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## RELIGIO-SCIENTIFIC RELATIONSHIPS IN THE TWENTIETH AND THE THIRTEENTH CENTURIES

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### ABSTRACT

Our whole planet became conscious of a religio-scientific relationship during the moon-orbiting Apollo 8 flight, at Christmas, 1968. Its astronauts were the first men to leave the gravitation of Earth, the first to come under another gravitational body, the first to travel so far from Earth (233,000 miles), the first to see the other side of the moon. Contemplation of the scientific and technical achievements of their Mission against a new background of the incredibly immense Universe and the wonders of its creation, led them to depart from flight plan to re-read to planet Earth from outer space the Genesis story of creation: "In the beginning, God created, etc." This demonstration of a religio-scientific relationship in our scientifically remarkable 20th century made so strong an impression that the U.S. Government yielded to popular demand by issuing a special religio-scientific postage stamp of recognition. And this in the face of a 20th century skepticism and supposed antagonism between religion and science, as summarized in the slogan, "God is dead."

Interesting comparisons can be made with another extraordinary century, the 13th, a pre-Renaissance century when western man was developing and discovering many new things in his material world, a century outstanding for its religious fervor and faith, a century in which religion and science enjoyed very cordial relations generally, and yet a century which was also known for uncertain and questioning religious faith, as illustrated by Albigensianism and other dissenting "isms."

The century opened with one of the greatest of the popes, Innocent III, on the papal throne. Among other notable achievements, Innocent was an outstanding patron of medicine, the founder of the modern city hospital and other charitable foundations, and promoter of women serving professionally in them. It was the century of St. Louis of France, St. Ferdinand of Spain, Frederick II of Germany, and Edward I, the English Justinian. It was the century of the signing of the Magna Charta and the rise of freedom and democracy for the masses, of the Vatican-promoted founding of the Universities which expanded rapidly to great numbers of students, including many women, and much research. It was the century of the great Gothic cathedrals. It was the century of St. Francis of Assisi; St. Dominic; the great scientist-theologian St. Albert the Great, father of colloidal chemistry; St. Thomas Aquinas; Roger Bacon, one of the greatest of Medieval scientists; Alexander of Hales; Pope Honorius III, distinguished patron of learning; and John XXI, very famous as a scientist, physician, surgeon, ophthalmologist, and medical writer before becoming Pope. The official papal physicians were renowned as the very best men available, and one of them, Guy de Chauliac, is known as the father of modern surgery. The first important medical dictionary was written by Simon of Genoa in the 13th century. He also did much to make the use of opium more scientific, and worked out rules for its administration.

Apart from the 20th, the 13th has been hailed as "the greatest of the centuries."

Our whole planet became conscious of a religio-scientific relationship during the first manned moon-orbiting Apollo flight, that of Apollo 8, at Christmas, 1968. Its three astronauts, Frank Borman, James A. Lovell, Jr., and William A. Anders, were the first men to leave the gravitation of Earth, the first to come under another gravitational body, the first to travel so far from Earth (233,000 miles), the first to see it from a quarter of a million

miles away, and the first to see the far side of the Moon. Contemplation of the scientific and technological achievements of their mission against a new background of the incomprehensibly immense Universe and the wonders of its creation led them, on Christmas Eve, to depart from their flight plan to re-read to their fellowmen on planet Earth from outer lunar space the Genesis story of creation: "In the beginning, God created heaven and earth . . .". They took turns, each solemnly reading a portion of the first 10 verses of Genesis. Their reading reminded one of the statement by the world famous space scientist, Wernher von Braun: "All I see teaches me to trust the Creator for all I do not see", and also of an observation made by Pope Pius XII at an official reception for the members of the Pontifical Academy of Sciences on November 22, 1951: "In fact, true science, contrary to what was thoughtlessly asserted in the past, increasingly discovers God as its progress advances. It is as though He were lying in wait behind every door that science opens."

