**Versalius and the nature of experimentation**

**By Tong Zou**

The year 1543 often evokes images of revolution and change amongst the historians and scientists of today. Commonly regarded as the starting point of the Scientific Revolution, the year saw the publication of two very distinctive and influential works: Nicolas Copernicus’s “On the Revolutions of Heavenly Spheres”, and Andreas Vesalius’s “On the Fabric of the Human Body”, both of which catapulted their respective authors into scientific fame and lore. While Copernicus’s work was published upon his death (for fear of controversy) and received little attention until the time of Galileo Galilei, Vesalius’s work was published within his lifetime (though it was initially criticized) , underwent several revisions, and cemented Vesalius’s role as the ‘father of modern anatomy’. The success of his work was largely due in part to the numerous illustrations represented in his work. These illustrations were large, detailed, and crucial to the understanding of the human body at the time. Numerous public anatomies and dissections carried out by Vesalius himself led to these remarkable findings. It would fair to say that these public anatomies and dissections were a form of experimentation, due to their empirical nature, mechanistic implications, and rigorous analysis.

The notion that knowledge is obtained through experience or through the senses, is a theory that traces its roots to antiquity. Aristotle believed that observation through qualitative analysis and methods of induction and deduction would lead to the ascertaining of knowledge. Aristotle believed that the qualities associated with mathematics are pure, immutable and eternal, while bodies inherent to the earth are mutable, changing and imperfect. Thus, observation was inherently subject to uncertainty, as the constantly shifting nature of the world leads to an experience that was in truth, trial and error. Yet many of these qualities, that of mutability, uncertainty, imprecision and change are often associated with the experimental method. The scientific method, in the context of the seventeenth century, was defined very loosely. Francis Bacon’s method consisted of procedures for isolating the cause of the phenomenon, while Rene Descartes’ method caused him to dismiss all knowledge that was not cemented in absolute truth, instead starting from what he knows to be true. The different variations on scientific method make it difficult to ascertain the true definition or validity of the experimental method, but to say that Andreas Vesalius’s significant findings on the human body were not caused by experimentation would be dubious at the least. Observations fueled his works, and whilst predictions were made about functions of certain organs, explanations were made for others, falsifying Galen’s beliefs centuries earlier – all noted facets of the scientific method and of experimentation. Consider the role of the natural philosopher: those who contemplate nature, and of physical bodies. Then consider human beings as a part of nature, and the inner workings of the human body in relation to the physics of nature – both follow laws and are subject to interpretation based on the senses. In this context, Vesalius was a natural philosopher, an empiricist who observed the workings of the human body and provided detailed descriptions much like a natural philosopher who observes nature and deduces from them laws and elements of causality. Thus, in light of these considerations, it would be quite fit to say that Vesalius’s anatomies, that he performed for his students (and even encouraged them to try), are indeed experiments, inquiring into the nature of the world and into the body of humans.

Now that it has been shown that Vesalius’s scientific method could be justly regarded as empirical and experimental, his discoveries could also be regarded as such. The newfound illustrations of the human body provide for the basis that the body is analogous to a machine, with organs and veins functioning in place of the cogs and gears. Vesalius’ model of the human body had an underlying mechanistic nature, a philosophical principle that would later be shared by subsequent philosophers such as Thomas Hobbes and Rene Descartes. Descartes himself gives a mechanistic view of the corporeal substance as follows: “I should like you to consider that these functions (including passion, memory, and imagination) follow from the mere arrangement of the machine’s organs every bit as naturally as the movements of a clock or other automaton follow from the arrangement of its counter-weights and wheels.”[[1]](#endnote-2) In addition, Isaac Newton’s discovery of gravity helped bind the entire cosmos to a single mechanical principle, and when combined with Descartes’ theory, seemed to lend itself to universal mechanism. But before either Descartes or Newton, Vesalius had firmly established the mechanical workings of the human body, achieved through his findings on human cadavers. His descriptions of the various organs of the human body, all working in harmony, seemed to lend itself perfectly to Descartes’ mind-body dualism[[2]](#endnote-3). Comparisons could be drawn to that of Robert Hooke’s description of insects and structures in his “Micrographia”, in which he investigates the properties of a piece of cork “to be the channels or pipes through which the Succus nutritius, or natural juices of vegetables are convey'd and seem to correspond to the veins, arteries, and other vessels in sensible creatures."[[3]](#endnote-4) The marvelous work of Vesalius, more than 100 years prior to Hooke’s publication, had similar mechanistic implications, and it was his empirical approach – which could now be called experimental – that had given rise to it.

