Leonardo's Life: A timeline of genius
The OpenLearn Team (The Open University) (2008)

1452

Private life

Leonardo da Vinci was born on Saturday 15th April at 10.30 pm in Anchiano, Vinci, a small town just outside of Florence. He was the illegitimate son of 25year-old ser Piero Fruosino di Antonio da Vinci (a notary) and a country girl, Caterina.

The illegitimate nature of Leonardo's birth, did not appear to have carried with it social stigma, with the exception that some professions would have been closed to him. He was a welcomed child and was raised in his father's house, who married another woman.

1460

Leonardo moved to Florence (see Florence), with his father.

Florence

In the 14th Century, Florence had been a city in decline. It had seen wars, civil uprisings and political conspiracies. However, in the 15th century it grew to become the most prosperous Italian city and the European capital of the Arts. Florence became wealthy through its commercial enterprises, based on silks, textiles, metalworking and banking. Politically, power was held by those responsible for the city's wealth; the merchants, manufacturers and bankers.

Florence also became renowned for its tradition of liberty and humanist (see Humanism) learning.

A number of its chancellors were scholars, who advanced the concept that learning could be applied to the running of public affairs. It was a city famous for its financial and political shrewdness and its exceptional craft skills. These factors gave the people of Florence a renewed confidence and belief in their city.

The famous banking family, the Medicis, seized power in 1434, marking the beginning fifty year rule. With their wealth and influence, the Medicis encouraged a vibrant exchange of intellectual, artistic, political and philosophical ideas, which enabled Florence to enjoy a period of unrivalled cultural activity.

Cosimo Medici was patron to Brunelleschi, Donatello, Fra Angelico and Fillippo Lippi. Brunelleschi's stunning dome of the cathedral dominated the city's skyline. The cathedral itself was surrounded by impressive public buildings and the palaces of wealthy Florentine families. These families competed with each other to secure the finest artists to work for them (see Patronage). Cosimo's grandson, Lorenzo, continued this patronage, encouraging a great flourishing of art, music and poetry.

Humanism

Humanism was the great intellectual movement of the Renaissance. Humanists rediscovered Greek or Latin classics, believing them to contain the lessons individuals needed to lead a moral and purposeful life. From this "rebirth" or "renaissance" of the ancient classical world, humanists developed a new, disciplined classical scholarship. In antiquity these disciplines were called "artes liberales" or"liberal arts". These were considered to provide the knowledge and skills which would enable an individual to be free, to determine for themselves, truth and falsehood. Humanist philosophy emphasised the dignity of humanity. Humanists developed their own view of theology, some believed the message of Christianity could be learnt by any educated person who studied the Bible.

Patronage

The 'ideal' patron of the arts is someone who financially supports an artist and purchases their work. However from the very earliest days of patronage, works of art were regarded as either items for use, or as a display of wealth, designed to enhance the prestige of both patron and artist.

Historically wealthy individuals or communities endeavoured to employ the finest craftsmen to work for them. As early as the 14th Century, Giotto found patrons who not only engaged him as recognition of his fame, but also considered that his presence in Florence would enhance the prestige of their city.

Ambitious popes of the 15th and early 16th Century tried to impress upon artists the power of their religious positions and the following they commanded, to secure artists to work

for them. Pope Julius II was notable for his desire to return Rome to its former imperial grandeur. Famous artists such as Bramante, Michaelangelo and Raphael worked for him.

In the Northern states, King Francis I of France employed Leonardo and Cellini, while Emperor Maximilian engaged Durer and Burgkmair. In England, King Henry VIII employed Holbein and Torringiano. Such rulers also wanted to be seen as enabling the arts to flourish under their patronage, thus enhancing their reputations.

1469

Leonardo became an apprentice in the workshop of the great Florentine sculptor and painter Andrea del Verrocchio (c. 1436 -88). His apprenticeship followed the established training of grinding and mixing paint pigments, the mixing of colours, studying their uses and preparing panel surfaces. He made studies of nudes and draped models in preparation for pictures and statues. He studied geometry, optics and perspective and also learnt the technical skills of foundry and metalwork.

