

The notebook or written and visual manuscripts of Leonardo da Vinci are, to date, a masterpiece of human history that continues to amaze people over 500 year after its creation. The numerous pages are known for the beauty of the representation of a multitude of subject matter transforming art into visual science. The unrealized potentials within notebooks thwarted the evolution of science and art. The cause of this hindrance is lack of circulation and investigation by people over centuries. Today the official collection of papers comprising Leonardo's entire work of notebook writings and drawings extends over a period of 51 years ranging from 1472 to 1513 and is roughly 600 pages in length. (Elmer Belt 4) He died May 2, 1519.

An abbreviated history of the geographic locations of Leonardo's life includes: He was born Saturday the 15th of April, 1452 in the Tuscan hill town of Vinci out of wedlock. His grandfather recorded that he was the illegitimate son of Ser Piero da Vinci who became a prominent lawyer in Florence (Kemp 10). He moved to Florence at a young age and entered the studio of the artist Andrea Verrocchio. He spent his early years, 1473-1482 in Florence and then for the following 30 years depended on courtly employment until ending his career in the French royal service with a substantial salary and residing in a grand manor house. (Kemp)

The fifteenth century witness a great advance in the sciences of mathematics and geometry. The kind of painting that developed from the time of Masaccio onwards was constructive in the sense that it applied a formulaic approach to the representation of man and nature. Alberti and Brunelleschi advocated observation and that it exactly what the artists had been practicing; the integration of geometry exhibited itself as a rendering and compositional device for artists. Leonardo turned the study of anatomy into a science. His scientific studies informed his compositional preparatory sketches for complex compositions. He differentiated

between 'natural' and 'accidental' perspective. The former being scientifically geometrical and the latter 'that which is created by art'. Leonardo advocated using a mirror as a guide. "When you wish to see whether the general effect of your picture corresponds with that of the object represented after nature, take a mirror and set it so that it reflects the actual thing, then compare the reflection with your picture, and consider carefully whether the subject of the two images is in conformity of both." (Read 140) This is probably why the entire notebook is written backwards and may have been interpreted as gibberish by people of the time.

Hidden in the notebooks is a visual documentation of the cultural deviance and the genius mind of Leonardo. His advanced methods of classification, visual representation, and academic ability all combine together to create a monumental document. Visually Leonardo showed ingenious ways of representing anatomy that has never been seen before. Each drawing embodied the information gathered from numerous dissections as well as the multitude of layers that actually exist within living things. The body of material faced within Leonardo's writings is large in terms of quantity, range, and inherent difficulty. At the time of completion the magnitude of Leonardo's work was overlooked as monumental and was assimilated into the times. Leonardo felt that his notebooks and drawings were to be where his "...illustration of the human body shall be demonstrated to you, not otherwise that if you had a real man before you" (Quaderni I, 2 r) as well as where he planned and recorded his thoughts and processes.

Dispersed and disconnected the contents of his notebooks were in private hands for nearly a century after his death. After general interest from the public ignited, a sculptor named Pompeo Leoni purchased and composed the available pages in about 1600, over 75 years after the death of Leonardo. (Elmer Belt 8) Leoni intended to show them to King Phillip of Spain, but the King died before he could see them. After the death of the Spanish King, Leoni brought

some of the manuscripts back to Italy and left the rest in Spain. In 1638, Thomas Howard, Earl of Arundel purchased the pages from a Spanish owner. The manuscripts were then kept further from the knowledge of the people until being rediscovered in a chest in Kensington Castle in about 1760, under the rule of King George III. So for over 250 years the immense value of the manuscripts was latent. It is known that Durer saw some of the drawings when he travelled to Italy because he carefully copied some of the principle figures seen in Windsor castle into his Dresden Sketchbook. (Elmer Belt 38) In line with the Renaissance tradition of learning from observation, Leonardo's advice to painters is to "be sure you know the structure of all that you then wish to depict". (Clark 213)

Despite a number of the drawings being lost over time the remaining known pages are well managed and preserved. Dr. Hunter was a servant of King George and was the first individual to realize the inherent value of the images to society and then actively try to publish the manuscripts. Hunter died in 1783 before the first publication of the drawings which appeared in part in Chamberlaine's volume, published in 1796. Since 1796 various edition and reproduction of the notebook have increased in circulation. An initial issue with the printing of the manuscripts lies in the lack of reproduction methods. Today there are 600 drawings at Windsor castle. At the time of rediscovery there were 779 (Elmer Belt 11). The location of the 179 drawings unaccounted for in Windsor castle is ultimately unknown.