Vesalius’s approach and its mechanistic nature may lead one to believe him as an empirical philosopher rather than a scientist. Perhaps the terms ‘scientist’ and ‘experiment’ embodies that of scientific rigor and quantitative analysis, and while Vesalius did not take any quantitative measurements, he certainly attended to his profession with great effort and rigorousness. His public anatomies, performed by himself in front of his students, set an unprecedented benchmark for the level of detail and intricateness employed in the study of the human body. His great work “On the Fabric of the human body” featured numerous detailed illustrations which made his work widely read and understood, as nobody before Vesalius’s time had created such complex anatomical maps. Vesalius was, in actuality, no different from notable scientists associated with the scientific revolution, such as Tycho Brahe, Johannes Kepler and Galileo. Like Brahe, he was a detailed observer, but one who focused on nearly all aspects of the human body[[4]](#endnote-5), including the skeletal system, muscular system, nervous system, and the heart (although William Harvey would later identify the true motions of the circulatory system and the heart). His description and contributions on these areas (especially the skeletal, muscular and vascular systems) could be likened to Kepler’s laws of planetary motion on the solar system; both of them governed their respective systems and set the standard on how the system was to be taught. His public anatomies could also be compared to the experiments often performed by Galileo, who revered mathematics as the language of God. In his influential book “The Assayer”, Galileo states “[the universe] is written in the language of mathematics, and its characters are triangles, circles, and other geometrical figures, without which it is humanly impossible to understand a single word of it; without these, one is wandering around in a dark labyrinth.”[[5]](#endnote-6) Through his mathematical measurements and scientific rigor, Galileo formulated the law of falling bodies, and established kinematics as the foundation of physics, which closely paralleled the establishment of Vesalius’s work as the foundation of anatomy. Thus, Vesalius was in truth a scientist, whose inquiries for truth and knowledge gave rise to his empirical approach and experimentation on human remains.

Archimedes is said to have remarked “Give me a lever long enough and a fulcrum on which to place it and I shall move the world.”[[6]](#endnote-7) The world was indeed moved in the year 1543, not by levers and fulcrums, but by the publications of “On the Revolutions of Heavenly Spheres” and “On the Fabric of the Human Body”, contributing to the development of astronomy and anatomy, respectively. While Copernicus predated Vesalius by half a century, the two men were remarkably similar, not only in how they revolutionized the world, but that they dared to defy the beliefs long held for centuries, their experiments paving the way for empiricism and mechanism. Vesalius’s work, often considered the starting point for modern anatomy, was fundamentally brought about by his numerous *experiments* as Vesalius’s method was thoroughly empirical, relying upon his observation and senses, and at the same time full of characteristic rigor and carrying mechanistic implications – all aspects of experimental science. Vesalius was in all respects, the sixteenth-century precursor to Descartes, Bacon and Galileo. He was a natural philosopher seeking truth and knowledge, and advocated the spreading of knowledge via his students. It would be thusly unfair to deem his work the title of anything but ‘experiments’ – human beings themselves could be considered as nothing more than ‘experiments of God’.

**Bibliography**

1. Wikipedia, <http://en.wikipedia.org/> , 2007
2. Hooker, Richard, European Enlightenment, <http://www.wsu.edu/~dee/ENLIGHT/> , 1996
3. Baigrie, Brian S, Scientific Revolutions, Pearson Education Inc, USA, 2004

1. Descartes, Treatise on Man, p.108 [↑](#endnote-ref-2)
2. The notion that the mind was separate from the body, the mind being immaterial and the body being material, almost like a machine. [↑](#endnote-ref-3)
3. Hooke, Micrographia, 1665 [↑](#endnote-ref-4)
4. Vesalius passed over parts of the brain without much to say. [↑](#endnote-ref-5)
5. Galileo, The Assayer, 1623 [↑](#endnote-ref-6)
6. Attributed to Archimedes. [↑](#endnote-ref-7)