1470 - 1473

Verrocchio was commissioned to paint ***Baptism of Christ***. This is the first evidence of a Leonardo painting, on which he assisted while still in Verrocchio's studio. He painted the angel on the extreme left of the picture. Verrocchio painted in tempera, Leonardo in oil.

Tempera was an ancient painting medium using a mixture of coloured pigments, egg yolk which acted as an adhesive and water. The fifteenth century saw the introduction of paints with an oil base and at the time of Leonardo, was relatively innovative.

1472

After his three year apprenticeship, Leonardo was admitted as a member of the Painters Guild of Florence. Although this meant that he was now able to undertake his own commissions, he chose to remain in Verrocchio's workshop.

1476

Private life

Leonardo was anonymously accused, along with three others, of committing sodomy with Jocopo Salterelli (a 17-year-old part-time model in Verrocchio's studio). The case was dropped, due to lack of evidence and possibly due to the fact that co-accused Lionardo Tornabuoni was the son of a Medici. The Tornabuoni family were also patrons of Verrocchio.

Military

Despite calling war "beastly madness" Leonardo designed some of the most formidable weaponry of his time. His notebooks display numerous sketches of military weaponry and plans for fortifications.

He was able to observe the many armourers' workshops and arsenals in Florence, which stimulated his ideas on improving existing weapons and designing new ones.

Leonardo's approach to weapons design was distinct, and followed his overall design philosophy; to organise, assemble and mechanise a particular activity. His goal was to devise a single machine, where previously several were needed, to achieve the same results.

Milan had a long history of arms specialism, producing the highest quality traditional weaponry of the time. Many of Leonardo's designs were, however, unique and it was the uniqueness of his machines that he promoted. The social standing of a military engineer during the Renaissance was highly regarded, providing not only political, but also military prestige to those who engaged them.

City states

In the 15th Century what is now Italy was divided into many small independent states, which were ruled in various ways. In the South, Naples was ruled by a series of kings. The middle part of Italy was ruled by the Popes of the Roman Catholic Church. Northern Italy was ruled by powerful families who controlled the richest and largest city states such as Milan, Venice and Florence. In a climate of continual power struggles, these city states fought wars against each other and military weaponry played an important role.

1481

Military

In 1481, Leonardo wrote a fascinating letter to Ludovico Sforza, later to become Duke of Milan. This letter, aimed at obtaining work at Sforza's court, reads like a Renaissance CV, but it is Leonardo's emphasis on his military skills which makes this document so remarkable. He notes, almost as a postscript, that he is also a painter and sculptor, able to create an equestrian bronze sculpture, which is to be commissioned.

"Most illustrious Lord, having by now sufficiently considered the experience of those men who claim to be skilled inventors of machines of war, and having realised that the said machines in no way differ from those commonly employed, I shall endeavour, without prejudice to anyone else, to reveal my secrets to Your Excellency, for whom I offer to execute, at your convenience, all the items briefly noted below.

I have a model of very strong but light bridges, extremely easy to carry, by means of which you will be able to pursue of if necessary flee an enemy; I have others, which are sturdy and will resist fire as well as attack and are easy to lay down and take up. I also know ways to burn and destroy those of the enemy.

During a siege, I know how to dry up the water of the moats and how to construct an infinite number of bridges, covered ways, scaling ladders, and other machines for this type of enterprise.

If by reason of the height of the banks or the strength of the place and its position, it is impossible when besieging a place, to avail oneself of the plan of bombardment, I have methods for destroying every rock or other fortress, even if it were founded on rock.

I have kinds of mortar; most convenient and easy to carry; and with these I can fling small stones almost resembling a storm; and with the smoke of these cause great terror with the enemy, to his great detriment and confusion.

I know how to use paths and secret underground tunnels, dug without noise and following tortuous routes, to reach a given place, even if it means passing below a moat or a river.

I will make covered vehicles, safe and unassailable, which will penetrate enemy ranks with their artillery and destroy the most powerful troops; the infantry may follow them without meeting obstacles or suffering damage.

In case of need, I will make large bombards, mortars, and fire-throwing engines, of beautiful and practical design, which will be different from those presently in use.

Where bombardment would fail, I can make catapults, mangonels, trabocchi, or other unusual machines of marvellous efficiency, not in common use. In short, whatever the situation, I can invent an infinite variety of machines for both attack and defence.

