

Christianity and the Origin of Modern Science

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All of us in modern society recognize the impact that modern science has had on our lives. Few, however, know about the Christian origin of modern science. In our contemporary culture, Christianity is often portrayed as being antithetical to science, yet if we examine our history books, we find that modern science was birthed, nurtured, and flourished in Europe under the influence of the Christian worldview. It was Christianity that decisively shaped science and provided an intellectual framework in which science could operate. Even scientists are typically unaware of this connection because scientists are trained to follow the scientific method but are given little or no training in the history or philosophy of science. For most people (scientists and non-scientists alike), the fact that science simply works is sufficient reason to accept science and so feel that there is no need to explore where modern science came from or why it works.

The practice of modern science is a relatively new phenomenon and has only been around for about 350 years. Modern science is distinguished from ancient science by its use of the scientific method, which emphasizes experimentation, verification, falsification, and quantitative (rather than qualitative) analysis. Many ancient cultures, such as the Egyptians, Chinese, and the Greeks, investigated the natural world and gave rise to many advances in mathematics and astronomy yet their practice of science was hindered and never developed the sophistication or vitality found in later European science. In each case, the absence of the scientific method as well as certain specific beliefs about the universe hindered the birth science. The advent of modern science represented a fundamental shift in how people viewed and explored the natural world and was not simply an increase in technology or level of sophistication. Since the birth of modern science represents a change in the philosophy of science, we need to examine the historical development of science from a theological and philosophical point of view.

Judeo-Christian Scripture and Christian Worldview Gave A Basis for Modern Science to Emerge and Flourish. Science today is commonly taught as a methodology or process without reference to the presuppositions that are required for science to operate. Few scientists are equipped or encouraged to contemplate the philosophy of science that is the very basis for their work. As a result, most people (scientists and non-scientists) do not recognize that modern science is grounded in philosophical and theological ideas. Typically, when scientists are asked to explain the basis for science, they simply argue "science works." This answer is unsatisfactory and we must recognize that there are some basic presuppositions that provide the framework for modern science. Charles Hummel identifies six basic presuppositions:

- 1) Order in nature. Nature has an underlying order, shown in patterns and regularities that can be discovered. Such knowledge is attainable and human intellect is capable of acquiring it, even though infinite variation exists.
- 2) Uniformity of nature. The forces of nature are uniform throughout space and time. What happens here in one laboratory also occurs in other countries around the world (in both the past and present) under the same conditions.
- 3) Validity of sense perceptions. Reliable data can be obtained by using the human senses or their extensions (for example, by reading a thermometer or voltmeter).
- 4) Principle of simplicity. If two theories or explanations fit the data, the simpler is usually to be preferred. For example, although Copernicus' system did not provide a better fit than that of Ptolemy to the available data, or make more accurate predictions of celestial phenomena, it was mathematically simpler; it was preferred because it could account for the observations with a less complicated scheme.
- 5) Moral responsibility. All scientists are expected to report honestly the results of their experiments so that others can have confidence in their data and the use of those results in their own research.
- 6) Consensus of acceptance. Scientists around the world engaged in research in the same discipline, using similar procedures and equipment, test research results and give them relative objectivity. Acceptance is based on the agreed competence of experts, a group of trained, skilled observers.

How does Christianity provide a basis for these basic presuppositions? Christianity rests on the foundation of a very specific understanding of God—one that is distinct from other religions. Some fundamental aspects of the Christian view of God are that (a) God is infinite, (b) God is eternal, (c) God is righteous, (d) God is a personal creator and sustainer, (e) God creates ex-nihilo ("out of nothing"), and (f) God transcends (is separate from) the

universe. This understanding of God gives rise to three principles that form a rational basis for the six basic presuppositions of science.

a) Physical material world exists as an objective reality. Since God created the world, the reality of the world flows naturally out of the reality of God. Since God is eternal, infinite, and unchanging, this must naturally be true uniformly over both time and space (presupposition 2).

b) Creation reflects a rational view of God. The universe, as God's handiwork, must necessarily reflect His character and purpose. The rational nature of God naturally leads to an understanding that the universe is orderly and uniform (presuppositions 1 and 2). Similarly, the simplicity and beauty revealed about God in the Bible must also apply to God's creation (propositions 3 and 4).

c) Humankind was uniquely created. Man was created by God and was created as separate and distinct from the rest of nature (Genesis 1:26-27). Man, as God's special creation, can stand apart from the rest of nature and so is able to comprehend the orderliness of nature. Because the heavens declare the glory of God (Psalms 19:1-6) and character of God (Romans 1:18-20), God had to give man the ability to reason and accurately view nature to appreciate His revelation (presupposition 3). Similarly, because man is created in God's image, man has God's moral law written on his heart, including the capacity for honesty and integrity (presuppositions 5 and 6).

