

General Overview – Source: Museum of Science

The illegitimate son of a 25-year-old notary, Ser Piero, and a peasant girl, Caterina, Leonardo was born on April 15, 1452, in Vinci, Italy, just outside Florence. His father took custody of the little fellow shortly after his birth, while his mother married someone else and moved to a neighbouring town. They kept on having kids, although not with each other, and they eventually supplied him with a total of 17 half sisters and brothers.

Growing up in his father's Vinci home, Leonardo had access to scholarly texts owned by family and friends. He was also exposed to Vinci's longstanding painting tradition, and when he was about 15 his father apprenticed him to the renowned workshop of Andrea del Verrochio in Florence. Even as an apprentice, Leonardo demonstrated his colossal talent. Indeed, his genius seems to have seeped into a number of pieces produced by the Verrocchio's workshop from the period 1470 to 1475. For example, one of Leonardo's first big breaks was to paint an angel in Verrocchio's "Baptism of Christ," and Leonardo was so much better than his master's that Verrocchio allegedly resolved never to paint again. Leonardo stayed in the Verrocchio workshop until 1477 when he set up a shingle for himself.

In search of new challenges and the big bucks, he entered the service of the Duke of Milan in 1482, abandoning his first commission in Florence, "The Adoration of the Magi". He spent 17 years in Milan, leaving only after Duke Ludovico Sforza's fall from power in 1499. It was during these years that Leonardo hit his stride, reaching new heights of scientific and artistic achievement.

The Duke kept Leonardo busy painting and sculpting and designing elaborate court festivals, but he also put Leonardo to work designing weapons, buildings and machinery. From 1485 to 1490, Leonardo produced a studies on loads of subjects, including nature, flying machines, geometry, mechanics, municipal construction, canals and architecture (designing everything from churches to fortresses). His studies from this period contain designs for advanced weapons, including a tank and other war vehicles, various combat devices, and submarines. Also during this period, Leonardo produced his first anatomical studies. His Milan workshop was a veritable hive of activity, buzzing with apprentices and students.

Alas, Leonardo's interests were so broad, and he was so often compelled by new subjects, that he usually failed to finish what he started. This lack of "stick-to-it-ness" resulted in his completing only about six works in these 17 years, including "The Last Supper" and "The Virgin on the Rocks," and he left dozens of paintings and projects unfinished or unrealized (see "Big Horse" in sidebar). He spent most of his time studying science, either by going out into nature and observing things or by locking himself away in his workshop cutting up bodies or pondering universal truths.

Between 1490 and 1495 he developed his habit of recording his studies in meticulously illustrated notebooks. His work covered four main themes: painting, architecture, the elements of mechanics, and human anatomy. These studies and sketches were collected into various codices and manuscripts, which are now hungrily collected by museums and individuals (Bill Gates recently plunked down \$30 million for the Codex Leicester!).

Back to Milan... after the invasion by the French and Ludovico Sforza's fall from power in 1499, Leonardo was left to search for a new patron. Over the next 16 years, Leonardo worked and traveled throughout Italy for a number of employers, including the dastardly Cesare Borgia. He traveled for a year with Borgia's army as a military engineer and even met Niccolo Machiavelli, author of "The Prince." Leonardo also designed a bridge to span the "golden horn" in Constantinople during this period and received a commission, with the help of Machiavelli, to paint the "Battle of Anghiari."

About 1503, Leonardo reportedly began work on the "Mona Lisa." On July 9, 1504, he received notice of the death of his father, Ser Piero. Through the contrivances of his meddling half brothers and sisters, Leonardo was deprived of any inheritance. The death of a beloved uncle also resulted in a scuffle over inheritance, but this time Leonardo beat out his scheming siblings and wound up with use of the uncle's land and money.

From 1513 to 1516, he worked in Rome, maintaining a workshop and undertaking a variety of projects for the Pope. He continued his studies of human anatomy and physiology, but the Pope forbade him from dissecting cadavers, which truly cramped his style.

