

Invited Review - History of Anatomy and Embryology

## From conception to birth: ancient library sources of embryology and women anatomy kept in the Biblioteca Biomedica of the Università degli Studi di Firenze (Biomedical Library of Florence University)

Laura Vannucci<sup>1\*</sup>, Lucia Frigenti<sup>1</sup>, Maria-Simonetta Faussonne-Pellegrini<sup>2</sup><sup>1</sup>Biblioteca Biomedica and <sup>2</sup>Department of Anatomy, Histology and Forensic Medicine, University of Florence, Italy

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### Abstract

The Biomedical Library of the University of Florence boasts a prestigious group of books collected at first in 1679 at the hospital "Santa Maria Nuova" and then continuously enriched in the course of time up to today. The "Antique Collection" consists of 13 *incunabola*, hundreds of 16<sup>th</sup>-century books, more than one thousand books on medical subject from the 1600's, about six thousand 18<sup>th</sup>-century volumes and several large, valuable anatomical atlases. In this paper the most important, curious and fascinating books dealing with human ontogeny (from embryo generation to birth) and with female anatomy (mostly concerning pregnancy and childbirth) are reported in chronological order starting from the work of Hippocrates. Among the ancient sources useful for the reconstruction of the opinions about obstetrics there are also outstanding handbooks specifically edited for midwives. Many of these antique books are especially precious because they embed a great number of didactic pictures, some of which may compete against any modern book of anatomy, embryology and obstetric. Selected images from these books are shown.

### Key words

History of medicine; labor presentation; midwifery; obstetric delivery.

The Biomedical Library of the University of Florence (FBL) boasts a prestigious library fund made at first by a group of books collected in 1679 at the hospital "Santa Maria Nuova". This collection was enriched, in the course of time, by the contribution of well-known professors of medicine of the Florence University. The library fund consists of 13 *incunabola*, hundreds of 16<sup>th</sup> century books, more than one thousand books on medical subject from the 1600's, about six thousand 18<sup>th</sup> century volumes and several large, valuable anatomical atlases. Moreover, the Biomedical Library owns a rich archive of manuscripts written by 19<sup>th</sup> century physicians, 103

\* Corresponding author. E-mail: [laura.vannucci@unifi.it](mailto:laura.vannucci@unifi.it).

- L.V. is the Director of the Biomedical Library

- L.F. is the Responsible for the Antique Collection

- M.S. F.-P. is professor of Histology and Embryology

diaries (now also digitized) written by Antonio Cocchi (a famous physician, antiquarian, philosopher and intellectual of the 18<sup>th</sup> century), and dozens of medical qualification records released by the “Collegio Medico” of Florence (Collegium of Physicians), dating from the 16<sup>th</sup> to the 19<sup>th</sup> century.

Therefore, in the antique FBL archive there are several texts dealing with human ontogeny (from embryo generation to birth) and with female anatomy, mostly concerning pregnancy and childbirth. Among the texts about conception, in chronological order, we find the work of Hippocrates (470-377 b. C.), according to whom the fetus grows out of the union between “female semen” and masculine sperm, in consequence of which *maternal womb rises like bread*. The later Aristotelian theory stated woman’s contribution to reproduction to be only material and passive (through menstruation), and to be the man to give shape and spirit to the fetus; this theory opened the way to ideologies which looked at women as imperfect creatures who, being incapable of controlling their instinct, were even socially dangerous. Aristoteles (388-322 b. C.) also studied embryos (therefore he is correctly considered the founder of embryology) and foresaw that not all vital organs are present from the beginning of life. Galenus (129-216) revisited the theory of a seed originating from “female testicles”, nonetheless this seed had not, for him, the same role and importance for conception as had the male sperm, which needed its female counterpart just for nourishing and wrapping the fetus. Much later in time, Ludovico Bonaccioli (1475-1536) studied extensively the structure of the female genital tract and tried to imagine the prenatal development of humans; the FBL keeps a work by this author published in a collection of treatises which contains a table (Fig. 1) representing a fetus just a few weeks old and fully developed, although miniaturized. For centuries, even when the idea of a child already ‘inside’ the mother had been accepted, the matter if it was complete with all of its parts since conception or had to go through different phases, turning into a fetus from an unshaped being, has been an object of debate. Regarding embryology, a fascinating table (Fig. 2) accompanies the book *Embriologia sacra* by the Jesuit Francesco Emanuele Cangiamila (1702-1763) from Palermo: the precision of this drawing may compete against any modern book of embryology. Unfortunately, until the use of the microscope became wide-spread, it was impossible for scientists to confirm if the illustrations, although admirable, were indeed correct for embryos in early stages of development.

