratic courier. In this epistle, Vesalius admit-
ted that the LPS had been discovered in Rome by his rival though
he did not credit Colombo by name. It reveals Vesalius’ previous
doubts about the retractor-function of the orbicularis oculi and
his unclear postulations about other orbital structures that might
instead have this action. Written “from the royal court in Madrid,
17 December 1561,” the epistle was sent to a publisher in Venice
after failing to reach Falloppio before his death. The *Examen*
(1564) came after publication soon after Vesalius, returning from
a Jerusalem pilgrimage, had perished on the island of Zante.38
(Supplemental Digital Content 8, available at [http://links.lww.
com/IOP/A267: Vesalius’ tacit acknowledgment of Colombo’s
discovery.])

**DE RE ANATOMICA LIBRI XV**

On June 1, 1559, Colombo signed a prefatory dedication of
*De re anatomica* to Pope Paul IV. However, both Colombo
and the pope would die that summer while the book was still
being printed in Venice—Colombo in late June and the pope
in mid-August—and so the task of preparing a new dedication
fell to his sons, Lazarro and Febo [Lazarus and Phoebus]
who appear to have resided in Rome.39

The flourishing book trade of Renaissance Italy was par-
icularly centered at that time in Venice where Colombo’s book
would be published by Nicolò Bevilacqua (active 1554–1573).
A second printer, Vincenzo Valgrisi (active 1540–1572), par-
ticipated at some point as his colophon (printer’s mark) appears
on the last printed page of the work.40 Colombo’s third son,
Epiphanio (d. 1564) who appears to have resided in Padua, may
have helped facilitate the printing in Venice. Alone or with his
brothers in Rome, perhaps Epiphanio Colombo served as a li-
aison for the production of the frontispiece or, after his father’s
death, had a hand in securing privileges for subsequent editions
that were published elsewhere in Europe. (Supplemental Digital
Content 9, available at [http://links.lww.com/IOP/A268:
The frontispiece of *De re anatomica*].)

In 1897, James Moores Ball of St. Louis noted that a col-
league in Sing Sing, New York owned the first issue printed with
Colombo’s own dedication to Paul IV and stated, “... in another
exemplar, similar to my own, the dedication has been written by
the two sons of Columbus and is addressed to ‘Pio IIII., Pont. Max.’ this
postfitt, on the death of Paul IV, on August 18, 1559, became head
of the Church.”41 In actuality, Colombo’s sons were confronted with
the longest hiatus between papacies in the sixteenth century, the
papal conclave lasted from September 5 until December 25, 1559
when Pius IV finally ascended to the papal throne.

Before his death, Colombo had arranged for the pro-
duction of an elegant frontispiece, having it designed and ex-
cuted with great care and probably at great expense (Fig. 2).
The organization of *De re anatomica libri v* is outlined in
Table 1. As cited elsewhere in this essay, portions of the work
have been previously translated into English. A new translation
of Chapter 8 of Book 5 follows; a link to a translation of Chapter
9v is also provided. (Supplemental Digital Content 10, available

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ON THE MUSCLES OF THE EYELIDS. CH. VIII.

(English translation excerpted from De re anatomica)

“I have no doubt that our investigation concerning the muscles of the eyelids is going to delight all, because the treatments conducted by others do not much agree with the truth of the matter itself. I, on the other hand, to the extent that I was able, took pains so that they might be described as truthfully as possible. The muscles of the eyelids, therefore, are six in number, three, obviously, on each side. Of these, two are situated outside the eye-sockets, while the rest are situated inside, right next to the muscles of the eyes, and on account of this, all anatomists who wrote before me have been deceived to reckon that these serve not the eyelid, but the eye. The orbicularis, therefore, having fibers that are also circular, are first born in the canthus,
in a suture common to the head and the upper maxilla, with a sharp beginning; and they get broader upwards, towards the forehead, in which place they get fused together with the muscles of the forehead. After that, going toward the ear, the closer they approach the lesser canthus, the broader they get, and they turn about downward around the socket, so that they end up with a sharp end right next to their beginning. They have been made to close the eyelids, and contract them forcefully, and in order to protect the eyes from external harm. These Vesalius divided up in four; however, at that part where he drew back the flesh, they are fleshier than in the rest of their tract. Second will be two muscles straight, broad, fleshy in the upper region of the eyes, having arisen in the interior of the socket from the visual nerve, like the rest of the eye muscles. These muscles end up with a rather broad end in the topmost part of the eyelid. They have been made to draw the eyelid upward, and open the eye. The third group of muscles is of a slender shape, and slim, born with a rather broad end in the topmost part of the eyelid. They have been made to draw the eyelid upward, and open the eye. However, they have been created above all for this function, that is, to draw the eyelid, and open the eyes; which function, and position, because it is the same in animals too, I cannot fail to wonder how Galen, Vesalius, and the rest of the Anatomists have numbered these four muscles which serve the eyelids among the muscles of the eyes, deceived, perhaps, by the fact that they are situated inside the socket of these."

