The Father of Modern Scientific Investigations

“Knowledge is power”. These honest words were written as “nam et ipsa scientia potestas est” by the Englishman Francis Bacon. Bacon lived in the midst of the Scientific Revolution; a time of unparalleled advancements in physics, astronomy, mathematics, chemistry, human anatomy, and even philosophy. A time when anything was possible, so long as man used sound reason. God was no longer the answer. Greece and Rome were no longer the epitome of human knowledge. The sky was literally no longer the limit. A vast universe stretched beyond, waiting to be discovered. Francis Bacon devised a method of scientific investigation that not only revolutionized the scientific world but is still in use today. Yet like a true man of the Scientific Revolution, he did so much more. Francis Bacon was a prominent politician, influential philosopher, and curious scientist.

Francis Bacon was born in London in 1561 to a wealthy and well-connected family. His father was Sir Nicholas Bacon, Lord Keeper of the Seal, and his mother sister-in-law to Sir William Cecil, one of the most powerful men in all of England (Simpson 2). He received an education befitting his social standing. At the age of twelve, he entered Trinity College. The school’s focus on scholasticism made Bacon loathe Aristotelianism and its dependence on deductive reasoning. Nevertheless, young Bacon proved to be a brilliant scholar, and he began to study law at the prestigious Gray’s Inn in 1576. He completed his degree in 1582 and in 1584 was elected into Parliament in the House of Commons. Thus he embarked on his long political career.

Francis Bacon was a prominent politician. In 1596 he was appointed to Elizabeth I’s Queen’s Counsel. Here he assisted the Queen in the conduct of legal affairs. His important role in the royal family did not end when Elizabeth I’s reign ended. Upon the ascension of James I,
he was knighted and served in the King’s Counsel. In the following decade, he continued to scale the political ladder, gaining the position of Attorney General, membership in the Privy Council, and finally his father’s former position: Lord Keeper of the Royal Seal. He reached the zenith of his political career in 1618, when he was made Lord Chancellor. The Lord Chancellor is the head of the House of Lords and chooses the members of the King’s Counsel. Amazingly, Bacon was not done. He became Baron Verulam that same year and Viscount St. Alban in 1621. He was now Sir Francis Bacon, 1st Viscount St. Alban, Lord Verulam, KC.

Francis Bacon was an influential philosopher who inspired both his contemporaries and great thinkers of the future. In 1597, he published the first edition of *Essays*. In *Essays* he wrote about a variety of topics, from truth and superstition to ambition and riches. Their immense popularity led to two subsequent editions. His claim to fame, the appropriately named Baconian method, was published in *Novum Organum* in 1620. The Baconian method is a procedure for scientific investigation that is based off of inductive reasoning. Inductive reasoning derives conclusions from observed facts rather than from previous conclusions or theories. Simply put, it goes from detailed facts to general principles. This sounds like common sense now, but at the time it was a novel concept. Aristotle and past philosophers had relied on deductive reasoning, which is essentially the opposite. In deductive reasoning, the conclusion is reached from a series of accepted facts, or from general to particular. There is nothing wrong with deductive reasoning; it is just not always suitable for scientific investigations. An important characteristic of the Scientific Revolution is the break from classic Greco-Roman ideals. Aristotle wrote his ideas of logic in *Organon*. Bacon chose to title his work *Novum Organum*, novum meaning new, as a reference to Aristotle (The Philosophy of Francis Bacon 2). He obviously thought his system of logic was superior.
Francis Bacon passionately believed that the application of the Baconian method would transform society for the better. In his 1624 utopian novel *New Atlantis*, Bacon describes his ideal world. In this world, a team of specially trained workers in a central research system collect data, conduct experiments, and apply the knowledge they gain to produce useful and practical things for man’s life. They eventually share these with the outside world. This book not only served as a model for the British Royal Society that was to form in 1660; it was the blueprint for the modern research center (Simpson 3). Ever a true man of the Scientific Revolution, Bacon sought to improve society with his ideas. He fervently believed his new method was one step closer to the perfect society, in which at last science and reason were united.

Sir Thomas Browne, John Stuart Mill, and William Whewell all built upon the works of Francis Bacon. In his book *Pseudodoxia Epidemica*, Browne analyzed several presumed truths using empirical observations. John Stuart Mill published *A System of Logic* in 1843. In this book he outlined five methods of induction that are collectively known as Mill’s Methods. Mill believed that deductive reasoning was useless because it tells what one already knows; it does not truly move from a universal truth to a particular one (Heydt 5). Like Bacon, William Whewell believed that scientific progress was historical progress, and he titled his work, *Novum Organon Revovatum* because he considered it an extension of Bacon’s work and himself a follower of Bacon.

Francis Bacon helped establish empiricism and the Baconian method is the precursor of the modern scientific method. Empiricism is the belief that all knowledge comes from experience. The modern scientific method is a combination of inductive reasoning, deductive reasoning, and empiricism. The scientific method is the method that scientists use when carrying out an experiment. First, a hypothesis is composed by observing all of the known information.
An experiment to test the validity of the hypothesis is then formed. Next, a prediction is formed from the hypothesis. A prediction tells the expected results of the experiment if the hypothesis is supported by the experiment. These parts require deductive reasoning because one goes from broad knowledge and deduces a specific aspect from it. The prediction is then tested with an experiment. The experimenter makes careful observations and using data from the experiment, evaluates the hypothesis. The hypothesis is not wrong or right, it is merely supported by the experiment or not supported. The same hypothesis can be tested many times in different ways. Eventually, a theory can be made. If there is enough evidence to support the theory, it can become a scientific law. The most important part of the scientific method, the analysis, relies on inductive reasoning. The conclusion is induced by studying the specifics in detail. The conclusion is based exclusively on the observed facts of the experiment, not on speculation or what one thinks should have happened.

Francis Bacon was a curious scientist up until the very end. He was one of the first to describe heat as motion. However, he suggested that it was the expansion of heated materials that causes particles to move; in actuality it is the exact opposite. As materials are heated they expand because the kinetic energy increases, which results in increased particle activity. As the particles move faster, the distance between them increases, leading to an increase in volume. Ironically, his curiosity got the best of him as he was studying the absence of heat, coldness. On a chilly night in March of 1626, he stuffed a chicken with snow for an experiment on the antiseptic effects of snow (Jokine 3). While doing this, he caught pneumonia. Francis Bacon died on April 9, 1526.

“Knowledge is power”. This simple statement wholeheartedly characterizes the core of the Scientific Revolution, an era of true infinite possibilities. One man attained not just both but
an enduring legacy: the one who laid the foundation for modern scientific investigations. Never before had the world seen such a prominent politician, influential philosopher, and curious scientist. Never before had a single man changed man’s perception of scientific exploration so radically. Never again will the world know another Francis Bacon.