Indeed, the mechanism of human reproduction remained misunderstood for many centuries and only in 1866 the term “gamete” appeared, coined by Gregor Mendel (1822-1844). The discovery of spermatozoa possibly dates back to 17<sup>th</sup> century physicians who called them “animalcules”, such as Antonio Vallisneri (1661-1730), who fought against the spontaneous generation theory. There was, however, not uniform agreement on this subject and abbot Lazzaro Spallanzani (1729-1799) himself stated that so-called animalcules do not have a decisive role in human generation. Others, instead, considered spermatozoon as a human being in miniature (preformation theory). From the 17<sup>th</sup> century on, *animalcules theory* was especially contrasted by the advocates of the so-called *ovules theory*, who emphasized the role of ovaries in the process of reproduction, such as Johannes Van Horne (1621-1670) and Thomas Theodor Kerckring (1640-1693). Caspar Bartholin (1585-1629), on the contrary, had conjectured that male seed fertilized a woman by penetrating her blood before her eggs. Only in 1838, after the studies of Theodor Schwann (1810-1882) and others, the idea of living beings originating from a cell (zygote) began to spread. This cell was



**Figure 1** – Séverin Pineau, *De integritatis et corruptionis virginum notis*, Lugduni Batavorum, 1650 (bound with Ludovico Bonacciolli, *De foetum formatione*).



**Figure 2** – From Francesco Emanuele Cangiamila, *Embriologia sacra*, Palermo, 1745.

thought as the product of fecundation, i.e. the fusion of the male and female gametes, which afterwards splits into other cells to originate tissues and organs. Finally, with the work of Rudolf Albert von Kölliker (1817-1905), some degree of symmetry and complimentary between ovule and spermatozoon were asserted, as well as between ovaries and testicles, and the cell structure of spermatozoa was confirmed.

Human embryology is also indebted to studies on animals, such as those by William Harvey (1578-1657).

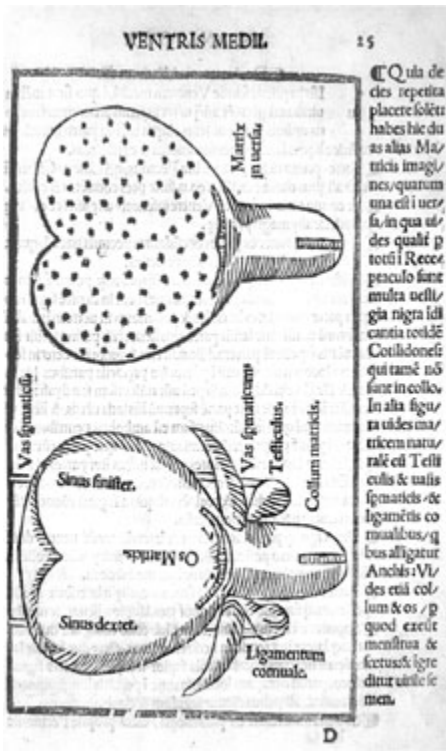
Similar to embryology, female anatomy and in particular its relation to pregnancy and childbirth has remained a mystery for many centuries, at least for official medicine. In fact, woman's health responsibility had always been delegated to midwives, who dealt with issues related to menarche, sexuality, troubles of the menstrual cycle, delivery and puerperium, and were experts in avoiding or causing pregnancy. These skilled women (often considered just females lacking theoretical knowledge, or even witches) rarely left any written evidence of their own work or knowledge. One remarkable exception was Trotula (XI sec.?), whose work is kept by the FBL. An especially valuable work of the FBL antique fund is indeed the collection entitled *Medici antiqui omnes*, published in a precious Aldine edition dating 1547 and reproducing in the Renaissance the text written by the ancient female physician Trotula, a controversial figure of the *Schola Medica Salernitana*, i.e. Salerno School of Medicine (Trotula, 1547). To understand at least in part the difficulty