And if battle is to be joined at sea, I have many very efficient machines for both attack and defence; and vessels that will resist even the heaviest cannon fire, fumes and gun-powder.

In peacetime, I think I can give perfect satisfaction and be the equal of any man in architecture, in the design of buildings public and private, or to conduct water from one place to another.

I can carry out sculpture in marble, bronze, and clay; and in painting can do any kind of work as well as any man, whoever he be.

Moreover, the bronze horse could be made that will be to the immortal glory and eternal honour of the lord your father of blessed memory and of the illustrious house of Sforza.

And if any of the items mentioned above appears to anyone impossible or impractical, I am ready to give a demonstration in your park or in any other place that should please Your Excellency - to whom I recommend myself in all humility, etc.

1480 – 1482
Military
Eight-barrelled organ

Sketches of the eight barrelled organ (or gun) appear in the Codex Atlanticus and are dated between 1480-1482. Leonardo designed a fan-shaped formation of small calibre gun barrels. The barrels were supported on a single wheel carriage and would have achieved a longer firing range and greater accuracy of adjustment than traditional guns. The gun carriage itself, despite holding eight barrels, wasn't large or cumbersome, and would have enabled quick manoeuvrability in battle.

Thirty-three-barrelled organ

Sketches from the same Codex reveal plans for another of Leonardo's multi-barrelled artillery weapons, a machine gun capable of firing from thirty-three barrels. The barrels were designed to fire in sets of eleven, which were supported on a single revolving structure. The designs stipulate that when the first row of eleven barrels had been fired, the second and third rows of eleven barrels could be loaded. These were hinged to the framework so that they swung upwards for loading. Once loaded, the barrels would have been held in position with a metal bar fitted with wooden pins.

It is unclear from the codices if either of these weapons were ever built.

Art

The ***Adoration of the Magi*****,** was intended for the Monastery of Saint Donato a Scopeto near Florence, but it was left unfinished when Leonardo left for Milan.

The painting displays a crowd of people, some on horses, surrounding the Virgin and Child. The staircase of a ruined palace looms in the middle distance and a procession of people advance to join in the worship. To the far right of the picture stands a shepherd boy, which is thought by some to be the only self-portrait of a young Leonardo, based upon a bronze statue for which he modelled for his master, Verrocchio. The ruins have been thought to reflect the demise of paganism after the birth of Christ.

In terms of composition Leonardo focused attention on the central group, despite the animated crowd around them, using light, space, line and gesture.

The ***Adoration of the Magi*** is a highly ambitious painting, where Leonardo attempted to portray not only an intricate and crowded scene, but also delved into a study of human emotion. In this painting Leonardo displayed his interest in the complexity of human nature and anatomy. He was so intent on a true physical representation of his figures that he painted his figures nude first and then dressed them.

In order to paint a true narrative representation of the event, Leonardo returned to the Bible to study his vision of the original story.

There remain more preparatory sketches and drawings for this painting than for any of Leonardo's other works, one of which is based entirely on mathematically accurate perspectivei norder to create a convincing illusion of space. In these, Leonardo grappled with the final composition, drawing the figures in a multitude of forms. He also completed numerous studies for the horses, experimenting with different positions and placement.

1485
Flight
Parachute

Leonardo was the first known inventor of a parachute. His drawings show a pyramid-shaped linen canopy, which was about seven metres wide and equally deep, if held open firmly.

He concluded anyone could jump from any height without any risk at all. It is not known if Leonardo ever tested his design, however, modern parachutists have recreated his invention and tested it by leaping from a moving aircraft. It worked.

Aerial Screw (helicopter)

Leonardo's sketch of the Arial Screw was made while he was in Milan, between 1483-1486 and was part of a series of machines focused on mechanical flight. Some have likened his sketches of the Aerial Screw as a version of the modern-day helicopter.

The design had a diameter of 5 metres, and the proposed materials were wire, linen and reed. It is assumed that it would have been operated by four men standing on the central ledge, with their hands appliying pressure on the bars in front of them, enabling the shaft to turn.His notebook also contained sketches for a paper model of a screw, which would be propelled upwards using a coiled spring placed around the screw's base.

