

# Sixteenth-century venetian anatomy: the auditory organ.

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The Danish physician Hans Wilhelm Meyer (1894-1895)<sup>1</sup> identified the 16th century as the point of origin of an otology no longer dependent on the purely speculative dimension and based on eminently magical, mystical, or philosophical concepts.

The main obstacle was the complicated structure of the ear and, above all, its location, which was so difficult to access<sup>2</sup>.

The available anatomical preparation technique, which had made it possible to study the structure and functioning of other systems in detail, did not allow an equivalent acceleration of knowledge when applied to the hearing system.

The turning point was when the Republic of Venice granted the freedom to conduct new anatomical research.

Traditionally, Andreas van Wesel is identified as the reference figure (Andreas Vesalius 1514-1564)<sup>3</sup>.

The international scope<sup>4</sup> of his ergobiography intersects closely with that of the cities of Venice and Padua.

In fact, we should not forget that cadaveric sections were carried out, with similar formative and official value, in both cities.<sup>5</sup>

The Venetian element, which interested and enriched Vesalius' work, can be found on the title page of the 1604<sup>6</sup> edition of *De humanicorporisfabrica libri septem*, whose *editio princeps* was printed in Basel in 1543<sup>7</sup>.

<sup>1</sup> Meyer is credited, among other things, with the modern description of the hypertrophy of the pharyngeal tonsil and the development of specific instruments for its surgical treatment. See: Ruben R. J., The Adenoid: Its History and a Cautionary Tale, *The Laryngoscope*, 127, 2017, pp. S13-S28. He was also an esteemed historian of the discipline. Originally from Fredericia, during a trip to Italy for health reasons, he died in Venice on 3 June 1895, probably of typhus. He is buried in the Protestant section of the Venetian cemetery of San Michele.

<sup>2</sup> Reich W., Cenni storici sull'anatomia e la fisiologia dell'orecchio, *Rivista CIBA*, 2, 1948, (13), pp. 417-432.

<sup>3</sup> The literature on Vesalius is endless and cannot be summarised. See, among recent contributions: Zampieri F. (Ed.), *Andreas Vesalius 500 years later. Proceedings of the 2nd International Meeting on Medicine and Pathology, working group history of pathology of European Society of Pathology. Padua 2015*, Padova, CLEUP, 2019.

<sup>4</sup> Premuda L., Metodo e conoscenza da Ippocrate ai nostri giorni. Introduzione alla medicina moderna, Padova, CEDAM, 1971, p. 194.

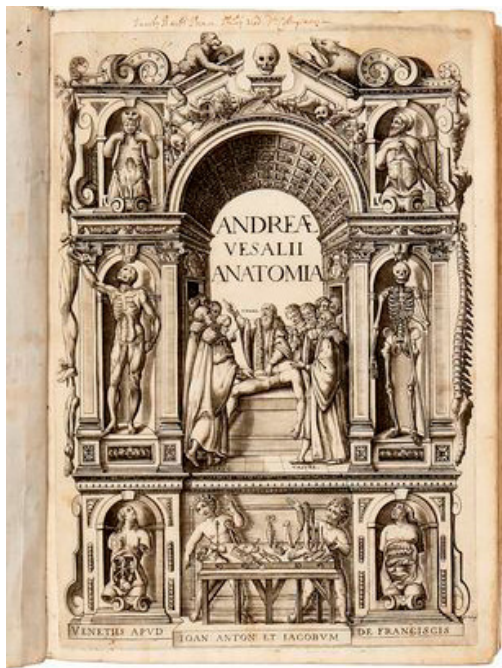
<sup>5</sup> Franco E. E., La tradizione anatomica veneziana e l'insegnamento dell'anatomia chirurgica nella Scuola Minich. Introductory lecture to the Course of Surgical Anatomy of the Minich School read in the Civil Hospital of Venice on 23 January 1925, *Rivista di Storia delle Scienze Mediche e Naturali*, 16, 1925, (3-4), pp. 49-63.