The purpose of the drawings is to reveal structures and purpose and function through visual depiction of the dissected material. He combines the experience of multiple dissections into each drawing. (Elmer Belt 13) During dissection he insisted on sawing bones horizontally and vertically to be satisfied with the examination. Upon dismantling the skull Leonardo

demonstrated for the first time the sinus. (Elmer Belt 15) In all, over his lifetime he had dissected 30 bodies. (Luca Beltrami, Documentation, Milano, Fr. Treves, 1919, p. 149

Leonardo learned the anatomy of flayed bodies as a youth when he studied in Florence at the bottega under Verrocchio. (Elmer Belt 3) His immense understanding of the underlying structures of the human allowed Leonardo to capture the breathtaking poses of the human figure and render them in photorealistic images. Leonardo's advice to painters is to "be sure you know the structure of all that you then wish to depict". (Clark 213) As Leonardo progressed in his anatomical studies he realized that a complete investigation would include a study of the body from babyhood to old age and must even include a study of the fetus in various stages. Through this intense observation he gained a greater understanding of the natural forces that are behind life. His advanced methodology was far beyond others of his time. His comparisons of anatomy hint at a theory of evolution (Clark 216). Also his drawing of shells which he found in the mountains and a side note questioning how they got there (Clark 218) indicate a bewildered and inquisitive thought process removed from the cultural expectation of accepting a religious doctrine, most notably Christianity as described after the great schism.

In both science and art, man affirms his mental scheme. Both have a limited influence from accident. In the notebooks he combined the study of structure along with portrayal of function. He never separated structure from function in his thinking. Leonardo often stated that experience in anatomy can only be obtained by dissection. (Elmer Belt 6) Before Leonardo, scientifically accurate drawings were limited to six figure studies or schematic pictures. In addition to human anatomical drawing Leonardo expanded the idea of botanical illustration to include studies of the plant striving and emboldened with life compared to the static illustration of antiquity. Leonardo succeeds in showing the form in quick, violent, and dramatic motion. The

realistic depiction is the pinnacle of the Renaissance motive and accomplishment focusing of the revival of ancient Roman and Greek traditions.

The visual and semantic organizational methods Leonardo used were at his time unknown to human kind. Leonardo wanted to demonstrate visually how things operated as whole. Leonardo dictated in his notebook that he sought to scrutinize observable 'effects' in a way as to comprehend their basic 'causes', 'reasons', or 'principles'. (Kemp 3) His use of muscle groups and the visual diagramming is the first of its type and the first to use this method of illustration at all. (Elmer Belt 16) Within the drawing he came up with a nomenclature system for muscles and bones structures and their interactions. (Elmer Belt 20) He illustrated for the first time the proper double curvature of the spine, the true tilt of the pelvis, and the proper number of vertebrae, actually portraying each, especially those of the cervical spine and sacrum. (Elmer Belt 13) In addition, he was the first to accurately show the bones of the hand. Leonardo was the first artist who is known to have advanced beyond the anatomy of flayed bodies and to have carried out studies into deeper muscles and thoracic and abdominal viscera. His scientific curiosity and advanced drawing skills allowed him to produce a phenomenal visual analysis of his experiences. The medium of the drawings differ. Often there is a correlation to the mediums used for the anatomical drawings to those he was using for other art produced during that time period. Leonardo often renders things in a young and old motif. This could be based off of his observation methods and opportunities keeping him in touch with the change of time.

The anatomical drawings uncover cultural stigmas of the time. Examples include the idea that breast cancer comes from retained breast milk and sperm originates in blood (Elmer Belt 46). It was also thought that different food produced different blood and therefore different children. (Elmer Belt 47) Leonardo described the blood vessels of the body as constantly

