Chapter 1 : Robert Boyle - Wikipedia

Robert Boyle was the chief apologist of the 17th century for the corpuscularian or mechanical philosophy. He was also a pious, though doubting and tormented Christian, and his adoption of a semi-Epicurean ontology and his curiosity-driven experimentation with substances rich in sensory qualities caused him no little psychological conflict.

Robert Boyle the father of modern chemistry From: The Encyclopedia Britannica says of him: As a devout Protestant, Boyle took a special interest in promoting the Christian religion abroad, giving money to translate and publish the New Testament into Irish and Turkish. In he developed his theological views in The Christian Virtuoso, which he wrote to show that the study of nature was a central religious duty. Boyle never married and from the age of 41 lived with his sister Katherine, Lady Ranelagh. He was a shy man with deep religious convictions. He had been a pious youth spending some years in the care of the village parson, Mr. Then at the age of 13, during a violent thunderstorm, he experienced a religious conversion not unlike that of St. Although an ardent defender of the Anglican Church, he was tolerant of the religious views of others and in later years became particularly sympathetic to the Dissenters. He was offered a position in the clergy but felt a stronger commitment to science. He saw no conflict between the two. He wrote widely on religious themes and gave financial support to his his friend Edward Pococke to translate the New Testament into Malayan. He left a large portion of his considerable estate to charitable organizations. Robert Boyle died in London on December 30, He was buried in the Church of Saint-Martin-in-the-Fields next to his sister. Later the church was demolished and no record was made as to where his remains were moved. It is clear that he contributed much more to the development of modern chemical thought. Robert Boyle and Christopher Wren in their early thirties were regarded by their British contemporaries as "the wonders of the age. Although called the father of chemistry he was truly an amateur and owed his reputation largely to his social position and personal character To his insatiable curiosity and indomitable persistence, he added integrity of mind. To his shrewd business ability and scrupulous honesty, he joined a broad generosity. He refused various honors and appointments, e. He gave one-third of his Irish income for the propagation of the gospel among the North American Indians e. In his will he bequeathed the income from his unentailed property for Irish poor, preachers and their wives, and, in general, for good, pious purposes Boyle was not just a teacher and propagandist; above all, he was a lay preacher and, through his writings, a prolific author of religious topics. Only one, however, was devoted to dogmatic theology, viz. He was, moreover, unsympathetic with all sectarianism; he preferred the via media of Anglicanism. He hated bitterly all religious strife over creeds and ceremonies. Although a regular church attendant, to him Christianity meant essentially the practice of holy living; its fruits, peace and charity. Throughout his life he had a conviction of personal Divine Guidance. A turning point occurred when he was thirteen during a night thunderstorm in Geneva; he made a vow of piety; four years later his faith was established. A second crisis occurred when he perceived in science "a means of discovering the nature and purpose of God;" he realized, of course, that revelations about the Creator in the book of nature are not as significant as those about the Saviour in the Scriptures. All his work and thought became saturated with religion, composed in an atmosphere of humility. He definitely eschewed Holy Orders so that he might pursue theology freely-and hence more effectively. In , at the request of Lord Broghill, a brother, he published "Some Considerations Touching the Style of the Scriptures," noting the usual problems of translation associated with when, by whom, to whom, for what purpose. He himself believed in miracles, e. He believed the study of nature and the attributes of God were the noblest aim of life. In "The Excellency of Theology, Compared with Natural Philosophy" , written , he noted, "The vastness, beauty, orderliness of heavenly bodies; the excellent structure of animals and plants; and other phenomena of nature justly induce an intelligent, unprejudiced observer to conclude a supreme, powerful, just, and good author. Accordingly, he subsidized various translations of the New Testament, e. In his will, moreover, he left funds for eight annual lectures in a London parish "for proving the Christian religion against notorious infidels. Martin-in-the- Fields the remaining at St. The author submitted drafts to Newton, who replied in four celebrated letters, generally approving, but adding some additional arguments in support. The last lecture argued in favor of a Divine Providence from the

constitution of the universe as demonstrated in the Principia.