<sup>6</sup> [van Wesel A.], *Andrae Vesalii Anatomia: Addita nunc postremo etiam Antiquorum Anatome, Venetiis, apud Ioan. Anton. et Iacobum De Franciscis*, 1604. Two copies of the work are kept in the Library of the History of Medicine at the Scuola Grande di San Marco in Venice; other copies are kept in the Biblioteca Nazionale Marciana and the Biblioteca della Fondazione Querini Stampalia in Venice; another two copies are kept in the Biblioteca Universitaria and the Biblioteca Vincenzo Pinali. Sezione Antica, University of Padua.

<sup>7</sup> [van Wesel A.], *Andrae Vesalii Bruxellensis, schola medicorum Patauinae professoris, De humanicorporisfabrica libri septem, Basileae, ex officina Ioannis Oporini*, 1543. Two copies of the work are kept in the Biblioteca Nazionale Marciana and the University Historical Fund of the Ca' Foscari University of Venice; one copy is kept in the University Library and two more copies are kept in the Vincenzo Pinali Library. Ancient Section, University of Padua. The copy in the Biblioteca Nazionale Marciana in Venice belonged to Tommaso Giannotti Rangone (1493-1577), who held managerial positions in the Scuola Grande di San Marco in Venice; the volume was publicly displayed during

In an architectural setting that recalls the parallelism between the house that welcomes us and the body that is at the same time our home<sup>8</sup>, Vesalius is portrayed in the act of performing a cadaveric section in the presence of the Venetian surgeon Giovanni Andrea Dalla Croce (or Della Croce 1515-1575)<sup>9</sup>. This also outlines a relationship with the surgical field, at a time when the training of surgeons was clearly divided from that of doctors, also in terms of rank.

This image of Venetian anatomical-surgical interaction deserves to be emphasised.



[van Wesel A.], *Andreae Vesalii Anatomia: Addita nunc postremo etiam Antiquorum Anatomie, Venetiis, apud Ioan. Anton. et Iacobum De Francis, 1604* (Biblioteca di Storia della Medicina. Scuola Grande di San Marco. Venice. Fondo Collice).

The frontispiece of the *editio princeps* in Basel is far more complex, with references that do not exclude the theological dimension. It has also been interpreted as a mnemotechnical, cabalistic and hermetic expression of *memory theatre*<sup>10</sup>, depicting all the science that validates the new Vesalian anatomy.



[van Wesel A.], *Andreae Vesalii Bruxellensis, schola medicorum Patainae professoris, De humani corporis fabrica libri septem, Basileae, ex officina Ioannis Oporini, 1543*

As is often the case in Vesalian work, the detailed representations are of particular interest, and the iconography of the *ossiculi auditus organa*<sup>11</sup> does not escape this kind of rule<sup>12</sup>.

his funeral and, more recently, was exhibited in the exhibition dedicated to Arte, Fede e Medicina nella Venezia di Tintoretto (Venezia, Scuola Grande di San Marco, 6 settembre 2018-6 gennaio 2019). See: Porro A., Arte, fede e medicina: il grande racconto di una "triplice alleanza", Luoghi dell'infinito, a. XX, 2018, n. 234, pp. 62-63.

<sup>8</sup> This topic was later to be explored in the encyclopaedic reflections of the physician Toviyah ben Moshe ha Kohen, better known as Tobias Cohn (1652-1729), in a work published in the Venetian context (Toviyah ben Moshe ha Kohen, *Ma'aseh Tovyah*, Venice, in the stamperia Bragadina, [1707-1708]).