This demonstration by the three astronauts of a religio-scientific relationship in our scientifically and technologically remarkable twentieth century made so strong an impression that the U.S. Government yielded to strong popular pressure by issuing a special religio-scientific commemorative postage stamp of recognition. And this in the face of a twentieth century skepticism, dissent, materialism, and even supposed antagonism between religion and science, as summarized in the recent slogan, "God is dead"!

When Apollo 13's service module suffered a midcourse oxygen tank explosion en route to the moon on April 13, 1970, the U.S. Congress promptly passed a resolution asking the people to pray for divine assistance at 9:00 p.m., local time, April 14. Evangelist Billy Graham in Paris commented: "At no time in history have so many people been praying in so many languages representing so many races and nationalities for a single event as for the the successful return of our astronauts to Earth." President Nixon proclaimed Sunday, April 19, as a national day of prayer and thanksgiving for their hoped for safe return, "on target," on April 17. As we all gratefully know, they did indeed return safely, "on target" and on schedule, on that day. *Time Magazine* of April 27 carried a large front cover color photograph of the three returned astronauts, James A. Lovell, Jr., Fred W. Haise, Jr., and John L. Swigert, Jr., their heads bowed in prayer of thanksgiving on the deck of the recovery ship, the U.S.S. *Iwo Jima*.

The scientific and technological achievements of the twentieth century in every older field and in many newer sub-and-para-fields are too well known to call for a detailed review. The advances of the health sciences have led to very rapid increases in the Earth's population. By very far, most of the scientists who have ever lived, are alive today! Phenominal communications and travel advances have made the planet Earth become rather small, have made it just a neighborhood, so to speak. Technologically highly advanced and gigantic

industries, often automated and computerized, and large scale mechanized and scientifically advanced agriculture are making marked sociological, ecological and political impacts by creating more and more leisure time for man and simultaneously creating more and more pollution for his planet. But twentieth century man, according to the evidence, with all his doubts and skepticism (Gallup, 1970, p. 36), is still basically theistic as he still turns to Divinity in times of stress, strife, dilemma, or outright dire need.

Why the comparison with the less known thirteenth century? Because in the thirteenth century, at least in the Old World, despite significant instances of religious dissent, disagreement and animosity, religion and science did generally enjoy very cordial relationships, because thirteenth century scientific, health, educational, social, legal, political and artistic advances were relatively great, and because they were almost all brought about by or through "men of the cloth".

A comparison is made with the regions known as the Judeo-Christian-Moslem areas of the thirteenth century. This is not intended as any slight of the rest of the world, including the far reaches of the Orient, Africa and the Western Hemisphere, but adequate information for comparison is not available beyond the regions chosen.

The thirteenth was a remarkable century of religious faith on the part of Jew, Christian and Moslem. Faith was so strong and immovable that many of the Crusades and the corresponding resistance to the Crusades occurred in that century.

It was the theocentric age when Christian faith produced the artistically beautiful, intricate, immense, and encyclopedic Gothic cathedrals of Western Europe with incidental marked advances in architecture and engineering, painting, glasswork, sculpture and music.

It was the age when great, new Christian religious Orders sprang to life and into the world of men rather than the isolated and restricted world of cloistered monasteries. It was the age from which the Christian humanism of the Renaissance evolved.

It was the age of one of the greatest Jewish rabbinical scholars and scientists of all time, Moses ben Maimonides (1135-1204), rabbi, philosopher, physician, hygienist and nutritionist, sometimes referred to as "the second Moses". By basing theological principles on reason, Maimonides did for Judaism what the physician-philosopher, Averroës (Ibn Ruschd) (1126-1198) had attempted for Islamism and what Thomas Aquinas (c. 1225-1274) would do for Christianity. Maimonides owed his great medical ability, in good measure, to Arab and Moslem medicine, which had preserved and enhanced medical knowledge from the decadent Greco-Roman cultures. Court physician to Saladin, enlightened and chivalrous Moslem sultan in Cairo, Maimonides was highly esteemed by Jew and Moslem and Christian alike.