Chapter 2 : Robert Boyle (Stanford Encyclopedia of Philosophy)

Robert Boyle: Robert Boyle, Anglo-Irish natural philosopher and theological writer, a preeminent figure of 17th-century intellectual culture. He was best known as a natural philosopher, particularly in the field of chemistry, but his work covered many areas, and he also wrote on theological issues.

Biography Robert Boyle Facts The British chemist, physicist, and natural philosopher Robert Boyle was a leading advocate of "corpuscular philosophy. His father was one of the richest and most powerful men in Ireland, and throughout his life Boyle enjoyed, in addition to his native talents, the advantages of position, family, and wealth. At the age of eight he was sent to school at Eton and then in to Geneva, Switzerland, where he was privately tutored for the next two years. Upon the death of his father, Boyle returned in to England, where after some initial delay he settled at the manor of Stalbridge in Dorsetshire, which he had inherited from his father. Boyle devoted much time to study and writing, and although he wrote extensively on ethical and religious topics, he became increasingly interested in natural philosophy. He interested himself in nearly all aspects of physics, chemistry, medicine, and natural history, although it was chemistry that "bewitched" him and primarily occupied his time. In Boyle left Stalbridge for Ireland, where 10 years of civil war had seriously disordered the family estates. During his stay he continued to pursue his scientific interests. In he settled in Oxford, then the scientific center of England. He there associated himself with a group interested in the "new learning. Having learned in of the vacuum pump recently invented by Otto von Guericke, Boyle immediately set Robert Hooke, his brillant assistant and later an eminent scientist in his own right , the task of devising an improved version. Utilizing this improved pump Boyle immediately began a long series of investigations designed to test properties of the air and to clearly establish its physical nature. Boyle made extensive studies of the elasticity of the air and of its necessity for various physical phenomena, such as combustion, the propagation of sound, and the survival of animals. By placing a Torricellian barometer in the receptacle of his pump, he also verified that it was indeed air pressure which supported the column of mercury. Directing his attack at what he conceived as the erroneous foundations of contemporary chemical theory, he brought forth extensive experimental evidence to refute the prevailing Aristotelian and Paracelsian concepts of a small number of basic elements or principles to which all compounds could be reduced by chemical analysis. He demonstrated that common chemical substances when decomposed by heat not only failed to yield the requisite number of elements or principles, but that the number was a function of the techniques employed. Accordingly, he denied that elements or principles as thus defined had any real existence and sought to replace these older concepts of chemical change with what he termed the "corpuscular philosophy. Behind his more specific and detailed work was a general theory of the structure of matter; and his continued advocacy of the mechanical philosophyâ€”that is, explanation in terms of matter and motionâ€”was one of his most significant contributions. These particles tended to combine in groups or clusters which, because of their compactness, had a reasonably continuous existence and were the basic units of chemical and physical processes. Any change in the shape, size, or motion of these basic clusters altered the properties of the substance involved, although chemical reactions were generally conceived as involving primarily the association and dissociation of various clusters. Boyle also made significant contributions to experimental chemistry. He made extensive studies of the calcination of metals, of combustion, and of the properties of acids and bases. He emphasized the application of physical techniques to chemical investigation and developed the use of chemical indicators which showed characteristic color changes in the presence of certain types of substances. His pioneering study of phosphorus, during which he discovered nearly all the properties known for the next two centuries, well illustrates the effectiveness of his experimental techniques. Science and Religion An influential public figure, Boyle was often at court and was among those who in used their influence to obtain a charter for the Royal Society. He was a charter member of the society, as well as one of its initial council members, and provided the society with two of its most influential early officials: In Boyle moved to London. As a leading figure of English science and a member of a prominent family, he was offered numerous honors, including a peerage and a bishopric, all of which he declined, insisting that he preferred to

remain a simple gentleman. In he even refused the presidency of the Royal Society on the grounds that his conscience was, as he said, "tender" about subscribing to the necessary oaths. Throughout his life Boyle maintained a deep and pervasive religious commitment. As an active supporter of missionary work, he was appointed by the King the governor of the Corporation for Propagating the Gospel in New England. He was particularly concerned, however, with demonstrating that science and religion were not only reconcilable but in fact integrally related, and in his effort to promote this belief he produced numerous essays and tracts on religion and natural theology. He died on Dec. A case study of his work in pneumatics is contained in James Bryant Conant, ed. Encyclopedia of World Biography. Copyright The Gale Group, Inc.