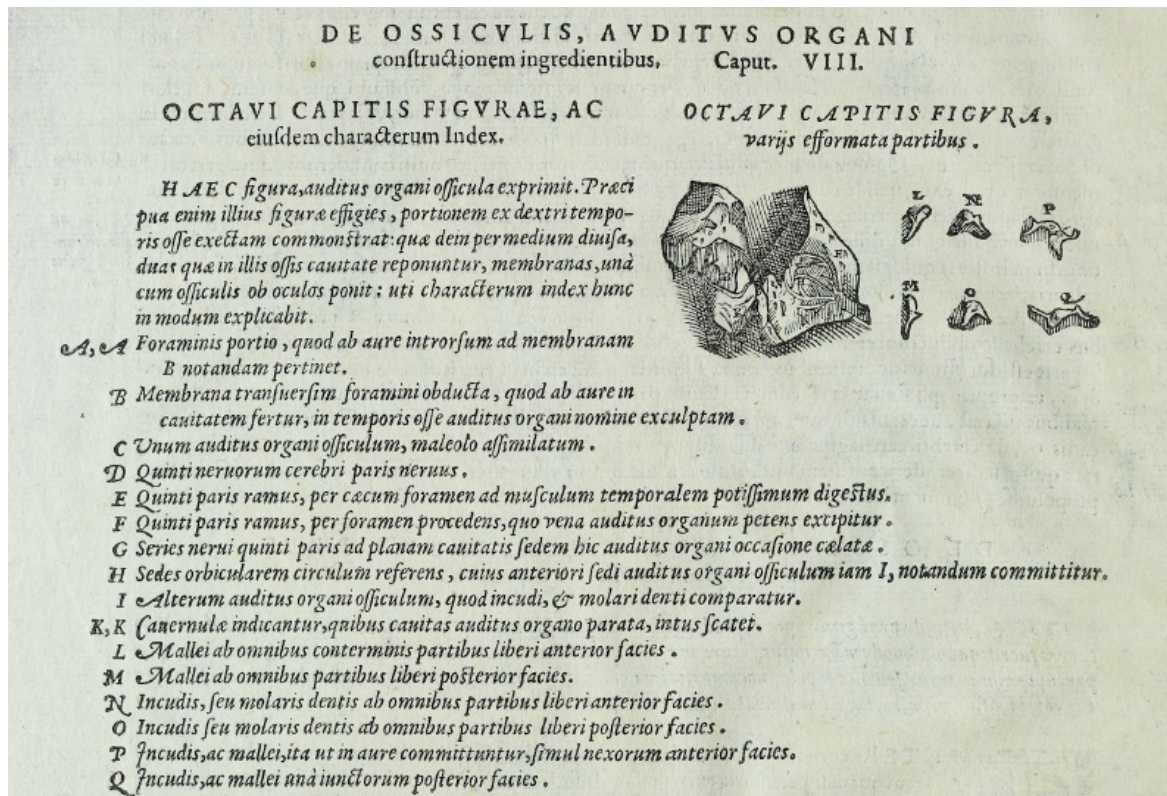
<sup>9</sup> See: Stefanutti U., Venezia nella Storia della Medicina, *Rassegna Medica. Convivium Sanitatis*, 33, 1956; [pp. 1-16]; Stefanutti U., *Date fondamentali nell'evoluzione della medicina veneziana. Prefazione all'albo dei medici di Venezia 1980*, Venezia, [Gasparoni?], 1980, pp. 1-12.

<sup>10</sup> In this case too, the interconnection between the two cities of the Republic, Venice and Padua, is evident. It was precisely in the capital city that Giulio Camillo known as Delminio (ca. 1480-1544) managed to build his theatre of memory, after great hardship. The theatre was also related to anatomical activity, understood as referring to the perfection of the *human microcosm*.

<sup>11</sup> The ancient use of the letter V to indicate sounds that are currently referred to as the letter U has been maintained.

<sup>12</sup> The figure has been taken from the above-mentioned 1604 edition for the sake of ease of reproduction, because