The bottom line is that the preconditions of science are rooted in Christian theism's belief in an infinite, eternal, and personal creator who has ordered the universe and has provided man with a mind that corresponds to that universe intelligibly. So, while most of Western society accepts the six basic presuppositions of science, only Christianity provides a reasonable and consistent basis for them.

Virtually All of the Early Scientists Were Devout Christians.

Almost every major branch of modern science can be traced back to 17th and 18th century Europe. If we open virtually any textbook on science and look at the men who founded and dominated each of these fields, we find that almost all were strong Christians. Christianity provided the intellectual framework for science to develop and grow but also motivated people to pursue scientific inquiry. That is, the Christian faith of these scientists made their science possible but it also made it desirable. The list of such scientists is much too long for this paper and can be found elsewhere, so only a few prominent examples are given here.

1) Nicholas Copernicus (Astronomy). Copernicus is most known for his work on establishing the heliocentric model for the solar system in *De Revolutionibus*. In addition to his scientific work, he served as a canon (religious office) and was an active churchman. He believed that the world "has been built for us by the Best and Most Orderly Workman of all" and so was worthy of study.

2) Galileo Galilei (Astronomy; Refracting telescope). Galileo wrote supporting Copernicus' heliocentric model and developed the first working telescope with which he discovered the moons of Jupiter, sun spots, and moon craters. Galileo, along with Francis Bacon, played a central role in developing the scientific method. Central to Galileo's thinking was that God reveals himself in two ways, through the Book of God's word (Bible) and the Book of God's works (creation) and so we must study both. He believed that there would never be a contradiction between the facts of nature and the Holy Scriptures.

3) Johannes Kepler (Astronomy). Kepler derived three laws of planetary motion based on observational data, which gave direct support for Copernicus' heliocentric model. Originally, Kepler wanted to go into Christian ministry but financial problems forced him to pursue mathematics and eventually astronomy. Kepler later realized that this was God's plan for him and that his work as an astronomer was a way that he could bring glory to God. He believed that the study of science was "thinking God's thoughts after him" and that astronomers were "priests of the highest God in regard to the book of nature." It was Kepler's faith that kept him working despite ill health, personal misfortunes, chronic financial woes, persecution, and arduous work.

4) Isaac Newton (Physics; Calculus; Gravitation law; Reflecting telescope). Newton formulated his famous three equations of motion, which were the basis for physics for the next 200 years and are still commonly used today. Newton also developed the law of gravity, revolutionized optics, and invented calculus (along with Gottfried Wilhelm Leibnitz). Newton is unequivocally the greatest scientist of his time. In addition to his science, he was a faithful Anglican, helped plan for the building of churches, and wrote more than 1,300,000 words on Biblical subjects. While some of his beliefs may not have been completely orthodox, he certainly held to a personal God who created the universe and that "natural philosophy" (science) complimented and supported the words of the Bible.

5) Robert Boyle (Chemistry; Gas dynamics). Boyle laid the foundation for modern chemistry and studied the properties of gases. His contributions once and for all overthrew alchemy and established modern chemistry. He may have been the first researcher to confirm by experiment every scientific claim that he made. As a Christian, Boyle opened each day with a prayer and Bible reading, wrote and translated works on the gospels, and wrote books on apologetics. He spent time trying to communicate the advances in science to common folk showing how science gave evidence for the Christian faith. He co-founded the Royal Institute of London, which was the first scientific association in the world. In his will, he left money to found the Boyle lectures for proving the Christian religion.

6) Blaise Pascal (Hydrostatics; Barometer; Probability theory). Pascal is best known for his development of an adding machine, which would eventually be a forerunner of modern computing. He also made many advances in geometry, mathematics, fluid mechanics, and atmospheric studies. He was a devout Jansenite (a Calvinistic quasi-Protestant group within the Catholic church) and gave frequently to the needy. The Bible became his most important reading as he resolved to give first place in his life to the God of Jesus Christ. The laboratory became an upper room in which the Bible held the place of honor. His most celebrated non-scientific work is *Pensées* ("Thoughts"), a work on Christian apologetics that he didn't finish writing before his death.