Chapter 3 : Robert Boyle and the Study of Nature - Oxford Scholarship

1. Life []. Robert Boyle was born in Lismore, Ireland, on January 25, He was his parents' fourteenth, penultimate, child, and the last to survive to adulthood.

Empirical science historically developed out of philosophy or, more specifically, natural philosophy. Natural philosophy was distinguished from the other precursor of modern science, natural history , in that natural philosophy involved reasoning and explanations about nature and after Galileo , quantitative reasoning , whereas natural history was essentially qualitative and descriptive. In the 14th and 15th centuries, natural philosophy was one of many branches of philosophy, but was not a specialized field of study. The first person appointed as a specialist in Natural Philosophy per se was Jacopo Zabarella , at the University of Padua in Modern meanings of the terms science and scientists date only to the 19th century. Before that, science was a synonym for knowledge or study, in keeping with its Latin origin. The term gained its modern meaning when experimental science and the scientific method became a specialized branch of study apart from natural philosophy. In general, chairs of Natural Philosophy established long ago at the oldest universities are nowadays occupied mainly by physics professors. Even in the 19th century, a treatise by Lord Kelvin and Peter Guthrie Tait, which helped define much of modern physics, was titled Treatise on Natural Philosophy Greek philosophers defined it as the combination of beings living in the universe, ignoring things made by humans. Natural philosophy has been categorized as a theoretical rather than a practical branch of philosophy like ethics. Sciences that guide arts and draw on the philosophical knowledge of nature may produce practical results, but these subsidiary sciences e. The study of natural philosophy seeks to explore the cosmos by any means necessary to understand the universe. Some ideas presuppose that change is a reality. George Santayana , in his Scepticism and Animal Faith, attempted to show that the reality of change cannot be proven. According to this system, everything that is "matter" is deterministic and naturalâ€”and so belongs to natural philosophyâ€”and everything that is "mind" is volitional and non-natural, and falls outside the domain of philosophy of nature. Branches and subject matter[edit] Major branches of natural philosophy include astronomy and cosmology , the study of nature on the grand scale; etiology , the study of intrinsic and sometimes extrinsic causes ; the study of chance , probability and randomness; the study of elements ; the study of the infinite and the unlimited virtual or actual ; the study of matter ; mechanics , the study of translation of motion and change ; the study of nature or the various sources of actions; the study of natural qualities ; the study of physical quantities ; the study of relations between physical entities; and the philosophy of space and time. Adler, For the history of natural philosophy prior to the 17th century, see History of physics , History of chemistry , and History of astronomy. Philosophical, and specifically non-religious thought about the natural world, goes back to ancient Greece. These lines of thought began before Socrates, who turned from his philosophical studies from speculations about nature to a consideration of man, viz. The thought of early philosophers such Parmenides , Heraclitus , and Democritus centered on the natural world. In addition, three presocratic philosophers who lived in the Ionian town of Miletus hence the Milesian School of philosophy, Thales , Anaximander , and Anaximenes , attempted to explain natural phenomena without recourse to creation myths involving the Greek gods. They were called the physikoi natural philosophers, or, as Aristotle referred to them, the physiologoi. Plato followed Socrates in concentrating on man. This book determines the warp and woof of the whole of Western thinking, even at that place where it, as modern thinking, appears to think at odds with ancient thinking. But opposition is invariably comprised of a decisive, and often even perilous, dependence. Atomistic mechanism got a shot in the arm from Epicurus â€¦ while the Stoics adopted a divine teleology â€¦ The choice seems simple: This was how Aristotleâ€¦ when still a young acolyte of Plato, saw matters. But Aristotle grew to abandon this view; although he believes in a divine being, the Prime Mover is not the efficient cause of action in the Universe, and plays no part in constructing or arranging it But, although he rejects the divine Artificer, Aristotle does not resort to a pure mechanism of random forces. Instead he seeks to find a middle way between the two positions, one which relies heavily on the notion of Nature, or phusis. While the vagaries of the material cause are subject to circumstance, the formal, efficient