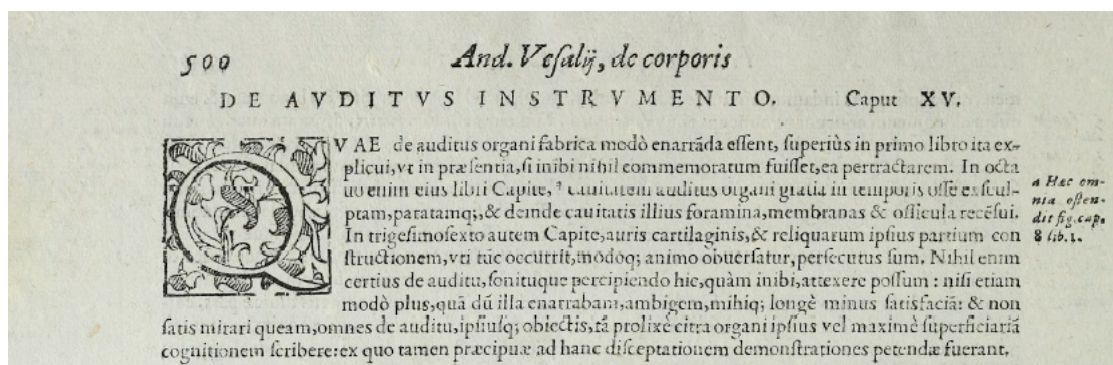




[van Wesel A.], *Andree Vesalii Anatomia: Addita nunc postremo etiam Antiquorum Anatome, Venetiis, apud Ioan. Anton. et Iacobum De Franciscis, 1604* (Biblioteca di Storia della Medicina. Scuola Grande di San Marco. Venezia. Fondo Collice).

The confirmation of both the identification and Vesalian designation of the *hammer* and the *anvil*, as well as the cross-section of the *portionem ex dextri temporis osse* represent the starting point that will lead to further reflections in terms of *animate anatomy* (today we would use the term *physiology*).

In fact, the limited possibility of analysing the physiological datum is not surprising. Even for Vesalius, the extensionist treatment could only be intrinsically superficial, as expressed in the relevant paragraph.<sup>13</sup>



[van Wesel A.], *Andree Vesalii Anatomia: Addita nunc postremo etiam Antiquorum Anatome, Venetiis, apud Ioan. Anton. et Iacobum De Franciscis, 1604* (Biblioteca di Storia della Medicina. Scuola Grande di San Marco. Venezia. Fondo Collice).

in the Basel *editio princeps* the image and the caption are placed on different pages.

<sup>13</sup> Also taken from the above-mentioned 1604 edition.

However, the first move had been made decisively, so that we can mention the developments in post-Vesalian anatomical investigations, which prove to be most relevant to our analysis<sup>14</sup>.

In fact, the anatomy lacked an *ossiculus*: the *stirrup*.

The most interesting post-Vesalian anatomists are Giovanni Filippo (Gianfilippo) Ingrassia (1509-1580), Bartolomeo Eustachi (c. 1500-1574), Gabriele Falloppia (Falloppio) (1523-1562), Realdo Colombo (1516-1559), Giulio [Cesare] Casseri (c. 1552-1616) and Girolamo Fabrici (or Fabrizi) da Acquapendente (c. 1533-1619).

It does not seem relevant, however, to get lost in disquisitions concerning the primacy of the observations of *ossicles* or other anatomical structures. Any claims made in this regard would be devoid of any basis for historical research.

It is more pertinent to recall that Vesalius' work contributed to the development of new anatomical investigations.

However, one cannot ignore the fact that school divisions or personal aversions may have played a role, sometimes even a significant one at the time, and the relationships between Vesalius, Ingrassia, Falloppia, Eustachi, Casseri and Fabrici could occupy simultaneously the ranges of respect and aversion.<sup>15</sup>

Regarding Ingrassia's identification of the stirrup ossicle, which can be traced back to 1546<sup>16</sup>, it should be noted that the news only came into the public domain through Ingrassia's printed work in 1603/1604<sup>17</sup>, but the related iconography reproduces Vesalian one<sup>18</sup>.

We thus face the problem of observations that are published at a distance from their creation, as well as the possibility of information circulating independently of the author's printed work.

**GABRIELIS FALLOPPII**  
**MEDICI MVTINENSIS**  
**OBSERVATIONES**  
*Anatomicae.*

**AD PETRUM MANNAM**  
 medicum Cremonensem.

**Cum Priuilegio Summi Pontificis,**  
**Regis Philippi, Senatusque**  
**Veneti.**



**V E N E T I I S.**  
**Apud Marcum Antonium Vlmum**  
**M D L X I.**

<sup>14</sup> Hachmeister J. E., An Abbreviated History of the Ear: From Renaissance to Present, *Yale Journal of Biology and Medicine*, 78, 2003, (1), pp. 81-86.