of a historical reconstruction of Trotula's life, of her medical activity, of her scientific production and, on the other end, of the destiny of her writings, it is enough to consider that her name had been hidden even in the historical catalogue of the FBL on paper, where it had been substituted by the entry "Erotis", genitive of "Eros", the name of a freedman (*libertus*) of the Roman empress Julia. He was wrongly thought to be the writer of a further version of the Renaissance-printed text, to be found in the collection of ancient medical writings published by Israel Spach (1560-1610) in Strasbourg in 1597. It is remarkable that great attention is given in both edition of the text to caring the perineum lacerated at childbirth, an issue unusual for that time and ignored by known previous authors. The book edited by Spach (1597) is also important because it quotes a work on gynecology written by another woman, Cleopatra, who was even believed to be the renowned Egyptian Queen of the first century before Christ. In Spach's publication we can also find: the text of Anatomy by Félix Platter (1536-1614) from Basel, enriched with explicative pictures; the essay on generation by Ambroise Paré (1510-1590); and the first printing of the Latin text of François Rousset (1530-1603) on caesarean section, besides other works by Girolamo Mercuriale (1530-1606), Giovan Battista Montano (1534-1621), Vettore Trincavelli (1496-1568) and Albertino Bottoni (1528-1596?).

The understanding of female genitalia has gone through a long road and has not made significant progress for a long time. Indeed, not even the dissection of female corpses which was practiced first in the Atheaneum of Bologna, then also in Ferrara, Padua and Pisa, could lead anatomists to achieve results independent of the statements of Galenus and Avicenna (980-1037), whose authority was influential to all branches of medicine. Some time had to pass before the reform of Andreas Vesalius (1514-1564) spread out and obstetric and gynecologic studies could be based on empirical anatomical observation. The path to Vesalius was opened by Berengario da Carpi (1470-1550), both because the latter was probably the first anatomist to understand the didactic value of printed texts, and because he gave emphasis to direct experience for the acquisition of medical knowledge. Berengario described the anatomy of the female tract, even sometimes contradicting revered predecessors, and the important anatomical tables which equipped his *Isagogae* included some representing the uterus and its environment (Fig. 3).

Vesalius, while changing the knowledge of female anatomy, also renewed the iconographical representation with drawings published in Amsterdam in 1592 in *De humanis corporis fabrica* (Fig. 4).

But these pictures still show a heart-shaped uterus and a vagina definitely resembling a penis; ovaries are called "feminine testicles" and they seem to be linked to the uterus by subtle filaments (named *sperm viae*, and corresponding to the male *vasa deferentia*), which have nothing in common with the uterine tubes identified and correctly described by Gabriele Falloppio (1523-1562) in his many anatomical studies in the same period (hence the name "Fallopian tubes"). It was Reinier De Graaf (1641-1673) to provide a representation of the female genital tract similar to that currently known, except that he envisaged a pre-formed child in the ovarium. Later, the anatomist Michele Girardi (1731-1797) edited an important text written by Giovanni Domenico Santorini (1681-1737), adding some personal contribution, and two plates of mammary structure engraved by Giuseppe Patrini (18<sup>th</sup> century). Remarkable was finally the work by Georg Wilhelm Stein (1737-1803) and in particular his representation of a pregnant woman's skeleton.