The thirteenth also experienced considerable religious disagreement, dissent and intolerance (its schisms, heresies such as the Albigensian and Waldensian, its inquisitions, its harshly anti-Jewish restrictions by both Christians and Moslems, and its Crusades). It was also an age when astrology played an important role in the lives of even the learned, perhaps because the Ptolmeic geocentric universe concept still prevailed. The thirteenth century philosopher, Thomas Aquinas, however, exceptionally used the Ptolmeic concept only as a working hypothesis. Strangely enough, astrology seems to be growing in favor in the educationally informed and enlightened twentieth century, perhaps as a substitute or partial substitute for religion. It is certainly far less comprehensible in the twentieth century than it was in the thirteenth!

The thirteenth was a century of intensive and extensive social, educational, scientific, medical, legal, political and artistic awakening and advance, as is the twentieth century.

In 1200, the current language of scientific literature was Arabic, and the greatest scientific change in the early thirteenth century was the rediscovery of Aristotle as his complete works were translated into Latin, first from the Arabic versions and then directly from the Greek.

In this work, one of the foremost scholars was Robert Grossteste (1170-1253), Chancellor of Oxford and Bishop of Lincoln, who also wrote on comets and their causes.

One of his pupils was the great English Franciscan friar-scientist, Roger Bacon (c. 1214-1294), known as the "admirable doctor", who was a pioneer in inductive science. He especially stressed the value of experiment in the development of knowledge, and was one of the most wise and far-seeing of the medieval scientists. He clearly pointed out the errors of the Julian calendar, calculated corrections, and suggested how future errors could be avoided. He wrote 18 treatises on chemical problems (Walsh, 1908, p. 135). He is credited with the invention of an explosive substance which anticipated modern explosives, and with foreseeing the possibilities of internal combustion engines for ships and carriages. He is also credited with the invention of the magnifying glass, and he did more than anyone else to establish the principles of lenses on a mathematical basis (Walsh, 1907, p. 42-43). His wisdom is epitomized in the following excerpt from his *Opus Majus* on the causes of error: "There are in fact four very significant stumbling-blocks in the way of grasping the truth, which hinder every man however learned, and scarcely allow anyone to win a clear title to wisdom, namely, the example of weak and unworthy authority, long-standing custom, the feeling of the ignorant crowd, and the hiding of one's own ignorance while making a display of apparent knowledge. Every man is involved in these things, every rank is affected. For every person, in whatever walk of life, both in application to

study and in all forms of occupation, arrives at the same conclusion by the three worst arguments, namely, this is a pattern set by our elders, this is the custom, this is the popular belief: therefore it should be held." (Bacon, 13th century.)

Chief of the scholars who interpreted Aristotle was the German Dominican, Albertus Magnus or Albert the Great (c. 1200-1280), known as the "universal doctor", perhaps the most scientific mind of the Middle Ages. He was also eminent as a theologian and a bishop. He was declared a Doctor of the Church by Pope Pius XI in 1931, and the patron saint of natural scientists by Pope Pius XII in 1941. Albertus worked Aristotelian, Arabic and Jewish knowledge into a whole, which included all contemporary knowledge of astronomy, physical geography, botany, zoology, mineralogy, chemistry and medicine. He also added to knowledge himself, and was the first to describe arsenic in its free form. He is really the father of colloidal chemistry, although this honor is customarily accorded to a nineteenth century British chemist, Thomas Graham. Albertus' complete works consist of 20 large folio volumes, averaging 500,000 words each. Along with Roger Bacon, Bartholomew de Glanville or Bartolomeus Anglicus, an English Franciscan who wrote a celebrated medieval encyclopedia, "*Book on the Properties of Things*" (c. 1240-1250), and Vincent de Beauvais (1190-c. 1264), a French Dominican who wrote "*Mirror of Nature*", Albertus Magnus is known as an Encyclopedist. He was also the teacher of both Roger Bacon and the great Dominican philosopher-theologian, Thomas Aquinas, the "angelic doctor", who was Albert's favorite pupil. It is not generally known that Thomas also wrote on chemical and medical subjects. He wrote three chemical treatises, and is believed to have been the first to use the word "amalgam" to describe an alloy of mercury. (Walsh, 1908, p. 135). Medically, he discussed inheritance of mental traits, particularly idiocy. The Encyclopedists were all members of the new, learned and influential religious Orders, the Dominicans and the Franciscans.