<sup>15</sup> A demonstration of the difficulty of interpreting this tumultuous period is provided by the words of Guillaume Benjamin-Amand Duchenne (de Boulogne) (1806-1875). They refer to another complex anatomical problem, that of the muscular structures of the hand, but are also well suited to our context: On s'explique difficilement comment il se fait que Fallope, qui a discuté les opinions de Vésale et de Valverde, qui a reproduit les opinions de Colombus, son maître, dans un ouvrage intitulé *Historia dellacomposicion del corpo humano*, n'ait pas mentionné les recherches anatomiques de Colombus, antérieures aux siennes, et qu'il devait connaître. Mais Fallope tenait Vésale en grande vénération, bien qu'il combattît ses opinions, tandis qu'il professait un grand mépris pour Colombus, qui accablait d'injures Vésale, dont il n'aurait pas dû oublier ainsi qu'il était l'élève. Est-ce à cause de ce motif que Fallope parle si peu de Colombus dans ses écrits?(Duchenne (de Boulogne) G. B. A., *Physiologie des mouvements démontrée à l'aide de l'expérimentation électrique et de l'observation clinique et applicable à l'étude des paralysies et des déformations*, Paris, Baillière, 1867, pp. 282-283, nota 2).

<sup>16</sup> Gitter A. H., Eine kurze Geschichte der Hörforschung. II. Renaissance, *LRO Laryngo-Rhino-Otologie*, 69, 1990, (9), pp. 495-500.

<sup>17</sup> [Ingrassia G. F.], Ioan. PhilippIngrassiae [...] in Galeni librum de ossibus [...], Panormi, ex Typographia Io. BaptistaeMaringhi, 1603. A Venetian edition is also reported to have appeared the following year.

<sup>18</sup> Also in Felix Platter's work (1536-1614), with peculiar iconography (Platter F., *Corporishumanipartium per icones delineatarum explicatio*, Basileae, apud Frobenium, 1581), the reference illustrations are Vesalian: however, they contain the delineation of the stirrup.



25

eadem adest, quæ in reliquis articu-  
lorum generibus reperitur. Hæc an-  
tiquis anatomicis (si eorum scriptis  
fidem præstamus) ignota fuisse, pri-  
musque, qui in lucem produxerit  
fuit Jacobus Carpsus, primus quo-  
que procul omni dubio anatomice  
artis, quàm Vesalius postea perfe-  
cit, restaurator. Nam in isagoge ana-  
tomica, & in commentarijs in Mun-  
dini anatomem luculentam duorum  
ossiculorum mentionem fecit, quo-  
rum historiam postea diuinus Vesa-  
lius expoliuit, atque alterum quod  
prius est malleolum, alterum verò  
incudem à similitudine appellauit,  
simulq; optimè descripsit. Tertium  
(si nolimus debita laude quædam  
de-fraudare) inuenit, ac promulga-  
uit primus Iohannes Philippus ab  
Ingrassia Siculus philosophus, ac  
medicus doctissimus, dum Neapo-  
litano in gymnasio publicè anatomi-  
am doceret, atque etiam theori-

D

[Fallopia G., Gabrielis Fallopii[...] *Observationes Anatomicae* [...], Venetijs, apud Marcum Antonium Vlmum, 1561.

In fact, in Fallopia's<sup>19</sup> *Observationes anatomicae* (1561) the Sicilian anatomist's observation is clearly acknowledged and explicated<sup>20</sup>.

In the edition of this text printed in Venice in 1561, the treatment of anatomical structures

dedicated to hearing is detailed. In addition to Ingrassia, Jacopo (Giacomo) Barigazzi (Bergengario) da Carpi (ca. 1466-1530) is cited as a predecessor in the observation of *ossicules*.

Unfortunately, Fallopia's work is not illustrated. However, we know that the author had planned to produce an iconographic apparatus similar to that of Vesalius' work<sup>21</sup>, in the context of a more general anatomical treatise, which never saw the light of day.