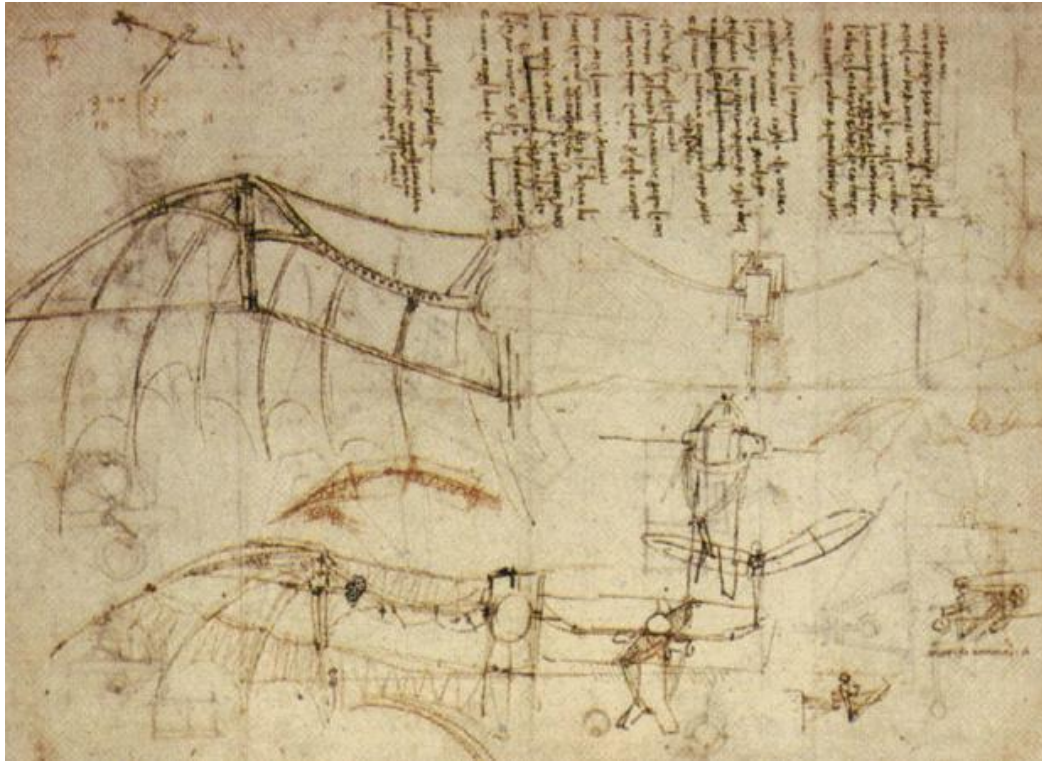
diminishing by division to the size of a hair, he was the first to use the word capillary to describe these hair-like structures meaning too fine to see. Ultimately, he was unable to attain a complete understanding of the human body in part because of the lack of others interested in this same avenue of inquiry and his lack of understating of the circulation and oxygenation of blood through the lungs. Leonardo would often interchange the parts from animals into the drawings of humans. The drawing of the fetus in uteri shows the uterus of a cow. (Elmer Belt 19)

The use of limbs and their possibilities was to Leonardo a mechanical performance worthy of study. (Elmer Belt 4) He studied the bat wing intensely for his flight mechanism, see image 1. Also evident of his ability to absorb and desire to learn, Leonardo copied manuscripts of others into his notebook, this is evidence of his commitment to self-education and that the writings of which he studied may have only been available in manuscript as was common in the quattrocenno. The additional manuscripts copied by Leonardo are valuable for understanding the Renaissance and the products of that time.