Leonardo's sketch, was not designed as an actual flying machine but as a study of a propeller's efficiency. However, he appears to be suggesting in his notes that, in principle, if constructed in a larger size and given enough power, the Aerial Screw could have lifted from the ground.

1485 – 1487
Military
Giant crossbow

Whilst Leonardo was renowned for his innovation for new forms of military weapons, now regarded as incredibly advanced for his time, much of his work focused upon improving traditional weaponry design, adapting them to work more effectively. An example of this was his work on a giant crossbow, which was intended to fire large arrows into enemy lines. The enormous bow was designed to be made in a number of sections which would increase not only the force of the arrow but would also enable flexibility of movement. In the design, a rope was stretched by a mechanical device and released by lever action. To provide firing stability, the six carriage wheels that supported the crossbow could be inclined.

1487
Military
Armoured car (tank)

One of Leonardo's most famous military designs was an armoured car, sometimes referred to as a tank. It had a tortoise-like shape with a framework that was reinforced with metal plates. It had an inner turret armed with guns and it would have been powered by either horses, or by men, using a crankshaft to turn the wheels. Leonardo favoured the use of men, fearing that horses may panic in the midst of battle. The guns could be fired through slits in the upper parts of the metal armour.

Sketches for the armoured car can be dated to 1487 and appear in the Codex Arundel.

Deep-sea diving suit

Leonardo's sketches for a leather diving suit can be found in the Codex Atlanticus. In them, he proposed that cane hoses would be attached together using leather joints, allowing the diver to breathe. To prevent the joints being crushed by underwater pressure, steel spirals would reinforce the leather. A floating mechanism was designed to hold tubes in place, above the water to avoid obstruction of the air flow.

Leonardo clearly anticipated the diver would be able to remain under water for some time, as the suit was not only provided with a plentiful air supply, but was also furnished with a urinating facility. This took the form of a sealed leather bag, operated by a valve. The diver was also equipped with sandbags for ballast, rope, a knife and horn which was used to signal when the underwater work was completed.

Art

Leonardo's diagram ***Vitruvian man'***, illustrates a passage in the book '*De Architectura'* by the Roman architect Virtruvius, who wrote in the 1st Century BC. '*De Architectura'* covered both the theory and practice of building, and was the only technical treatise of its kind to have survived from antiquity. It became essential reference material for Renaissance architects. In some of Leonardo's studies of proportions, his measurements are based on Vitruvius' treatise, with the face being the tenth part of a man's complete height.

In ***Vitruvian man***, Leonardo illustrated the classical formula devised by Vitruvius, demonstrating the proportions of the human body. He showed that it fits perfectly into a square or circle, as described by Vitruvius:

> *'The navel is naturally placed in the centre of the human body and if a circle is described round a man lying with his face upwards and his feet are extended, it will touch his fingers and his toes. It is not only by a circle that the human body can thus be circumscribed, as may be seen by placing it within a square, for if we measure from the feet to the crown of the head and then across the arms fully extended, we shall find the latter measure equal to the former, so that the lines at the right angles to each other, enclosing the figure would form a square'.*

Renaissance architects regarded this human geometry and the human body as the 'noblest living form', seeing it as a model for the wider universe, the basis upon which the wider world could be constructed.

Anatomy

Through his notebooks and works, it is evident that Leonardo showed great interest in the subject of anatomy, at different stages during his lifetime. His first anatomical sketches date from c1487.

His drawings of the human body, while stunningly artistic, are also scientific observations. They record in superb detail, not only appearance, but also function. Leonardo saw the human body as a mechanism. He aimed to demonstrate the close analogy between the human body and the machine, regarding them both as great achievements of nature.

Leonardo's fascination with how the human body worked, and his need for artistic accuracy, inevitably led to an active interest in dissection. He dissected about 30 cadavers at a time when human dissection was rare. In doing so, Leonardo was able to examine every part of the human body and explore its mechanics, paying particular attention to the muscles (see Myology).

He made plaster casts of the cavities of the heart and brain, using the lost-wax method. This involved filling the cavities with molten wax to discover their true shape. Once the wax was set, and removed from the cavity, a plaster cast was built around it. The wax was then melted and poured off to leave a mould. From the mould, a copy of the original cavity could be created in plaster.