**Figure 3** – From Jacopo Berengario, *Isagoge breves*, Bologna, 1523 .



**Figure 4** – From Andreas Vesalius, *De humanis corporis fabrica*, Amsterdam, 1592.

Among the ancient sources useful for the reconstruction of the opinions about women anatomy and obstetrics there are handbooks specifically edited for midwives, many of which are kept by the FBL; these books are especially precious because they embed a great number of didactic pictures. In 1532, Eucharius Rösslin junior (?-1554) published in Frankfurt the first edition of a Latin translation of a work of his father Eucharius Rösslin (1470-1526). The translation was entitled *De partu hominis et quae circa ipsum accidunt, adeoque de parturientum & infantium morbis atque cura, libellus*. The FBL keeps a copy of this work enriched with a large number of xylographies (Fig. 5), among which are seventeen pictures of the various positions of the fetus in the womb. Interestingly, the book translated by Eucharius Rösslin junior had been originally written in German with the title *Der swangern Frawen und he bammen Roszgarten* in 1513, in order to be read immediately by midwives who were not learned in Latin language.

Another work of the *Roszgarten* cycle is the rare text in German language by Walther Hermann Ryff, surgeon in Strasbourg (about 1500- 1548), published in Frankfurt in 1545. When the handbook was published, Ryff was denigrated by Vesalius who publicly accused him of plagiarism for having re-used large part of Rösslin’s work and for having put under his name diagrams of the major anatomists of the time.

Another text of the cycle is *De conceptu et generatione hominis*, written by the Swiss doctor and physicist Jakob Rueff (1500-1558) and published first in Zurich in 1554 (the FBL owns a copy of a Frankfurt edition dating 1587). The precious wood engravings which illustrate Rueff’s volume (Fig. 6) had mostly a didactic aim, such as the illustration of delivery taking place on a birth chair.