7) Carolus Linnaeus (Taxonomy; Biological classification system). Linnaeus was the son of a Lutheran minister and was raised around plants most of his life. His single greatest contribution was to develop a classification system for identifying plants, which is still in use today. He also developed the binomial nomenclature, where by any living thing is identified by its genus and species. (For example, humans are identified as *Homo sapiens*.) This replaced the confusing plethora of names that had existed with a single unified naming system. Linnaeus was a student of the Bible and drew the term "species" from the Latin word for "kind" used to describe groups of living creatures in Genesis 1:21,24-25. He wrote, "One is completely stunned by the incredible resourcefulness of the Creator" and "I saw the infinite, all-knowing and all-powerful God from behind. I followed His footsteps over nature's fields and saw everywhere an eternal wisdom and power, an inscrutable perfection."

The Worldview of Ancient Cultures Hindered and Stifled the Birth of Modern Science

Many ancient civilizations made impressive discoveries about the natural world, yet as eminent historian and philosopher of science Stanley Jaki explains, science remained stillborn and never reached the maturity that occurred later in Europe. Why was science not self-sustaining in these societies? Why didn't the Chinese, Indians, etc. develop the scientific method long before it came about in Europe? Jaki and others have identified seven impediments in these and modern cultures that stifle the growth of science.

1) Cyclical view of history. According to a cyclical view of history, everything moves in cycles and always comes back to the beginning. There is no opportunity for progress, since things will return to the same point. As such, a cyclical view of history hindered progress, promoted complacency, and gave no basis for cause and effect relationships.

2) Pseudo-scientific explanations for natural phenomena. Pseudo-science, such as astrology, hindered science because it gives false answers while taking away the need or desire to look for scientific explanations, which leads to a passive or fatalistic attitude toward nature. Pseudo-science also lacked any real sense of falsification. If an omen failed in its prediction it would never be discarded but simply assumed that it had not been interpreted correctly or that other omens should have been included.

3) Deification of nature. There are two main ways in which nature can be deified: animism and pantheism. In animism (such as in Native American religions), various portions of nature (such as the sun, rivers, and earth) are believed to be inhabited by or represented by spirits. In pantheism, everything in the universe is viewed as being part of god. In both cases, nature is to be revered or worshiped, not studied.

4) Denial of the existence or orderliness of the universe. Many Hindu beliefs taught the concept of *Maya*, which holds that the world around us is an illusion. In other cultures, the nature of the universe changed with the whim of the gods and so couldn't be trusted.

5) Organismic view of nature. In this view, everything including man is part of one giant organism that goes through cycles of birth, death, and reincarnation. Man is viewed as weak and impotent compared to the majesty of nature of which he is a part, which encourages passivity and inactivity toward nature. In this view, man is to contemplate nature but not to study it or to act so as to remain in harmony with nature.

6) Lack of balance between faith and reason. An imbalance in the direction of faith leads to the premature exclusion of naturalistic conclusions and simply assigns God (or gods) the credit. When asked, "Why is the grass green?" this group would reply, "Because God made it that way." An imbalance in the direction of reason hinders progress by not considering all available possible conclusions. In other words, an unreasonable naturalistic

explanation is always preferred over any non-naturalistic explanation. This leads to stagnation when naturalistic explanations don't fit the evidence.

7) Humankind as a part of nature. If man is a part of nature, then how can he step away from nature to look back and get an objective view of it? To support the idea of man being able to objectively view the world, man must be different in kind (not just in degree) from nature. For example, if man is just the product of just blind natural processes, then how could we trust our brain to be able to effectively look for truth? While evolution might be able to explain the origin of intelligence as a tool for promoting our survivability, it cannot explain why man has the ability or desire to grasp truth.

How do these seven impediments apply to the great ancient civilizations that preceded the birth of modern science?

- 1) Mesopotamian cultures. The ancient Mesopotamian cultures made many advances in mathematics and astronomy, yet their belief in pseudo-science (astrology) held them back.
- 2) India. The Indus valley civilizations represent some of the oldest known cultures on the planet. Some of their advances include "Arabic" numbers and many discoveries in mathematics. The belief in Maya (the world as an illusion), reincarnation (cyclical view of history), astrology, an organismic view of nature, and pantheism prevented their science from developing to maturity.
- 3) China. The sophistication of the ancient Chinese culture is well known and includes advances in astronomy and medicine as well as the invention of paper and gunpowder. The belief in pseudo-science (yin-yang dualism and I Ching), a cyclical view of history, and an organismic view of nature (Taoism) hindered Chinese science.
- 4) Egyptians. When we stand in awe of the pyramids or the hieroglyphics of Egypt, we are reminded of the great sophistication of the early Egyptians. They had a well-developed system of astronomy and mathematics, however, their religious system deified nature.
- 5) Greeks. The Greeks are well known for their amazing advances in astronomy, mathematics, logic, and geometry. Sadly, Greek science was undermined by Greek philosophy. Plato taught that the physical world was just a shallow representation of the true world of ideas. Platonic dualism (emphasis on ideal world instead of the physical world) led them to de-emphasize physical reality and discourage experimental investigation.
- 6) Muslims. The early Muslims are often overlooked or downplayed in history books, however, they had a vibrant intellectual religious tradition and helped preserve and spread knowledge. They also made many discoveries in mathematics, astronomy, medicine, and even argued that the universe must have a beginning (Kalam cosmological argument). Their science, however, was stifled by the view that God could be arbitrary or even capricious. They were also plagued with astrology from the Hindus and Persians and Greek philosophy.