Leonardo was the first person to demonstrate the correct tilt of the pelvis and shape of the spine. He was also the first artist to correctly draw many aspects of female anatomy, for example, the uterine artery and vascular system of the cervix and vagina.
In the 15th Century it was commonly believed that the uterus was made up of different sections. In the case of multiple births, it was thought that each foetus grew in a different section. Leonardo dispelled this belief with a drawing of a single chambered uterus.

He also disproved the belief that the heart was the source of the body's 'vital spirit' and was, in fact ,another muscle. Whilst observing pigs being slaughtered, he noticed that the beat of the heart coincided with the movement of blood in the main arteries.

The first sign of Leonardo's interest and knowledge of anatomy in painting, and in particular the anatomy of the muscle, is seen in his painting of St. Jerome, painted in his youth. There is a particular emphasis and detail of St. Jerome's neck and shoulder. While contemporary artists limited their studies to superficial representation of anatomy in their figures, Leonardo searched more deeply into the human body.

1487 – 1490

Flight

The myth of Icarus fascinated Leonardo, who explored the art and science of flight at different times of his career. Throughout his career, he explored the art and science of flight. At least nine of his notebooks contain evidence of his research into flight. In one he wrote a treatise on aviation and studies on the flight of birds. In Florence between 1487 - 1490 he created designs for fabulous flying machines, incorporating birds' wings into his drawings. He began to integrate concepts of mechanics, engineering, physics, aeronautics and anatomy into

his ideas of flight. Extensive research led him to design several types of flying machines, including what we know today as a parachute, glider and a type of helicopter.

1489

Art

In 1489 Leonardo received the Sforza commission, to cast the largest equestrian statue ever, in honour of Ludovico's father. It was designed to stand over seven metres high, twice the size of the largest existing equestrian statue. Leonardo drew many studies for the statue and made a full-scale clay version.

1490

Personal life

In 1490 Leonardo meets and adopts Gian Giacomo Copotti da Oreno, a 10-year-old boy, who became his apprentice and life-long partner. It wasn't unusual for the time for apprentices to be formerly adopted by their tutors.

His apprentice was poorly behaved, to the extent that Leonardo nicknamed him "Salai", which was short for Salaino or "little devil". There is speculation amongst scholars that Salai was Leonardo's homosexual lover, but Leonardo may not have practised sex at all, as his writings about the penis show amusement and disdain for sexual practices.

1494

In 1494 King Charles VIII of France invaded the Italian peninsula, throwing the city states into the turmoil of war. The 66 tons of bronze which had been set aside to cast the statue was sent instead to Ferrara to make cannons for the war against France.

The clay cast for the statue was known as Il Colosso. It was displayed at the wedding of Bianco Sforza to great acclaim, but was later destroyed by French soldiers who used it for target practice.

1495 – 1497

Art

In 1495 Leonardo began work on ***The Last Supper.*** This fresco covered a wall of a rectangular dining hall of a Milanese monastery - Santa Maria delle Grazie. It is not known who commissioned the painting. Ludovico Sforza is the most likely patron, as his initials appear above the fresco*, SA Sforza Angelicus* - (he changed his name, adding the Angelicus as he believed himself to be descended from angels).

The painting appears to be another table in the dining room, and this effect was perhaps a deliberate device by Leonardo. The representation of Christ and the Apostles, being so close to the viewer, creates the illusion that they are present at the monks' meal.

The Last Supper is remarkable for other reasons. In traditional paintings of this subject, the Apostles were usually shown in a row, seated in silence, with Judas separated from the others. Leonardo's painting represents a break with this form. He returned to the Scriptures, hoping to create a pictorial representation of the scene described. As a result, Leonardo's ***The Last Supper*** has a sense of drama and movement not before seen in this subject.

Despite the sense of activity, harmony is achieved in its composition, with the Twelve Apostles seen in four groups of three, although they also appear also unified through their outstretched arms. An eye-witness account of Leonardo creating ***The Last Supper*** reported that he would stand there for the whole day, just thinking, not painting a single stroke. It was completed in 1497 and was a critical success within months.