A copy of the *editio princeps* of Vesalius' *De Humani Corporis Fabrica* dense with notes, glosses, and corrections of the iconographic apparatus referable to Fallopia, preserved at the University of Parma, would seem, beyond the traditional dictation, to confirm this hypothesis.

Fallopia's treatment of the anatomical structures we are interested in runs from the superficial to the deep and uses the dissection of skulls belonging to subjects of different ages but cannot depart from certain hypotheses (such as that of the *aerinnatus*) which will only be superseded by Domenico Cotugno's (1735-1822) observations on the *endolabirinal lymph*.<sup>22</sup>

The description of the tympanic membrane, the cavity with the three ossicles, the two windows, the other innermost cavities, the labyrinth, the semicircular canals, the cochlea, the course of the nerve structures<sup>23</sup>, the *chordatympani*<sup>24</sup>, show us both the skill of the dissector and the arduous difficulty of the anatomical preparations.

It remains to mention Bartolomeo Eustachi's research. We know that his *Tabulae* were published posthumously, only in 1714<sup>25</sup>,

<sup>19</sup> [Fallopia G., Gabrielis Fallopii[...] *Observationes anatomicae* [...], Venetijs, Apud Marcum Antonium Vlmum, 1561.

<sup>20</sup> Fallopia reported that he had been told about this in 1548, during his lectureship in Pisa, by one of Ingrassia's students. He had carried out specific dissections, which confirmed the Sicilian doctor's findings. Fallopia immediately informed his colleagues, who also confirmed that Realdo Colombo was unaware of the existence of the third ossicle. Colombo, the anatomist from Cremona, enters our discussion almost like a stone guest: the relative minimisation of his citation is apparent, especially from those who had worked closely with him.

<sup>21</sup> In the introduction to his *Observationes Anatomicae*, Fallopia also tells us about his complex decision to subject Vesalius' work to critical scrutiny: he believed that the Galenic and Vesalian positions had taken on dogmatic characteristics. Therefore, Fallopia considered it unavoidable to subject Vesalius' work to the same critical scrutiny with which the Flemish anatomist had investigated the Galenic positions.

<sup>22</sup> See: Lorusso L., Porro A., Palmieri A., Mezzogiorno V., Neuroanatomical illustrations in the 18th Century: The Contribution of the neapolitans Domenico Cotugno and Domenico Cirillo, *Neurology*, vol. 66, n. 5, supplement 2, March 2006 p. A1.

<sup>23</sup> The facial and acoustic nerves were considered as a unit.

<sup>24</sup> With mixed adherence regarding the nervous nature of the structure.

<sup>25</sup> [Eustachi B., *Tabulae anatomicae* [...] quas è tenebris tandem vindicatas et sanctissimi domini Clementis XI pont. Max. munificentia dono acceptas Praefatione, notisque illustravit, ac ipso sua bibliotheca dedicationis die publicijuris fecit]o. Maria lancisius intimus cubicularius, & archiater pontificius, Romae, ec officina typographica

while in the only text he printed during his lifetime<sup>26</sup>, an essential section is precisely *De auditusorganis*<sup>27</sup>.

The anatomist from the Marche region is universally known for his description of the *meatum* that bears his name, but his confirmation of the nervous nature of the *chor-datympani*<sup>28</sup>, his study of the semicircular canals and the cochlea, his description of the *tensortympani* muscle and its functions are also worthy of the highest consideration.

In Eustachi's case too, criticism of Vesalian positions is defined by the concept of superficiality, due to the extreme complexity of the structures to be analysed.

Finally, still in the context of the multiform relations between the anatomists working between Venice and Padua in the last years of the 16th century, Giulio [Cesare] Casseri from Piacenza. (1552-1616<sup>29</sup>) and Girolamo Fabrici (or Fabrizi) da Acquapendente (ca. 1533-1619<sup>30</sup>) are worth mentioning.

They are remembered jointly because their stormy relationship exemplifies the academic circles of the time and has significant repercussions on their scientific production.

