

De Formato Foetu (c. 1600), by Girolamo Fabrici ^[1]

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The embryological treatise *De formato foetu* (The Formed Fetus) was written by anatomist and embryologist [Girolamo Fabrici](#) ^[4]. There is no conclusive evidence regarding the first date of publication and what is listed on many copies ranges from 1600?1620, with speculation that the dates were altered by hand. Most forms of the book are dated 1600 and were issued by Franciscus Bolzetta who sold many copies in Venice and whose name appears on the engraved title-page. There is also verification of the book being printed in Padua by Laurentius Pasquatus in 1604. This treatise was the last publication to be issued before Fabrici retired from his teaching position at the Univeristy of Padua and it was the last anatomical work of his to be published during his lifetime. The book illustrates Fabrici's views on the anatomy of the [fetus](#) ^[5] and [uterus](#) ^[6] and demonstrates his struggle between accepting traditional authority and relying on his own experience in his investigations in [embryology](#) ^[7].

In the introduction of *De formato foetu*, Fabrici informed the reader that his studies in [embryology](#) ^[7] had been separated into three parts to cover the topic of generation. Fabrici wrote that the first part of his studies would document the generation of the [semen](#) ^[8] and the organs that produce it, but the intended manuscript, presumably *De instrumentis seminis*, was never published and is considered to have been lost. He wrote that the second part of his studies would be published in the book *De formatione ovi et pulli* ^[9] and would deal with how the [semen](#) ^[8] interacts to generate the [fetus](#) ^[5], and the topic of *De formato foetu* would cover the form of the [fetus](#) ^[5].

De formato foetu is separated into two parts. In part one, Fabrici describes in detail the morphological features of the [fetus](#) ^[5] and the [uterus](#) ^[6], having performed dissections of both. Fabrici brought to light observations by [Aranzio](#) ^[10], a contemporary anatomist of his time, and asserted that [Aranzio](#) ^[10] was incorrect in his beliefs that the human [fetus](#) ^[5] lacked an [urachus](#) ^[11], the embryological canal that connects the urinary bladder of the [fetus](#) ^[5] to the [allantois](#) ^[12], the sac-like feature involved in nutrition and excretion. Fabrici wrote that true cotyledons are found only in the pregnant ruminant [uterus](#) ^[6], such as in cows. He also took into account the presence of a fetal heart beat. These last two observations proved his predecessor, [Leonardo da Vinci](#) ^[13], flawed in his embryological annotations where Leonardo assumed that the human [uterus](#) ^[6] had cotyledons as well and denied that the [fetus](#) ^[5] had a heart beat.

In part two of the treatise, Fabrici examined the function of the umbilical vessels, [placenta](#) ^[14], [chorion](#) ^[15], [allantois](#) ^[12], [amnion](#) ^[16], fetal excretions, and heart vessels. Fabrici's writing conveys a heavy reliance on previous notions of anatomy put forth by [Galen](#) ^[17]. He agreed with [Galen](#) ^[17] that the nourishment of the [fetus](#) ^[5] is delivered from the mother's blood to the fetus's liver via the [umbilical cord](#) ^[18] and vessels. One slight difference in Fabrici's view was that the blood did not require the purification that [Galen](#) ^[17] thought it underwent before reaching the fetal liver. Fabrici reiterated Galen's view of special vital spirits that connected the [fetus](#) ^[5] to the mother through veins and arteries and allowed it to grow and mature within her [uterus](#) ^[6]. Fabrici expressed his belief that the [fetus](#) ^[5] lacked blood in the liver and the vital spirits that the full grown man had in the heart. He believed that the umbilical arteries were

responsible for supplying the [fetus](#) [5] with the vital spirit from the mother and the umbilical vessels carried out the function of supplying the fetal liver with blood. Fabrici agreed with [Galen](#) [17] that the [umbilical vein](#) [19] connected directly to the liver and that the liver was the source of all veins. Fabrici noted that if the [umbilical cord](#) [18] were to be cut, the vital spirit delivered from the mother via the umbilical vessels would be cut off and the [fetus](#) [5] would die, which he thought proved its reliance on the mother for vital spirit. Fabrici also followed the philosophy of [Aristotle](#) [20], which held that every organ served a purpose. He noticed that upon the delivery of the child, the [umbilical cord](#) [18] dries up and disintegrates, having performed its function within the [womb](#) [21].