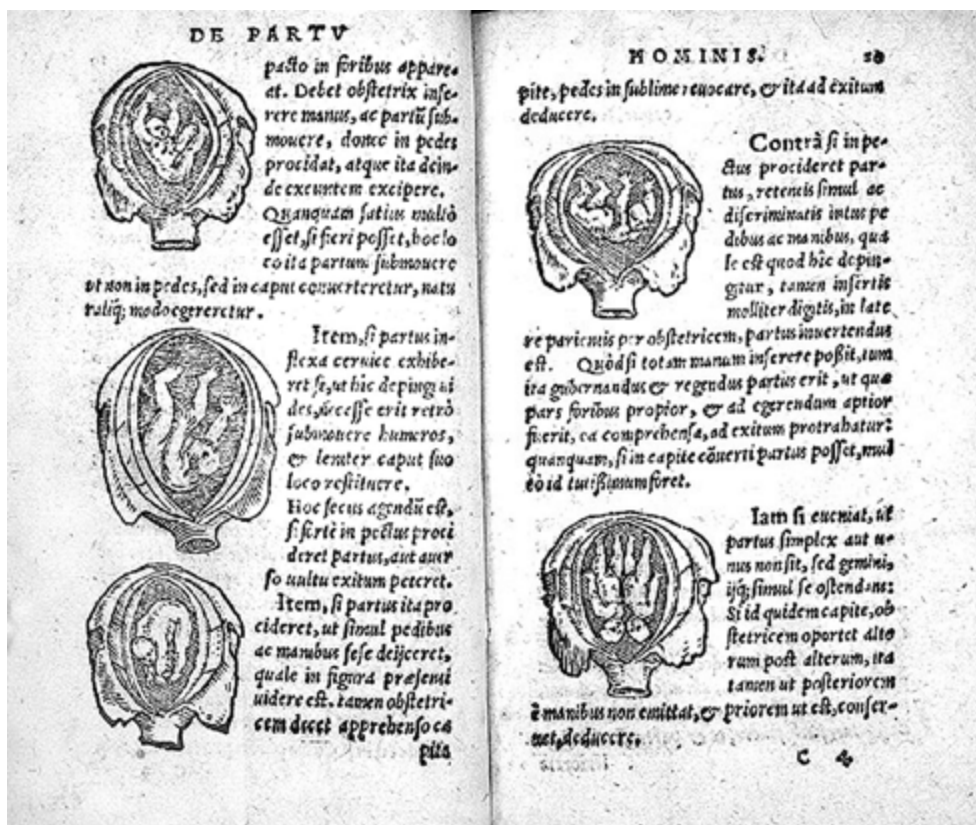


Figure 5 – From Eucharius Rösslin, *De partu hominis*, Frankfurt, 1532.

Many wooden engravings reveal images of specific gynecological and embryological interest. Rueff's illustrations show the influence of the innovation introduced by the drawings published by Vesalius.

The work written by the Dominican friar Scipion Mercurio (1540-1615?), *La comare o Ricogliatrice*, was published in Venice in 1596; it is composed of three volumes which investigate pregnancy, childbirth, the aid in case of difficulty during delivery, and obstetrical, gynecological, and childhood diseases. The first volume is equipped with precious anatomical Tables representing pregnant women, engraved in a copper slab by Francesco Valesio (1524-1592). Some of the illustrations in the second volume are quite bizarre, when Mercurio shows the positions to be taken by women in case of difficulties during childbirth or when women in labor are very fat. Here are also represented the two proper positions for a cesarean section, distinguishing between the 'strong' women (the *gagliarde*), who could be operated while sitting on the bed, and the weak ones (the *deboli*), to be operated while lying in bed. The volume is equipped with a rich critical apparatus of surgical instruments; by the end of the 16th century, however, childbirth in presence of a surgeon was an exceptional event: midwives summoned doctors very rarely.



Figure 6 – From Jakob Rueff, *De conceptu et generatione hominis*, Zurich, 1554.

In the following centuries also some women left written evidence of the knowledge they had about the female body, its function and disease. The FBL keeps the 17<sup>th</sup> century work *Die Chur-Brandenburgische Hoff-Wehe-Mutter. Das ist: Ein höchst-nöthiger Unterricht von schweren und unrechtstehenden Geburten, In einem Gespräch vorgestellt* ("The court midwife in the Brandenburg Electorate, or The most necessary education for difficulty during childbirth and deliveries with complications, presented in the form of dialogues") by Justine Siegemund (1636-1705). The FBL exemplar is one of the precious first edition of 1690 (Brandenburg), enriched with numerous pictures. Siegemund's work is the first official obstetrical text written in German by a women, and it can be traced back to a cultural environment when the competition between men and women regarding birth control was high (a rivalry also revealed by the proliferation of handbooks for midwives). This book is essential for the historical reconstruction of the socio-cultural restrictions to which midwives were subjected, in order to favor the profession of the doctors. Unfortunately, the observations and the instructions of Siegemund, although printed, have been ignored by the authors of the following centuries, which attributed them to various and different doctors.

She has thus become a symbol of women struck in the dignity of their job, being in her life the object of numerous attacks, of the well-known kind of works discrediting midwives. Siegemund's work is mostly didactic and it is equipped with thirty-eight beautiful engravings which could still be useful for modern obstetricians. These show indeed the different positions of the fetus inside the maternal womb and teach in particular the movement of the hands of the obstetrician to pick up or draw the child in cases of faulty presentation at delivery. Remarkable are the four engravings where Siegemund shows some complicated way to handle and turn a fetus, operations made with the aid of a "cloth string" and some sticks to find a solution to the delivery of a shoulder presentation (Fig. 7 and Fig. 8).

The far-sighted French obstetrician Angélique Marguerite Boursier du Courday (1712-1789) first used a cloth dummy as a practical method to help her illiterate pupils to learn how to behave during delivery; this method then appeared to be very useful also for surgeons, who actually lacked any practical experience. The handbook of Boursier, *Abregé de l'art des accouchements*, published in Paris in 1777, is enriched by numerous colorful engravings which show the various positions that the fetus can assume at childbirth.

