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| 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.  |   | musclesOoky AnatomyOne cannot exaggerate the unpleasantness of Leonardo's anatomy studies. Cadavers are already pretty awful, even when refrigerated and pickled in formaldehyde, but Renaissance Italy had no such niceties. Leonardo, in his fervor for knowledge, held countless creepy vigils with the local corpses, and their annoying tendency to decay forced him to work as quickly as possible. He described it as "living through the night hours in the company of quartered and flayed corpses fearful to behold," but as usual his curiosity pushed him ever onwardhead measurements.  |
| 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 Bosporus 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 te 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.  |   | http://legacy.mos.org/leonardo/images/newcrane2.gifLevers and GearsLeonardo recognized that levers and gears, when applied properly, could accomplish astonishing tasks. Gears were at the heart of nearly all his inventions, from the crane to the helicopter to the automatic turnspit.  |
| stone throwerDefense Contractor?Like any rational human, Leonardo abhorred war -- he called it "beastly madness" -- but since Renaissance Italy was constantly at war he couldn't avoid it. He designed numerous weapons, including missiles, multi-barreled machine guns, grenades, mortars, and even a modern-style tank. He drew the line, however, with his plans for an underwater breathing device, which he refused to reveal, saying that men would likely use it for "evil in war." |