**Leonardo da Vinci: Far More Than a Great Artist**

**1** Leonardo was and is best known as an artist, the creator of such masterpieces as *Mona Lisa*, *Madonna of the Rocks*,and *The Last Supper*. Yet Leonardo was far more than a great artist: he had one of the best scientific minds of his time and 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, Leonardo became more and more absorbed in his scientific investigations. The range of topics that came under his inquiry is amazing: anatomy, zoology, botany, geology, optics, aerodynamics and hydrodynamics among others.

**2** 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 only in those writings or the Bible. Instead, he took the startling approach of actually observing nature and asking misleadingly simple scientific questions like, “How do birds fly?” To finish the bill, he then systematically recorded their solutions in his sketches.

**3** Leonardo certainly had a remarkable ability to observe nature and record it. And to this he added an unusually cool determination. The first biographer of Leonardo da Vinci, Paolo Giovio, 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.”

**4** 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 simple and clear description 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 comments foresaw the birth of a new method of scientific study: the systematic, descriptive method of the natural sciences, which was the major method of scientific study well into the 19th century.

**5** 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.

**6** 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 profitable fields of architecture, military engineering, canal building and weapons design. Although against war 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.

**7** Lucky for Leonardo, he was actually really talented as an engineer. Good illustrators werea 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 eccentric geniuses, Leonardo wanted to create “new machines” for a “new world”.

**8** 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 disappointing engineers, who became mad 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 reasonable, proving yet again that Leonardo was the smartest man ever.

**9** Nearly a century before Galileo, Leonardo was absorbed by the challenge of measuring time. For him, the most interesting part was the use of mechanical gears, and he studied them with great enjoyment. Based on the gear, he came up with loads of different thingamajigs, including the bicycle, a helicopter, an “auto-mobile”, and some horrible weapons of course.

**10** What interested him most, however, was water. Recall that nobody had controlled 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 excellent 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 dredgers for clearing harbors and channels.

**莱昂纳多·达·芬奇：怎能以伟大的艺术家一言以蔽之**

1 从过去到现在，莱昂纳多·达·芬奇最为人熟知的头衔是艺术家，《蒙娜丽莎》《岩间圣母》《最后的晚餐》等传世之作的作者。然而他的成就远不止这些：他是他那个时代最具科学素养的人之一，弥合了中世纪极端愚昧的研究方法和我们现代可靠的研究手段之间的鸿沟。举例来说，他所进行的解剖学实验和对于液体的研究横扫前人的一切成就。从初次定居米兰开始，莱昂纳多就对科学研究产生了越来越浓厚的兴趣。他的研究范围之广令人惊叹，涉及解剖学、动物学、植物学、地质学、光学、空气动力学以及流体动力学等等。

2 与同时代的许多人不同的是，莱昂纳多虽然也深受古希腊和古罗马著作的影响，却意识到只从古希腊罗马著作和《圣经》中探究真理有着很大的局限性。他采用与众不同的实地观察大自然的方法，提出诸如“鸟是如何飞翔的”此类看似简单实则不然的科学问题。为了找到答案，他用草图系统地记录下解决方案。

3 莱昂纳多确实拥有观察和记录自然的非凡能力。此外，他有着非同寻常的果敢，甚至到了“冷酷”的地步。第一个为达·芬奇写传记的保罗·焦维奥在1520年写道：“在医学院里他在惨无人道、令人作呕的环境中学习解剖罪犯的尸体，……因为他想（仔细检查并且）画出人的四肢是如何屈伸以及这些动作和神经与关节之间的关联。因此，他对细微器官、毛细血管甚至骨架里隐藏的组织都做了细致的观察。”

4 在一项从不同角度对颈椎进行观测的研究中，莱昂纳多记录到：“当代的作者和之前的作者一样，写出的（解剖学）报告啰唆且混乱，令人抓狂。而从不同视角进行简单明了的描绘，事物就能得到明确的描述。为了避免我对人类做出的贡献（随着时间的流逝）消失了，我来教授如何用复刻的方式再现事物。”这些记录预示着一种崭新的科学研究方法的诞生，即自然科学的系统描述法。这一方法直到19世纪都是科学研究的主流方法。

5 随着莱昂纳多的研究兴趣扩展到越来越广的领域中，他一直使用这一方法进行科学探索：仔细观察，对观察结果反复测试，给目标物体或现象配上精准的插图并加上简要说明。借此他写下了数卷不同凡响的笔记，从太阳、月亮、星球的本质到化石的形成，尤其是对飞行奥秘的探索，涉及的主题范围之广令人叹为观止。

6 一直以来，艺术家们发现，仅凭艺术创作难以维系生活。即使是莱昂纳多这样的大师也被迫为生计卖光了所有的作品。因此他将绘画技艺用在建筑、军事工程、运河修筑以及武器设计这些更赚钱的行当上。尽管从心底反对战争，他还是将自己标榜成军事工程师，在米兰公爵处谋得了一份工作，（用画笔）勾画出自己可用于武器和防御工事的一些诡计。与其他为稻粱谋的艺术家一样，他只是向公爵约略地提及自己也擅长绘画。

7 幸运的是，莱昂纳多确实有当工程师的天赋。好的绘画师在文艺复兴时期的意大利比比皆是，但他的睿智和勤奋却助他开疆辟土，在同代人中独领风骚。同许多古怪的天才一样，莱昂纳多期望为“全新的世界”打造“全新的机械”。

8 纵观莱昂纳多的一生，无论是他的设计成品还是概念性的设计方案，都体现了其精妙而又超前的想法。在为臭名昭著的恺撒·博尔吉亚（教皇之子！）担任军事工程师和建筑师时，莱昂纳多提议开凿一条横跨伊斯坦布尔海湾的陆路，修建一座从金角湾直通博斯普鲁斯海峡的大桥。遗憾的是，和很多伟大的想法一样，造桥计划落空了。那些工程师们实在让人失望，他们一看到桥的体积那么庞大就崩溃了。不过，莱昂纳多的支持者最终还是取得了胜利，因为现代工程师们认定那座桥的设计完全可行。不仅如此，他们还指出桥的结构也非常合理，这也再次证明莱昂纳多确实是有史以来最聪明的人。

9 莱昂纳多还对时间测量方式提出了质疑，这比伽利略提前了差不多一个世纪。而他最感兴趣的还是机械装置的运用。他利用那些机械装置，设计出一大堆当时看来稀奇古怪的玩意儿，有自行车、直升机、“汽车”，当然还有一些可怕的武器。

10 莱昂纳多最感兴趣的其实是水。在那个没有电力的时代里，水是终极的能量来源。莱昂纳多研究了各种形态的水——液态水、水蒸气、固态冰——并且对于如何利用水动力，他有着各种绝妙的想法。他设计了一个可以测量湿度的装置、一个由蒸汽驱动的加农炮、许多不同的水车和大量用流水驱动的实用的工业机器。他拟定了通过运河水利来振兴米兰的雄心勃勃的计划，这一计划的实施将借由同样雄心勃勃的施工机械来完成。事实上，一旦他开始了与水相关的研究，就完全停不下来，脑海里充满了奇思妙想：用来在水上行走的漂浮雪靴、水下呼吸装置（包括潜水罩）、进行水下探索的手蹼、保持漂浮状态的维生装置、水下击沉船只的装置、“永不沉没”的双机壳轮船、港口和河道的清淤装置等等。