Following the death of his patron Giuliano de' Medici in March of 1516, he was offered the title of Premier Painter and Engineer and Architect of the King by Francis I in France. His last and perhaps most generous patron, Francis I provided Leonardo with a cushy job, including a stipend and manor house near the royal chateau at Amboise.

Although suffering from a paralysis of the right hand, Leonardo was still able to draw and teach. He produced studies for the Virgin Mary from "The Virgin and Child with St. Anne", studies of cats, horses, dragons, St. George, anatomical studies, studies on the nature of water, drawings of the Deluge, and of various machines.

Leonardo died on May 2, 1519 in Cloux, France. Legend has it that King Francis was at his side when he died, cradling Leonardo's head in his arms.

Fun Fact

In an era when left-handedness was considered the devil's work and lefties were often forced to use their right hand, Leonardo was an unrepentant southpaw. It has been suggested that this "difference" was an element of his genius, since his detachment allowed him to see beyond the ordinary. He even wrote backwards, and his writings are easily deciphered only with a mirror.

As a scientist

Leonardo the scientist bridged the gap between the shockingly unscientific medieval methods and our own trusty modern approach. His experiments in anatomy and the study of fluids, for example, absolutely blew away the accomplishments of his predecessors. Beginning with his first stay in Milan and accelerating around 1505, Leonardo became more and more wrapped up in his scientific investigations. The sheer range of topics that came under his inquiry is staggering: anatomy, zoology, botany, geology, optics, aerodynamics and hydrodynamics among others.

While greatly influenced by the writings of the ancient Greeks and Romans, Leonardo, unlike many of his contemporaries, saw the limitations of seeking the truth solely in those writings or the Bible. Instead, he took the startling approach of actually observing nature and asking deceptively simple scientific questions like, "How do birds fly?" To finish the bill, he then systematically recorded their solutions in his sketches.

Leonardo certainly had an uncanny ability to observe nature and record it. And to this he added a preternatural, even spooky determination. The first biographer of Leonardo da Vinci, Paolo Giovi, wrote in 1520: "in the medical faculty he learned to dissect the cadavers of criminals under inhuman, disgusting conditions...because he wanted [to examine and] to draw the different deflections and reflections of limbs and their dependence upon the nerves and the joints. This is why he paid attention to the forms of even very small organs, capillaries and hidden parts of the skeleton."

In a study of cervical vertebra shown from different perspectives, Leonardo notes: "[Both] former and contemporary authors have produced written reports [about anatomy] in tormentingly long-winded and confused styles. However, through a concise portrayal from different perspectives, things are described definitively; and to avoid that my gift to mankind could be lost [to time], I teach the technique of reproducing things by printing." These remarks heralded the birth of a new method of scientific study: the systematic, descriptive method of the natural sciences, which was the predominant method of scientific study well into the 19th century.

As his curiosity took him in ever wilder directions, Leonardo always used this method of scientific inquiry: close observation, repeated testing of the observation, precise illustration of the subject object or phenomenon with brief explanatory notes. The result was volumes of remarkable notes on an amazing variety of topics, from the nature of the sun, moon and stars to the formation of fossils and, perhaps most notably, the mysteries of flight

Overview as an artist

Leonardo got his start as an artist around 1469, when his father apprenticed him to the fabled workshop of Verrochio. Verrochio's specialty was perspective, which artists had only recently begun to get the hang of, and Leonardo quickly mastered its challenges. In fact, Leonardo quickly surpassed Verrochio, and by the time he was in his early twenties he was downright famous.

Renaissance Italy was centuries away from our culture of photographs and cinema, but Leonardo nevertheless sought a universal language in painting. With perspective and other realistic elements, Leonardo tried to create faithful renditions of life. In a culture previously dominated by highly figurative and downright strange religious paintings, Leonardo's desire to paint things realistically was bold and fresh. This call to objectivity became the standard for painters who followed in the 16th century.