In traditional fresco painting pigment is mixed with water and painted onto wet plaster. As they dry, they fuse together permanently. Leonardo, however, used oil mixed with varnish, and painted onto what he considered to be dry plaster. The plaster, however, was still wet, and the work soon began to deteriorate. Even during Leonardo's lifetime, this great painting was beginning to fade.

1517 - decay visible
1556 - Vasari notes it has become a mass of blots
1652 - doorway enlarged through painting
1726 - restored
1770 - restored
1821 - restoration
1903-08 - restoration
1924 - restoration
1943 allied bombs destroy most of refectory
1947-52 restoration
1976 restoration

1499
Military

In 1499 the Duke of Milan fell from power. Leonardo abandoned Milan and returned to Florence.

1500
Flight
Glider

Leonardo observed that sustained flight was more likely to be achieved imitating the flight of birds, rather than by using human-powered wing movement. His subsequent research led to designs for a glider. Drawings show the wings as bat-like in shape and structure,

streamlined to their most basic form. Attached directly to the body of the pilot, the outer parts of the wing were flexible. These could be moved by the pilot by using handles connected to a cable. The inner part of the wing remained fixed. Leonardo created this design having noted how birds' wings functioned; the inner part of their wings move more slowly than the outer part. He concluded from his observations that the function of birds' wings were not to propel it forward, but to sustain flight.

1502

1502 saw Leonardo appointed as Military Engineer to Cesare Borgia on his campaign to central Italy. While in this post he was able to inspect fortresses. He also saw the Romagna campaign.

1503 – 1507

Art

In 1503 Leonardo rejoined the Guild of Painters in Florence. In the same year he began painting the ***Mona Lisa*** (*La Gioconda*), who is believed to have been the wife of a wealthy Florentine, Francesco del Giocondo.

It is a painting which is striking in its realism, as though she is a living being and we are absorbed by the mysterious nature of her expression.

In the *Mona Lisa* Leonardo superbly demonstrated his understanding of the way the human eyes move and the way in which we see images. By observing how the eyes focus, he developed a painting style that imitated the working of the human eye. He realised that if the outlines of a painting were not drawn so acutely and instead were blended into the shadow, a more realistic image could be achieved. It was this technique, called 'Sfumato' which was Leonardo's great artistic invention. This technique can be seen in the *Mona Lisa*, where Leonardo has merged the corners of her mouth and eyes softly into the rest of her face. It is this quality which gives such ambiguity to her expression.

It's also interesting to note the detail that Leonardo paid to the landscape background of the painting. When examining the horizon line behind the *Mona Lisa*, it becomes obvious that the two sides are unequal. The horizon on the right appears higher than that on the left, making the *Mona Lisa* seem more upright on her right, while her left appears to lean more into the background. Although the landscape now looks dark and mysterious, infra-red photographs show the delicacy and lightness with which it was originally painted.

1513

Anatomy

Ten years after his initial research into anatomy, Leonardo returned to the subject. But this time he used his research into mechanics. He analysed the body's movements as semi-articulated joints, based upon the laws of the lever. He believed that every anatomical structure had a specific function and drew extensive three-dimensional sketches.

Leonardo was exhaustive in his anatomical research. He went on to dissect more cadavers during this period, searching for knowledge and understanding of the mechanics of the human body. His research extended into the respiratory, urogenital and cardio-circulatory systems. He saw them as networks and regarded the human body as the 'ultimate machine'. His sketches, as a result of his studies, were much more advanced than his drawings a decade previously.

Myology - the study of muscles

Leonardo's study of muscles constitute some of his strongest and most famous sketches. They set him apart in the history of art and anatomy in that they are original and startlingly unique. Not all his sketches are accurate. But the scientific application of his knowledge of engineering, mechanics and architecture to the function of muscles and their physiology, provided the analytical basis for generations to come. His interpretative drawings are as much a study of thinking as they are of anatomy.

Leonardo made significant advances in myology between 1505 and 1510 when he gainer wider access to human cadavers. His methodology laid the groundwork for anatomists to come, drawing muscles and tendons as fine threads, in order to show how they attached to the bone. He was the first to provide reasonably accurate representations of virtually every muscle in the human body. In studying how muscles move he was able to prove the relationship between them: that every movement of muscle is accompanied by a reciprocal or corresponding action on the part of a nearby muscle. He largely saw the movement of the body in terms of engineering and mechanics. Joints and tendons were compared to hinges and winches, the muscles and bones to levers and gears in a mechanical device. Leonardo was also the first anatomist to show the double curvature of the spine, the tilt of the pelvis and the correct number of vertebrae.