THE LPS FROM COLUMBUS TO MODERN TIMES

Early written descriptions of the LPS were summarized in 1734 by Bernhard Siegfried Albinus (1697–1770) in his book entitled, Historia Musculorum Hominis.43 Albinus’ chronological list of descriptions of the LPS begins with those of Colombo, Falloppio, and Vesalius. The next anatomist, Giulio Cesare Aranzi [Arantius] (1530–1589) was a student of Falloppio at the University of Padua who first correctly described the origin of the LPS arising from the sphenoid lesser wing (1579).44 The next two authors in Albinus’ list—Girolamo Fabrizi [Fabricius] (1553–1619) (in 1600) and Giulio Cesare Casseri [Cassierius] (1552–1616) (in 1609) included illustrations of the LPS. (Supplemental Digital Content 11, available at http://links.lww.com/IOP/A270: A history of illustrations of the LPS.) Albinus’ list continues with the unillustrated texts of Adrian van der Spiegel [Spieghelius] (1578–1625) and Jean Riolin the Younger (1577–1657),45,46 and then the names and publications of Molinetti, Cowper, Douglas, and Winslow. (Supplemental Digital Content 12, available at http://links.lww.com/IOP/A271: Early modern history of the LPS in the British Isles and France.) These authors appear in Table 2 in which the following (likely incomplete) list of additional authors, book titles, and LPS appellations have been added: Albinus (who coined the term, levator palpebrae superioris); Duverney; Wistar; Dalrymple; Whitnall; and Beard and Quickert.

Albinus’ name for the LPS fit nicely into his larger schema of several “levatores” that are listed as follows: tympanorum; angulorum oris; ani; breviore costarum, 1°–12°; labii superioris; labii superioris alaeque nasi; loniores costarum aliquot inferiorior; menti; palati mollis; palpebrae superioris [bold emphasis added]; and scapularum. To Albinus’ lasting

Table 2. Descriptions of the musculus levator palpebrae superioris

| Author            | Title                                      | Year | Appellation/nomenclature [m. …] |
|-------------------|--------------------------------------------|------|---------------------------------|
| Colombo           | De re anatomica                            | 1559 | Palpebrarum secundus, oculum aperiens |
| Falloppio         | Observationes anatomicae                   | 1561 | Pervus et tenuis etc. palpebrum attolens |
| Vesalius          | Observationum examen                      | 1564 | Quendium compertum cui palpebrum attolendi |
| Aranzi            | Observationes anatomicae                   | 1579 | Qui superiori palpebrae aperiendi destinatus |
| Fabrizi           | De visione sive de oculo                   | 1600 | Rectus palpebra musculus seorsim postis |
| Casseri           | Pentaesthesiae                             | 1609 | Palpebrarum superioris primus |
| Riolin II         | Anthropography                             | 1626 | Superiorem palpebrum attolens |
| Spiegel           | De humani corporis fabrica                 | 1631 | Palpebrum attollere & sic oculum aperire |
| Molins            | MYEKOTOMIA                                 | 1648 | Elevator palpebrae/aperiens palpebrum rectus |
| Molinetti         | Diss. anatomico-patholog.                 | 1675 | Pyramidalis |
| Cowper            | Myotomia reformata                        | 1694 | Aperiens palpebrum rectus |
| Browne            | Myographia Nova                            | 1697 | Elevator palpebrum/aperiens palpebrum rectus |
| Douglas           | Myographiae comparatae specimen           | 1707 | Aperiens palpebrum rectus |
| Winslow           | Exposition anatomique                     | 1732 | Le releveur propre de la paupière supérieure |
| Albinus           | Historia musculorum                       | 1734 | Levator palpebrae superioris |
| Duverney          | Anatomie de la tête                       | 1745 | Le releveur propre de la paupière supérieure |
| Wistar            | A System of Anatomy                       | 1811 | Levator palpebrae superioris |
| Dalrymple         | Anatomy of the Human Eye                   | 1834 | Levator palpebrae superioris |
| Whitnall          | Anatomy of the Human Orbit                | 1921 | Levator palpebrae superioris |
| Beard and Quickert| Anatomy of the Orbit                      | 1969 | Levator palpebrae superioris |
credit, the term, *levator palpebrae superioris* was adopted by the *Nomina Anatomica* in 1955 and its successor, the *Terminologia Anatomica* in 1998.

In conclusion, biobiographical methods have been used to establish Realdo Colombo as the individual who first described the LPS, to make the case that he was its discoverer, and to clarify various distortions in historical accounts that developed over time. This reappraisal of Colombo and his *De re anatomica* will hopefully guide the future inclusion of the discoverer and his work in catalogues of antiquarian collections and biobiographical sourcebooks and, most importantly, in recording his discovery among the milestones and histories of ophthalmology and oculofacial plastic surgery. (Supplemental Digital Content 13, available at [http://links.lww.com/IOP/A272](http://links.lww.com/IOP/A272): Anatomy of the LPS among milestones of oculofacial plastic surgery.)

**ACKNOWLEDGMENT**

The author gratefully acknowledges translations of Ancient Greek and Renaissance Latin texts by Theopholis Kyriakidis, MA, Classics Department, University of Texas, Austin, TX; the review of a draft of the manuscript by Russell Gommering, MD, MMM, FACS, CPHQ, Elm Grove, WI, research assistance by Robert Fleck III, Oak Knoll Books, New Castle, DE and Jörn Koblitz, Milestones of Science Books, Ritterhude, Germany, and Caralee Witteveen-Lane, Mercy Health St. Mary’s Library, Grand Rapids, MI.

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