As the century began, one of the greatest of the popes, Innocent III, occupied the papal throne (1198-1216). Among other notable achievements, particularly educational achievements, Innocent was an outstanding patron of medicine, the founder of the modern city hospital and other benevolent institutions, and the promoter of women serving professionally in them. Hospitals of less advanced types had of course previously been established by the Egyptians, Hindus, Greeks, Arabs, and others, and especially by Christian communities after the Council of Nicaea had encouraged such establishment in 325. Innocent built the Hospital of the Holy Spirit, not far from St. Peter's in Rome, where it still exists, and which became the mother and model hospital for the world. For example, Virchow, the nineteenth century "father of cellular pathology", lists over 100 towns in Germany with hospitals

modeled on this hospital in Rome (Virchow, 1879, p. 1-130). Since most of the towns contained fewer than 5000 inhabitants, it can be said that practically every town of any importance, at least in Germany, came under the influence of Innocent's great philanthropic hospital movement. Each of these hospitals was invariably associated with a chapel, and the hospital had a right to one fourth of all the revenues of the clergy. (Bachmeyer and Hartman, 1943, p. 8.) Several well known London hospitals, including St. Bartholomew's, St. Thomas, and St. Mary's, similarly took their origin in the late twelfth or early thirteenth centuries. The excellent and famous Arab hospital in Cairo, Al Mansur, was built in 1276.

An additional thirteenth century hospital movement, quite distinct from that of Innocent III, and which was also very valuable, was the establishment of lazar houses or leprosoria. Incidence of leprosy was quite common in Europe during the Middle Ages, and notably increased with the Eastern contacts brought about by the returning Crusaders and other travelers, such as those involved in the rapidly increasing trade with the East. The peak of incidence occurred in the thirteenth century. The number of leprosoria in Europe reached the astounding number of 19,000 (Letourneau, 1961, p. 532), and proved to be the best possible prophylactic against spread of the disease, which gradually disappeared during the next three centuries, and was thus a great hygienic, social and charitable triumph. (Garrison, 1929, p. 178-179.) This principle of hygienic segregation was regrettably dropped until the advent of Louis Pasteur and bacteriology in the nineteenth century.

Innocent was succeeded by the learned and able Honorius III, (1216-1227), who closely followed the lines of policy laid down by his illustrious predecessor. Honorius III was also a distinguished lawyer, and in 1226 published the collection of his decretal letters which his successor, Gregory IX, (1227-1241), incorporated in the official revision of canon law in 1234. Honorius III, known as a patron of learning, confirmed the new Dominican Order in 1216, and the rule of St. Francis for the Franciscans in 1223. He also continued Innocent's health care program, especially by establishing a religious Order, the Antonine Congregation of Vienna, devoted to patients suffering from the prevalent "holy fire", or erysipelas, and from various other maladies. (Walsh, 1907, p. 344). The Order of Soeurs Augustines was similarly founded (1217) for the nursing of the sick in the Hotel Dieu of Paris, which had itself been founded in the seventh century. (Bachmeyer and Hartman, 1943, p. 8-9.)

Everywhere during the thirteenth century there seemed to be, in Western Europe, a codification of laws and a laying of foundations in jurisprudence, upon which the modern superstructure of law was to rise. As Walsh states (1907, p. 16-17): "When the thirteenth century began men below the rank of nobles were practically slaves. Whatever rights they had were uncertain, liable

to frequent violation because of their indefinite character, and any generation might, under the tyranny of some conscienceless monarch, have even lost the few privileges they had enjoyed before. At the close of the thirteenth century this was no longer possible. The laws had been written down and monarchs were bound by them as well as their subjects. Individual caprice might no longer deprive them arbitrarily of their rights and hard won privileges, though tyranny might still assert itself and a submissive generation might, for a time, allow themselves to be governed beyond the domain of legal justification."