1507

In 1507 Leonardo met Francesco Melzi, a Milanese gentleman who became his pupil. He became one of Leonardo's lifelong companions.

1510-1513
Anatomy
Respiratory system

Between 1510 and 1513 Leonardo researched the respiratory systems of animals and made his conclusions fit humans. He was especially interested in the larynx (Leonardo himself being an accomplished musician and singer), but he failed to notice the vocal chords.

Alimentary system

Leonardo was the first to accurately represent the large and small intestine and their proper relationship to one another. Alimentary tissue deteriorates very quickly and, as a result, is particularly hard to inspect upon dissection.

Embryology

Leonardo showed there was no direct connection between maternal and foetal placental blood vessels. At the time, it was believed that a woman's uterus contained several internal chambers, a theory which was used to explain multiple births. Leonardo, however, was able to show that a womb had only one chamber. It's interesting to note that one of Leonardo's most famous drawings, that of an unborn baby in a uterus, contains an anatomical anomaly. The placenta drawn is that of a cow, not of a woman. It is thought this is due to Leonardo being unable to have access to a pregnant cadaver.

The established belief also held was that sperm originated in the spinal column, but Leonardo was able to show that it came from the testicles. He also showed that, contrary to popular belief, men and women were both progenitors of their children's characteristics, and not one or the other. He was the first to make accurate measurements of the foetus and to determine its rate of growth.

1513

Cardio-vascular

Although Leonardo had no professional working knowledge of the circulation of the blood, his drawings of hearts were consistent. It is believed that he gained his knowledge of the organ from his observations in 1513, when he examined ox hearts. He also studied pigs being slaughtered and noticed that the beat of the heart coincided with the movement of blood in the main arteries.

He disproved the belief that the heart was not a muscle and showed that the human heart consists of four chambers (the left and right atrium and ventricle) and not two, as was commonly held. He rejected the idea that the heart was the centre of 'innate heat', arguing that the body's heat came from the movement of blood moving within veins and arteries.

He gained enough knowledge through his dissection work to be able to make a glass model of a heart. This allowed closer examination, not only of its structure but also of its workings. He also rejected the accepted belief of the time that the kidney was responsible for the circulation of the blood. He diagnosed arteriosclerosis from a dissection of a cadaver, concluding that the veins had absorbed too many nutrients from the blood.

Personal life

Leonardo moved to Rome at the invitation of the newly elected Pope Giuliano dei Medici.

1513 – 1516

Art

St John The Baptist was not one of Leonardo's most popular or admired paintings. Saint John was a character who lived in the desert, surviving on a diet of locusts and honey and was usually portrayed as gaunt and wiry. So the androgynous portrayal of Saint John, with a womanly arm drawn across his breast and the same mysterious smile as the Mona Lisa, was disturbing to some.

It was painted late in Leonardo's life and it reflects his state of mind. The strong narrative that is so often present in Leonardo's paintings appears here to have given way to a more mystical quality. It's a philosophical work. The finger pointing upwards appears to be indicating the mystery of life, suggesting a world beyond the figure. The divine truth of geometry and mathematics disappears and only mystery remains.

It has been suggested that this painting is a portrait of his assistant Salai, but no evidence remains to either prove of disprove this speculation. At the time the painting sold for 404 lira, which in today's money would be approximately £80,000.

1517

In 1517 Leonardo moved to France at the invitation of the King, Francoise I. He was granted the post of First Painter, Engineer and Architect of the King. Leonardo, and his pupils, Francesco Melzi and Giocomo Salai moved into the chateau of Cloux near Ambroise.

1519

Leonardo died on 2nd May at Cloux, just a few weeks after his 67th birthday. He was originally buried in the Church of St Valentine at Amboise. In his will he left all his manuscripts, drawings, instruments and tools to his pupil, Francesco Melzi. To his other pupil, Salai, he left the paintings in his studio. Among these painting was the Mona Lisa.