Christianity Provided the Intellectual Foundation for Modern Science

Whereas the worldview of other ancient civilizations hindered the growth and development of science, modern science grew and flourished in the soil of the Christian worldview. What was it about Christianity that succeeded where others had failed? This question has three parts: (a) how did Christianity avoid the pitfalls that plagued other civilizations, (b) how did the Christian worldview specifically lead to the development of the scientific method, and (c) how does Christian theology encourage believers to study nature? To answer those questions, we can list at least 12 ideas fundamentally rooted in Christian theology:

- 1) Testing, verification, and falsification. The heart of the scientific method is testing, verification, and falsification. These three principles are directly commanded in Scripture in dealing with doctrinal issues. When these principles were transferred from theology to the study of nature, they formed the philosophical core of the scientific method. These principles along with the moral values of hard work, contemplation, reflection, and the pursuit of knowledge and wisdom can all be found in the Bible. (See next section.)
- 2) Biblical Method of Interpretation. Christian scholars throughout church history have all noted that wherever the Bible describes a sequence of physical events, it always prefaces that description with statements of the frame(s) of reference (points of view) and the initial conditions and closes it with statements of the final conditions and conclusions about the physical events. The Scottish theologian Thomas Torrance has both authored and edited book-length discussions on how Christian theology, and Reformed theology in particular, played a critical role in the development of the scientific method and the amazing advances achieved by Western science. In other words, the scientific method is simply the Biblical method of interpretation applied to the natural world.
- 3) Ockham's razor (principle of economy). This principle along with the scientific method forms the cornerstone of modern science. Ockham's razor states that the simplest theory that fits all of the existing facts is to be preferred and plays a vital role in guiding scientific advance in cases where there is insufficient evidence to directly rule out

competing theories. William of Ockham (c. 1280-1349) was a Christian philosopher and is credited with this principle although he actually borrowed it from Durandus, who was also a Christian philosopher. For both men, the universe was not an accident but was created and expressed the same simplicity and purposefulness found in the Bible.

4) God as transcendent. God transcends the universe, that is, God exists separately and independently of His creation. Because the creation is distinct from God, it is neither divine nor is it organismic in nature and the deification of nature is expressly forbidden in Scripture. This helped Europe avoid this major stumbling block to the development of modern science.

5) God as the lawgiver. God governs mankind through legal and moral laws and God governs nature through natural laws. The Bible contains many statements that God created, fixed, and sustains the laws of nature. Because God governs the universe through fixed laws (rather than through angels or other intermediates), these laws are intelligible and discoverable. God can and does operate supernaturally on behalf of mankind but this does not invalidate His natural laws.

6) Creation reflects the Creator. God created the universe, so it must reflect His character and nature. This leads to the following conclusions: (a) The world is real (and not an illusion) because God is real. (b) The world is orderly because God is a God of order (1 Corinthians 14:33, 40). (c) The world is good (and not evil) because God is good and created the world 'very good' (Genesis 1:31). (d) The world is rational and intelligible because God is rational and so there is a sound basis for observation and experimentation.

7) World was created ex-nihilo. Since God created the universe ex-nihilo (?out of nothing?), then the universe is contingent. In a contingent universe, things could have been different and so leads to the question, "why are things the way they are?" This in turn leads to a desire to investigate. Or to put it simply, "A contingent universe arouses curiosity. A necessary universe does not."

8) The World has a beginning and ending. The Bible describes the creation of the universe (Genesis 1) and when God's purposes for the universe are completed, it will be destroyed (2 Peter 3:10-13) and replaced by a perfect universe (Isaiah 65:17; 66:22; Revelations 21-22). This leads naturally to a linear view of history with its emphasis on cause and effect. Similarly, Christ's work of redemption, His return, and the judgment at the end of time is once-and-for all (Hebrews 9:27-28) and so rules out reincarnation and cyclic views of history.