The thirteenth century was also the age of the signing of the Magna Charta (1215), the foundation of all the liberties of English speaking people ever since. In France, the foundations of law and jurisprudence were laid during the long reign of Louis IX (1226-1270), after whom our American city of St. Louis is named. In Spain, under Ferdinand III of Castille (1217-1252), a canonized cousin of Louis IX, the foundations of Spanish law were laid. In Germany there was a similar story. In England, Edward I (1272-1307) has become known as the English Justinian, or law-giver, for his exceptional legal interests and his circle of able lawyers and advisers. It was during his reign that the Model Parliament of 1295 was held, and the theory of representative consent asserted: "what touches all must be approved by all". The House of Commons was organized in 1265 and admitted to Parliament the next year.

The thirteenth century gave schools to the people, to the masses as well as the classes. Innocent III caused what we would now describe as academies and preparatory schools to be established at every cathedral center and every important monastery. It was probably the increase in literacy as well as the increase in commerce and urbanization which led to the general use of surnames in the thirteenth century. (Trease, 1964, p. 44.)

It was at the beginning of the century that the great universities in the modern sense, in which all the forms of ordinary learning were taught, came into being throughout Europe. They were papally sponsored, and included Bologna, Paris, Oxford, Salamanca, Padua, Montpellier, Toulouse, and Lisbon. Prominent on the faculties were the Dominicans, such as Albertus Magnus, and the Franciscans, such as Alexander of Hales (1175-1245), the "unanswerable doctor", and many others. The present title of "doctor" and many of our twentieth century academic customs and costumes took their origin from this period.

Co-education was extensive in Italy, if not elsewhere. Some women in Bologna were professors in the thirteenth century. Bologna as the name of a prepared food, sausage, appeared at that time, perhaps to save the university women some household drudgery! Co-education was accepted by the Renaissance, and continued in Italy in some degree in all succeeding centuries. But this greater freedom, established in Italy in the thirteenth century, for women to be in the world, to go to school, to enter the

professions, to serve professionally in the universities, in hospitals and other charitable foundations, was not really duplicated till the twentieth century which has achieved wide-spread woman suffrage and has provided wider opportunities for women in schools, universities, business, commerce, and the arts and professions.

The twentieth century is also recognizing two outstanding later medieval or early Renaissance canonized women who were great scholars and learned writers, for in this year of 1970, St. Catherine of Sienna (1347-1380) and St. Theresa of Avila (1515-1582) are each being elevated to the title of Doctor of the Universal Church, by Pope Paul VI. No woman has ever been accorded this honor previously, and only 30 men have received it, including the thirteenth century Dominicans, Saints Albertus Magnus and Thomas Aquinas, and the thirteenth century Franciscans, St. Anthony of Padua (1195-1231), and St. Bonaventure, the "seraphic doctor" (1221-1274).

The popularization of the languages of the people, with consequent blossoming of their vernacular languages in literature occurred in the thirteenth century. Dante Alighieri (1265-1321), one of the greatest literary men of all times, ranks with Homer and Shakespeare in poetry. He symbolizes what the educational environment of the thirteenth century was able to produce out of good intellectual material, and may be said to represent not merely a solitary phenomenon of this period, but rather a culmination.

The movements of emancipation in so many phases of thought and life led to a great flourishing of art, centered particularly in Florence in religious paintings, such as those of Cimbuè (1240-1302), Gaddi (1300-1366), and especially Giotto di Bondone (c. 1276-1337), architect as well as painter, and friend of Dante. Sculpture also had some supreme examples, as in *le Beau Dieu*, the beautiful God, in the wondrous Gothic cathedral at Amiens, 80 miles north of Paris. The great cathedrals became centers of musical development, and it was in the thirteenth century that the troubadours matured into learned musicians. Glass artistry, religious and secular, was flourishing in Venice and elsewhere in the thirteenth century. Incredibly beautiful rose windows, as in the cathedral of Chartres, France, were thirteenth century creations. In 1270, Venetian glassmakers introduced eye glasses.