Fabrici gives some original, though mistaken, thought to the [placenta](#) [14], which he studied in greater accuracy than his forerunners in anatomy. Fabrici is considered the first to have articulated a classification among various placentas in different animal species, and he limited the term [placenta](#) [14] only to descriptions of the [discoidal placenta](#) [22] found in [humans](#) [23]. He is also known as the first to have studied the human [decidua](#) [24], the term used to discuss the lining within the [uterus](#) [6] during [pregnancy](#) [25]. Fabrici contested Aranzio's beliefs regarding the function of the [placenta](#) [14], claiming that the [placenta](#) [14] only purified a tiny amount of blood, whereas [Aranzio](#) [10] thought the [placenta](#) [14] acted like a uterine liver in that it fully purified all of the blood that nourished the [fetus](#) [5].

Fabrici followed the tradition of previous anatomists in thinking that the [chorion](#) [15] was the receptacle for fetal urine. In his discussion of the [allantois](#) [12], Fabrici noticed that this structure was not evident in the fetuses of every animal, and he asserted that it was an extra organ in [humans](#) [23] that acted as an additional receptacle for urine. Fabrici then noted that the [amnion](#) [16], a membranous sac that surrounds and protects the [fetus](#) [5], was the container for fetal sweat. In his discussion of fetal waste, Fabrici agreed with the principals that [Galen](#) [17] endorsed. He restated that the [fetus](#) [5] had six waste products including sweat in the [amnion](#) [16], urine in the [chorion](#) [15] or [allantois](#) [12], bile, phlegm, feces, and caseous necrosis of the skin. On the fetal heart, Fabrici returns to his thesis on the mother being integral for supplying the vital spirit to the heart of the [fetus](#) [5]. He asserts that the heart beats only for its own preservation and has no relevance to the body until the child is born, when it receives its own vital spirits that it must sustain. Fabrici noted that the heart beats and grows while receiving cooling from the mother's body, and after the child is born the heart is then cooled by the process of breathing. On the position of the [fetus](#) [5] in the [womb](#) [21], he assumed that perceived differences in the anatomy of the sexes determined orientation, such that males were top heavy and therefore faced down in the [womb](#) [21] while females fetuses were positioned upright because they were bottom heavy. He ended the book with an emphasis on how much Nature provided for the development of the [fetus](#) [5].

Included in the book are comparative studies on the morphological details of the [uterus](#) [6] and fetuses in dogs, cats, mice, rabbits, goats, guinea pigs, [sheep](#) [26], cows, horses, pigs, [birds](#) [27], sharks, and [humans](#) [23]. Fabrici is responsible for accurately describing the [umbilical cord](#) [18] and its vessels in great detail, and for asserting the differences in the [placenta](#) [14] between animal species. Fabrici also provided an accurate description of the heart and pulmonary vein in the [fetus](#) [5]. Fabrici wrote that the circulation of blood was directly connected between mother and [fetus](#) [5], whereas his student [William Harvey](#) [28] later claimed that the circulatory systems were separate.

The book is illustrated by an unknown artist and contains thirty-four engraved plates depicting the comparative anatomy of the [uterus](#) [6] and the fetuses in [humans](#) [23] and other animals. Fabrici is considered the first to study and depict the human [decidua](#) [24] of the human [uterus](#) [6]

, although he did not name the organ or know what to call it other than a thicker membrane that was attached to the [uterus](#) [6]. In addition to the black and white engraved illustrations that are found within the volume, some copies of the book are included with a set of colored plates with over ten additional pages of explanation. The colored plates have since been collected and are held in library of the College of Physicians at Philadelphia.

The scope of Fabrici's achievements as an embryologist is evident in his manuscripts and the publication of his book. This treatise displays a gradual [evolution](#) [29] of knowledge in [embryology](#) [7] as well as how prevalent traditional authority was in the literature and scientific exploration of the time. His writings influenced later scientists like [William Harvey](#) [28] and his illustrations present a comparative look at [embryology](#) [7] in different animals that is of value now as it was then.