9) The Nature of man. The Biblical view of man is as foundational to science as the view of God. The Bible declares that man bears the Imago Dei ("image of God") but is marred by sin has important implications for the development of science. (a) Man is capable of comprehending truth (Romans 1:18-20), which gives validity to human rationality (math, logic, and language) and man's sense perceptions. (b) Man's sinful nature means that man can deceive and be deceived, therefore, an emphasis on testing and verifying before accepting claims.

10) Dual Revelation Theology. Dual revelation theology teaches that God reveals himself in two distinct but complementary ways – through the Bible (?special revelation?) and through creation ("general revelation"). Thus, the Bible and creation have the same Author and hence must complement and not contradict each other. Francis Bacon (the father of the scientific method), Galileo Galilei, and Isaac Newton expressed this as God having given man two books—the book of God's Word (the Bible) and the book of God's work (creation). Describing creation as a book implies that creation is both intelligible and worthy of study. As an example, Newton spent equal time and energy studying both books of God's revelation.

11) Creation reveals God's glory. The Bible clearly teaches that creation reveals God's glory (Psalms 19:1-6). As such, most of the early scientists were driven to study nature to glorify God rather than for personal, practical, or pragmatic reasons. For example Johannes Kepler endured through many years of tedious study and ill health, because he wanted to ?think God's thoughts after him.? Carolus Linneaus stated that he ?followed His footsteps over nature's fields and saw everywhere an eternal wisdom and power, an inscrutable perfection.?

12) Rejection of mysticism and astrology. Astrology and other forms of pagan mysticism proved to be a hindrance to science in almost all of the ancient and medieval civilizations. Astrology was problematic even for some of the early Christian scientists, such as Francis Bacon and Johannes Kepler. The Old Testament of the Bible is full of statements condemning and rejecting such practices. Early church father condemned astrology, such as Augustine in Confessions and Hippolytus in The Refutations of All Heresies. In later medieval times, the reintroduction of Greek classics also reintroduced astrology and other ancient beliefs. In response, Temper, Bishop of Paris, in 1277 wrote 219 propositions condemning astrology and other such anti-scientific beliefs. While these statements didn't completely immunize Europe from such ideas, it helped minimize their influence and provided a religious and moral basis for rejecting such practices.

The Principles Underlying The Scientific Method Arise from the Bible.

The Bible lays out principles that underlie and encourage scientific investigation. These principles paved the way for the development of the scientific method. (All Biblical references taken from the New International Version of

the Holy Scripture, italics mine.)

1) Christians are to pursue knowledge and wisdom but this pursuit is to be rooted in reverence for God.
Job 28:28 - "And he said to man, 'The fear of the Lord—that is wisdom, and to shun evil is understanding.'"
Psalms 111:10 - "The fear of the LORD is the beginning of wisdom; all who follow his precepts have good understanding. To him belongs eternal praise."
Proverbs 1:7 - "The fear of the LORD is the beginning of knowledge, but fools despise wisdom and discipline."
Proverbs 9:10 - "The fear of the LORD is the beginning of wisdom, and knowledge of the Holy One is understanding."
Matthew 22:37-38 – "Jesus replied: 'Love the Lord your God with all your heart and with all your soul and with all your mind. This is the first and greatest commandment.'"

2) There is a Biblical mandate to pursue intellectual virtues, such as contemplation, reflection, and testing.
Acts 17:11 - "Now the Bereans were of more noble character than the Thessalonians, for they received the message with great eagerness and examined the Scriptures every day to see if what Paul said was true."
Romans 12:2 - "Do not conform any longer to the pattern of this world, but be transformed by the renewing of your mind. Then you will be able to test and approve what God's will is—his good, pleasing and perfect will."
1 Corinthians 14:29 - "Two or three prophets should speak, and the others should weigh carefully what is said."
Colossians 2:8 - "See to it that no one takes you captive through hollow and deceptive philosophy, which depends on human tradition and the basic principles of this world rather than on Christ."

3) The values underlying the experimental method (testing, verification, falsification, and hard work) are deeply rooted in Scripture.

Job 34:4 - "Let us discern for ourselves what is right; let us learn together what is good."
1 Thessalonians 5:21 - "Test everything. Hold on to the good."
1 John 4:1 - "Dear friends, do not believe every spirit, but test the spirits to see whether they are from God, because many false prophets have gone out into the world."
Revelations 2:2 - "I know your deeds, your hard work and your perseverance. I know that you cannot tolerate wicked men, that you have tested those who claim to be apostles but are not, and have found them false."

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