By the 18<sup>th</sup> century another important obstetrics book was published, which was destined to remain a reference in Italy for all the 19<sup>th</sup> century. This is the work by Sebastiano Melli (1713-1750), *La comare levatrice istruita nel suo ufizio*, published in Venice in 1721. Melli overtly specified that midwives should not work in medicine: *My educated Comare, however, in order to be Modern, settles for exceptional know-how about her profession, and she just wants to be competent in the Offices called her own, leaving the*



**Figures 7 and 8** – From Justine Siegemund, *Die Chur-Brandenburgische Hoff-Wehe-Mutter*, Brandenburg, 1690.



art of Medicine to those who are not happy with their duty and aspire to the name of *Medichesse* (“medichesse” is a pejorative, feminine form of “medico”, which on the contrary indicates a male physician). The handbook is equipped with relevant anatomical tables and pictures (Fig. 9) of the various positions of the embryo in the maternal womb and resembles the following obstetrics treatises rather than the previous midwives handbooks.

The work of the priest Girolamo Baruffaldi (1675-1755), *La mammana istruita per validamente amministrare il Santo Sacramento del Battesimo in caso di necessità alle creature nascenti*, deals rather with the ethics of midwives. The booklet, published in Venezia in 1774, was widespread. It was not a sort of medical guide but rather gave ethical warnings, since the *Comari*, in case of need, had been allowed to administer baptism. Since the years of the Trento’s Council, there had been an internal debate in the Church regarding the salvation of the fetus. In order to keep the child from dying before receiving the sacrament, an appropriate instrument was employed: the



**Figure 9** – From Sebastiano Melli, *La comare levatrice istruita nel suo ufizio*, Venezia, 1721.

so-called Mauriceau (1637-1709) syringe, after the name of the famous French obstetrician. This instrument consisted of a little hosepipe linked to a brass syringe with which it was possible to baptize the child in the uterine cavity. In mid-18<sup>th</sup> century this question had been largely debated by Francesco Emanuele Cangiamila in his previously mentioned work *Embriologia sacra*: here the author stated that, for the salvation of an unborn child's soul, any fetus should be pulled out of a dead woman's corpse in order to be baptized, however late the pregnancy might be.

Finally, the FBL keeps gynecological and obstetrical writings dating to the 19<sup>th</sup> century; among these, there are outstanding works of Marie Anne Victoire Gillain Boivin (1773-1841), a talented obstetrician who was working at the Court of France when the Revolution broke out. By the first years of the nineteenth century she became a famous hospital manager and, later, her name was linked to anatomical discoveries and to the inventions of instruments to examine the cervix of the uterus. The works by Boivin which the FBL keeps are the *Observations et reflexions sur les cas d'absorption du placenta*, edited in Paris in 1829, and two copies of *Traité pratique des maladies de l'uterus et de ses annexes*, written together with Antoine Dugés (1797-1838) and dating 1833. The latter publication is a gigantic illustrated textbook (it may even be considered a commented atlas) with color pictures matching the text which had been drawn by the author herself, and stands out as an important evidence of the knowledge of the time about female anatomy. In recent centuries, together with advancements of the anatomical knowledge of the woman's body, a mechanical interpretation of childbirth started to prevail and, at a certain point, predominated over the ancient natural idea that the child pushed himself through the mother's reproductive tract. The new scholarship was willing to search and highlight mechanical principles and mathematical formulae which regulated the process, with the baleful consequence of an enormous and unjustified spreading of surgical interventions and of the use of traumatic instruments such as forceps; these were opposed by midwives, who emphasized their danger and insisted to practice their activity on the basis of their specific knowledge and of their acting with *mani di carne*, i.e. hands made of flesh, rather than with *mani di ferro*, i.e. hands made of iron.

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