and final cause often coincide because in natural kinds, the mature form and final cause are one and the same. Compare clay, steel, etc. Compare a clay sphere, clay block, etc. Efficient cause That which caused the object to come into being; an "agent of change" or an "agent of movement". Final cause The reason that caused the object to be brought into existence. From the late Middle Ages into the modern era, the tendency has been to narrow "science" to the consideration of efficient or agency-based causes of a particular kind: The action of an artist on a block of clay, for instance, can be described in terms of how many pounds of pressure per square inch is exerted on it. The efficient causality of the teacher in directing the activity of the artist, however, cannot be so describedâ€¦ The final cause acts on the agent to influence or induce her to act. If the artist works "to make money," making money is in some way the cause of her action. But we cannot describe this influence in terms of quantitative force. The final cause acts, but it acts according to the mode of final causality, as an end or good that induces the efficient cause to act. The mode of causality proper to the final cause cannot itself be reduced to efficient causality, much less to the mode of efficient causality we call "force. The issue that medieval philosophers had with motion was the inconsistency found between book 3 of Physics and book 5 of Metaphysics. Aristotle claimed in book 3 of Physics that motion can be categorized by substance, quantity, quality, and place. This disputation led to some important questions to natural philosophers: Is motion the same thing as a terminus? Is motion separate from real things? These questions asked by medieval philosophers tried to classify motion. There is an issue with the vocabulary behind motion which makes people think that there is a correlation between nouns and the qualities that make nouns. Ockham states that this distinction is what will allow people to understand motion, that motion is a property of mobiles, locations, and forms and that is all that is required to define what motion is. In becoming an oak tree, it becomes actually what it originally was only potentially. This change thus involves passage from potentiality to actuality â€" not from non-being to being but from one kind or degree to being another" [8] Aristotle held many important beliefs that started a convergence of thought for natural philosophy. Aristotle believed that attributes of objects belong to the objects themselves, and share traits with other objects that fit them into a category. He uses the example of dogs to press this point. An individual dog may have very specific attributes ex. This philosophy can be applied to many other objects as well. This idea is different than that of Plato, with whom Aristotle had a direct association. Aristotle argued that objects have properties "form" and something that is not part of its properties "matter" that defines the object. The form cannot be separated from the matter. Given the example that you can not separate properties and matter since this is impossible, you cannot collect properties in a pile and matter in another. He used his philosophy of form and matter to argue that when something changes you change its properties without changing its matter. This change occurs by replacing certain properties with other properties. Since this change is always an intentional alteration whether by forced means or by natural ones, change is a controllable order of qualities. He argues that this happens through three categories of being: Through these three states the process of changing an object never truly destroys an objects forms during this transition state but rather just blurs the reality between the two states. An example of this could be changing an object from red to blue with a transitional purple phase. You can help by adding to it. June Early Greek philosophers studied motion and the cosmos. Figures like Hesiod regarded the Natural world as offspring of the gods, whereas others like Leucippus and Democritus regarded the world as lifeless atoms in a vortex. Anaximander deduced that eclipses happen because of apertures in rings of celestial fire. Heraclitus believed that the heavenly bodies were made of fire that were contained within bowls. He thought that eclipses happen when the bowl turned away from the earth. Anaximenes is believed to have stated that an underlying element was air, and by manipulating air someone could change its thickness to create fire, water, dirt, and stones. Empedocles identified the elements that make up the world which he termed the roots of all things as Fire, Air. Parmenides argued that all change is a logical impossibility. He gives the example that nothing can go from nonexistence to existence. Plato argues that the world is an imperfect replica of an idea that a divine craftsman once held. He also believed that the only way to truly know something was through reason and logic not the study of the object itself, but that changeable matter is a viable course of study. Galileo proposed that objects falling regardless of their mass would fall at the same rate, as long as the medium they fall in is identical. The 19th-century distinction of a scientific enterprise apart from traditional