Other scientific developments of the thirteenth century included the introduction of the Arabic and decimal system of numerals into Western Europe in the field of mathematics, as well as in commerce and banking, and the expansion of exploration and geography through the efforts of travellers and traders such as the Venetian, Marco Polo (c. 1254- c. 1308), who visited China in the 1270s.

One of the thirteenth century patrons of learning was the brilliant Frederick II (1194-1250), Holy Roman Emperor, Emperor of Germany and

King of Sicily. In 1240 he promulgated edicts from his headquarters in Palermo, Sicily, favoring dissection as an aid to the study of medicine, and regulating the practice of medicine and pharmacy, by making them completely separate. This included use of a prescribed formulary, a kind of pharmacopeia, in order to guarantee the reliability and uniformity of the apothecary's drugs. Public pharmacies had been brought into Spain and Italy from the Arabs. The first drug store in Northern Europe was founded in 1267 in Muenster, Germany.

Additional contributions to the health sciences in the thirteenth century were numerous. We will conclude by referring to just a few more.

Mondino di Luzzi (c. 1275-1327), professor of anatomy at Bologna and the first great anatomy teacher, revived the lapsed study of human anatomy by dissection in place of the prevalent dissection of pigs, and wrote the first original textbook on practical anatomy in the Middle Ages (79 pages in an early printed edition of 1513). It was a dissecting manual, and remained popular for two centuries.

Theodoric de Lucca (1205-1298), monk, bishop, and surgeon, promoted an entirely unconventional approach to surgery. Surgeons had believed that pus must form in wounds to promote healing. In his *Chirurgia*, Theodoric vigorously opposed this theory and insisted on absolute cleanliness, or what we would call asepsis, in all operative procedures. "Do not impede nature," he wrote, "but let her accomplish agglutinizations, keep away from the wound after you have cleansed it thoroughly . . . do not cleanse it with the cautery." (Bettman, 1956, p. 78) He also recommended anesthesia.

Guy de Chauliac (1300-1370), star pupil of Mondino di Luzzi, born just at the close of the century, was the most eminent authority on surgery in the Middle Ages, and is known as the father of modern surgery. His *Chirurgia Magna*, written in 1363, became a standard surgery textbook. Born in France, he took holy orders, and was educated in medicine at Toulouse, Montpellier, Paris and Bologna. He settled in Avignon and was surgeon to the French popes. He operated for hernia and cataract, and employed the cautery for cancer. His discussion of fractures and dislocations is good. He was also an important writer of medical history.

The first important dictionary of medicine, *The Key of Health*, was written by Simon Januensis or Simon of Genoa in the thirteenth century. Physician to Pope Nicholas IV (1288-1292), he also did much to make the medical use of opium more scientific, and worked out rules for its administration.

Pope John XXI (c. 1215-1277), the only Portuguese pontiff, a classmate of Roger Bacon and a pupil of Albertus Magnus, was very renowned as a scientist, physician, surgeon, ophthalmologist, and medical writer before his election to the papacy in 1276. His *Book of Eye Diseases* was a standard

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work. His description of the external anatomy of the eye is quite complete. Glaucoma is well recognized and its unfavorable prognosis appreciated. Other works included *On the Rule of Health, A Dietetic Treatment of Surgical Patients*, and *Thesaurus Pauperum (Pharmacopeia for the Poor)*, which survived for centuries as an indispensable reference book. A homely first aid hint which it contained for hysterical fainting was to "blow pepper and salt up the patient's nose; she will soon come around." (Bettman, 1956, p.79.) He was years ahead of his time in the rejection of demons and evil spirits as causes of disease, although he did accept the general belief that the body is under the influence of the planets. He is the only pope whom Dante placed in his Paradise. (Kemp, 1969, p. 171.)

John XXI symbolizes and epitomizes the cordial and intimate religio-scientific relationships which existed in the thirteenth century, which Walsh, writing during the first decade of the twentieth century, hailed as "the greatest of centuries."

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