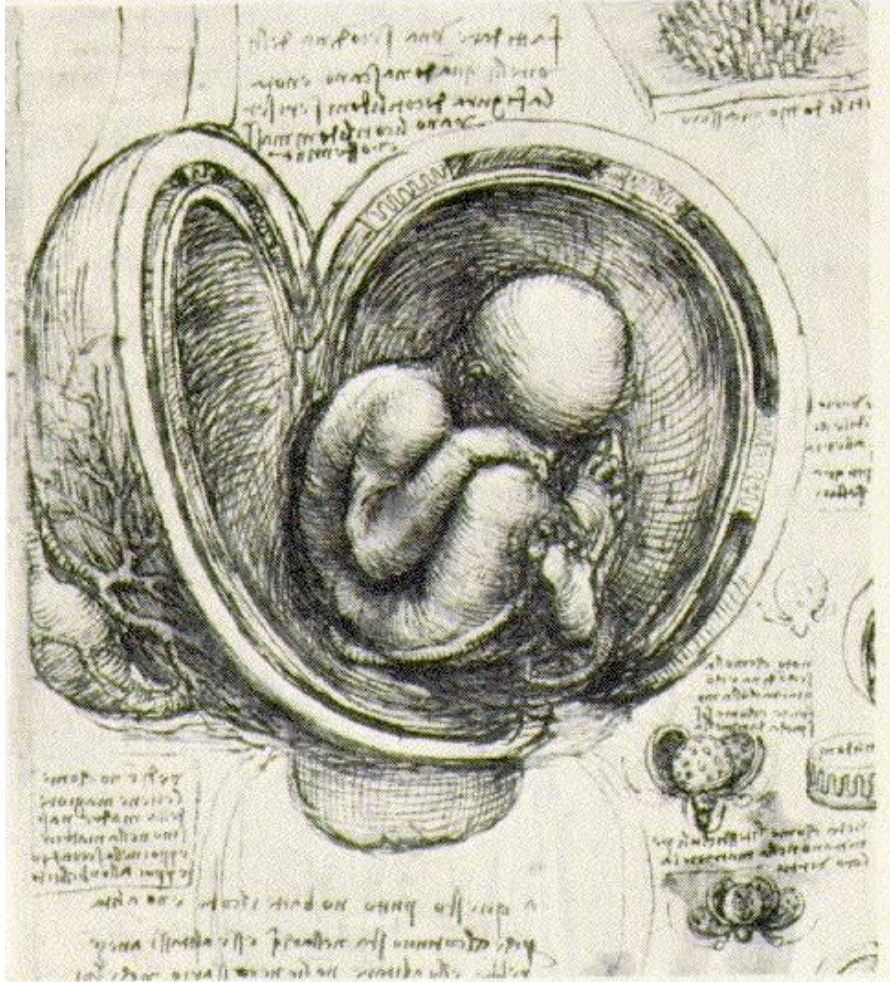
Overall, the impressive presentation of content and visual diagrams is only the obvious benefit of the notebooks of Leonardo da Vinci. After learning of the latent possibilities of the notebook, another aspect of the known genius of Leonardo da Vinci is exposed and available for further integration into human knowledge. The schematics and organization of the notebooks and the information within is perhaps the most understated revolution that if realized at the time may have hastened the development of scientific classification. This paper mentioned a few of the extraordinary entries of the notebook that I uncovered within reading and researching about Leonardo as an anatomist, botanist, and sheer innovator. Because much of his work is visual, it must be considered that the ability to convey ideas and information visually is exactly what Leonardo mastered as he continued his studies. On the other hand what was conveyed visually

was as innovative as the representational technique itself. In conclusion, many aspects of Leonardo da Vinci are ingenious and will be marveled for a long time to come.

Images:



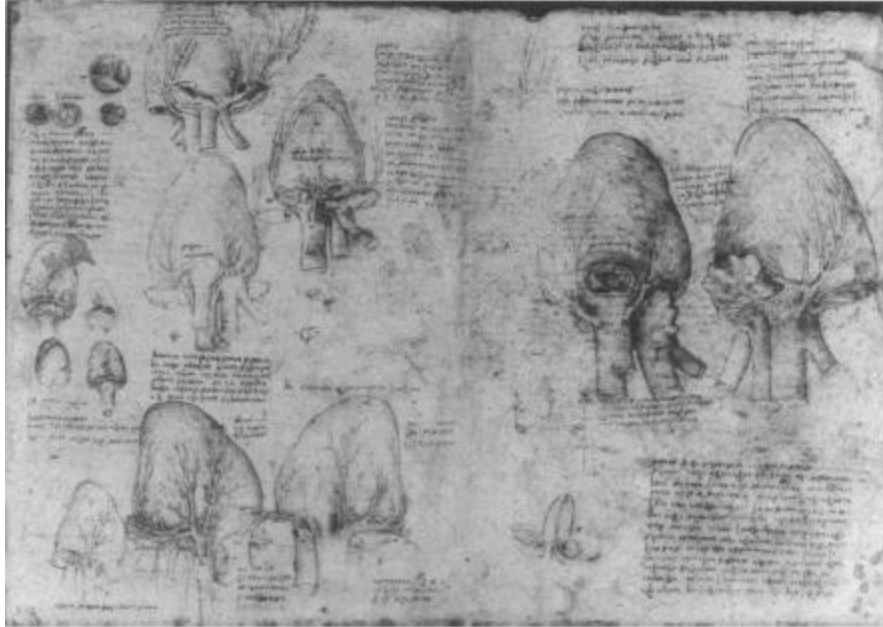
[Image 1]



[Figure 2]
Leonardo da Vinci
Representations of human fetus at term



[Figure 2.1]
Leonardo da Vinci
Representations of human fetus at term



This image shows the first known drawing of coronary arteries.

[Figure 3]

Leonardo da Vinci

Mechanism of the ventricle and heart

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