It is therefore no coincidence that, at almost the same time, the two authors published a work on the anatomy and physiology of hearing, also outlined in the field of comparative anatomy.<sup>31</sup>



[Casseri G.], *lvliiCasseriiPlacentini, De vocis auditus[que]organishistoria anatomica [...], Ferrariae, excudebatVictoriusBaldinus, 1600*

Francisci Gonzagae in via lata, 1714.

<sup>26</sup> [Eustachi B.], *BartholomaeiEustachii [...]* Opuscula anatomica [...], Venetiis, VincentiusLuchinusexcudebat, 1563.

<sup>27</sup> In epistolary form, dated from Rome on the fourth day before the Ides of October (10 October 1562), dedicated to Francesco Alciati (1522-1580), at that time Bishop of Civitate (the seat of the diocese was transferred to San Severo from 1580).

<sup>28</sup> In this case the support for the nervous nature of the structure is absolute.

<sup>29</sup> About Casseri, refer to the very valuable essay written by Giuseppe Sterzi, who at the time worked at the Anatomical Institute of the University of Padua: Sterzi G., *Giulio Casseri anatomico e chirurgo (c. 1552-1616)*, Venezia, Istituto Veneto di Arti Grafiche, 1909. More recently, see: Riva A., Orrù B., Pirino A., Testa Riva F., IuliusCasseri (1552-1616): The self-made anatomist of Padua's golden age, *The Anatomical Record*, 265, 2001, (4), pp. 168-175.

<sup>30</sup> The literature on Fabrici is vast. Of particular note are the still very valid works of Giuseppe Favaro: Favaro G., *Contributi alla biografia di Girolamo Fabrici d'Acquapendente*. In: *Memorie e documenti per la storia della Università di Padova*, vol. I, Padova, la Garangola, 1922, pp. 248-348.

<sup>31</sup> [Casseri G.], *lvliiCasseriiPlacentini, De vocisaudit[que]organishistoria anatomica [...], Ferrariae, excudebatVictoriusBaldinus, 1600*; [Fabrici da Acquapendente G.], *HieronymiFabricii ab Aqvapendente De visione, voce, auditu*, Venetiis, per FranciscumBolzettam, 1600.

Pupil (Casseri) and Master (Fabrici) clashed and success seemed to favour the pupil, at least as far as the appreciation of his anatomical activity was concerned.

Casseri's work unfolds by outlining the derivation of function from the understanding of morphology, with a tripartition concerning the *Structura* (Struttura<sup>32</sup>), the *Actio* (Functions of the parts<sup>33</sup>), the *Usu* (characteristic and effect of the function).

Casseri's work is praiseworthy for its description of the morphological characteristics

of the temporal bone in children and adults, for its focus on the obliquity of the tympanic membrane, on the structure of the inner ear and the determination of the number of semicircular canals, as well as for the aforementioned analysis in terms of comparative anatomy.

Similarly, to the iconography presented above, a part of the table dedicated by Casseri to the *Ossicula auditus diversorum animalium* organs is reproduced, which also highlights this aspect of Casseri's research.



[Fabrici da Acquapendente G.], *Hieronymi Fabricii ab Acquapendente De visione, voce, auditu, Venetiis, per Franciscum Bolzettam, 1600.*

As for Fabrici's work, he does not deviate from the other authors who questioned Vesalian observations. In this respect, his adoption of the aforementioned tripartite method of anatomical investigation inextricably links him to his student Casseri.

However, beyond the always possible clarifications, Vesalian value cannot be questioned as such.

Similarly, to what has been proposed previously, here too part of Fabrizio's iconography is reported.

To conclude, the anatomical panorama of the sixteenth century, with regard to the structures related to hearing, proves to be complex and interesting. The role played by the institutions of the Republic of Venice is central in the preparation of the basis of morphological knowledge.

Only on these anatomical bases, in the following century, that of the iatrophysicists and of animate anatomy, could the problems of physiology and aesthesiology be tackled with better knowledge.

But this is a different chapter.

<sup>32</sup> In fact, the chapters that interest us most are included in the description *De eorum, quae avrem internam componunt fabrica.*

<sup>33</sup> With inaccuracies regarding the physiology of deafness, believed to be related to the decomposition of earwax.