No slouch when it came to the techniques of the day, Leonardo went beyond his teaching by making a scientific study of light and shadow in nature. It dawned on him that objects were not comprised of outlines, but were actually three-dimensional bodies defined by light and shadow. Known as *chiaroscuro*, this technique gave his paintings the soft, lifelike quality that made older paintings look cartoony and flat. He also saw that an object's detail and color changed as it receded in the distance. This technique, called *sfumato*, was originally developed by Flemish and Venetian painters, but of course Super-Genius Leonardo transformed it into a powerful tool for creating atmosphere and depth.

Ever the perfectionist, Leonardo turned to science in the quest to improve his artwork. His study of nature and anatomy emerged in his stunningly realistic paintings, and his dissections of the human body paved the way for remarkably accurate figures. He was the first artist to study the physical proportions of men, women and children and to use these studies to determine the "ideal" human figure. Unlike many of his contemporaries -- Michelangelo for example -- he didn't get carried away and paint ludicrously muscular bodies, which he referred to as "bags of nuts."

All in all, Leonardo believed that the artist must know not just the rules of perspective, but all the laws of nature. The eye, he believed, was the perfect instrument for learning these laws, and the artist the perfect person to illustrate them.

Overview as an inventor

Artists have always found it difficult to make a living off their art. Even a master like Leonardo was forced to sell out in order to support himself, so he adapted his drawing skills to the more lucrative fields of architecture, military engineering, canal building and weapons design. Although a peacenik at heart, Leonardo landed a job working for the Duke of Milan by calling himself a military engineer and outlining some of his sinister ideas for weapons and fortifications. Like many art school types in search of a salary, he only briefly mentioned to the Duke that he could paint as well.

Lucky for Leonardo, he was actually really talented as an engineer. Good illustrators were a dime a dozen in Renaissance Italy, but Leonardo had the brains and the diligence to break new ground, usually leaving his contemporaries in the dust. Like many crackpot geniuses, Leonardo wanted to create "new machines" for a "new world."

Throughout his life he had brilliant and far-out ideas, ranging from the practical to the prophetic. As military engineer and architect to the notorious Cesare Borgia (son of the Pope!), Leonardo proposed creating a dry route across the Gulf of Istanbul, connecting the Golden Horn and the Bosphorus with a bridge. Alas, like most great ideas, the bridge plan was squelched by those killjoy engineers, who flipped when they found out how big it was supposed to be. Leonardo watchers got the last laugh, though, because modern engineers have determined that the bridge would have been completely sound. Furthermore, they show its construction would have been entirely feasible, proving yet again that Leonardo was the smartest man ever.

Nearly a century before Galileo, Leonardo butted heads with the challenge of measuring time. For him, the most interesting part was the use of mechanical gears, and he studied them with relish (see "Levers and Gears"). Based on the gear, he came up with loads of different thingamajigs, including the bicycle, a helicopter, an "auto-mobile", and some gruesome weapons of course.

The biggest mechanical bee in his bonnet, however, was water. Recall that nobody had harnessed electricity yet, so water was at that point the ultimate source for power. Leonardo studied all forms of water -- liquid, steam, and ice -- and he had all sorts of swell ideas of what to do with it. He cooked up plans for a device to measure humidity, a steam-powered cannon, many different waterwheels, and oodles of useful industrial machines powered by flowing water. He also devised some highly ambitious plans to revitalize Milan with canals, which he intended to implement with some equally ambitious construction machines. In fact, once he started on the subject of water he couldn't really stop, forever envisioning things like floating snowshoes to walk on water, breathing devices (including a diving hood) and webbed gloves to explore underwater, a life preserver to remain afloat, devices to attack and sink ships from underwater, and an "unsinkable" double-hulled ship and dredges for clearing harbors and channels.