natural philosophy has its roots in prior centuries. Proposals for a more "inquisitive" and practical approach to the study of nature are notable in Francis Bacon , whose ardent convictions did much to popularize his insightful Baconian method. The late 17th-century natural philosopher Robert Boyle wrote a seminal work on the distinction between physics and metaphysics called, A Free Enquiry into the Vulgarly Received Notion of Nature, as well as The Skeptical Chymist, after which the modern science of chemistry is named, as distinct from proto-scientific studies of alchemy. These works of natural philosophy are representative of a departure from the medieval scholasticism taught in European universities , and anticipate in many ways, the developments which would lead to science as practiced in the modern sense. As Bacon would say, "vexing nature" to reveal "her" secrets, scientific experimentation , rather than a mere reliance on largely historical, even anecdotal , observations of empirical phenomena , would come to be regarded as a defining characteristic of modern science , if not the very key to its success. For sometimes we use the word nature for that Author of nature whom the schoolmen , harshly enough, call natura naturans , as when it is said that nature hath made man partly corporeal and partly immaterial. Sometimes we mean by the nature of a thing the essence , or that which the schoolmen scruple not to call the quiddity of a thing, namely, the attribute or attributes on whose score it is what it is, whether the thing be corporeal or not, as when we attempt to define the nature of an angel , or of a triangle , or of a fluid body, as such. Sometimes we take nature for an internal principle of motion , as when we say that a stone let fall in the air is by nature carried towards the centre of the earth , and, on the contrary, that fire or flame does naturally move upwards toward heaven. Sometimes we understand by nature the established course of things, as when we say that nature makes the night succeed the day , nature hath made respiration necessary to the life of men. Sometimes we take nature for an aggregate of powers belonging to a body, especially a living one, as when physicians say that nature is strong or weak or spent, or that in such or such diseases nature left to herself will do the cure. Sometimes we take nature for the universe , or system of the corporeal works of God , as when it is said of a phoenix , or a chimera , that there is no such thing in nature, i. And sometimes too, and that most commonly, we would express by nature a semi-deity or other strange kind of being, such as this discourse examines the notion of. A projector was an entrepreneur who invited people to invest in his invention but - as the caricature went - could not be trusted, usually because his device was impractical. Historians of science have argued that natural philosophers and the so-called projectors sometimes overlapped in their methods and aims. Nature is reduced to a passive recipient of human activity. Students of his such as Jacob Klein and Hans Jonas more fully developed his themes. Ellis observes the rise of a "New Essentialism. He revives and defends the Thomistic-Aristotelian tradition from modern attempts to flatten nature to the limp subject of the experimental method. A Revolution for Thought and Life , Nicholas Maxwell argues that we need to reform philosophy and put science and philosophy back together again to create a modern version of natural philosophy.

Chapter 4 : Robert Boyle > Notes (Stanford Encyclopedia of Philosophy)

Robert Boyle FRS (/ b É”Éª l /; 25 January - 31 December) was an Anglo-Irish natural philosopher, chemist, physicist, and inventor. Boyle is largely regarded today as the first modern chemist, and therefore one of the founders of modern chemistry, and one of the pioneers of modern experimental scientific method.

June July 2, Introduction Robert Boyle was born to rich land-owning parents in Ireland but spent most of his life in England during a time of great civil and religious unrest. In addition, the great plague of London was taking countless lives forcing many to move out of the city into the country. Boyle was educated largely by private tutors and whilst overseas records his early conversion to Christianity. Boyle was a prolific author with nearly half his published works being in the area of theology. He was one of the founders of the Royal Society under Charles II and refused academic posts at Oxford and ordination to the Anglican priesthood, preferring to be known as a lay theologian and a Christian Virtuoso one skilled in the reading and interpretation of Scripture and experimental philosophy. And have joined two things, that how much so ever they may seem related, yet have been found so seldom together, that the World has been tempted to think them inconsistent; A constant looking into Nature, and yet a more constant study of Religious, and a Directing and Improving of the one by the other. Boyle was well placed to make such a contribution possessing a deep knowledge of Scripture including its original languages of Hebrew, Greek, Aramaic, and Chaldean and possessing the skill of an experimental philosopher at the dawn of modern science. I will depend predominantly or primary source material for this and on a recently published work by Jan Wojcik entitled, "Robert Boyle and the Limits of Reason" By looking forwards into the modern era from the past one can balance the post-modern view of Science, which looks backwards into the modern era from the present. This appears as a lengthy response to the vociferous debates within the religious community about predestination, the wearing of vestments, and the role of reason in interpreting Scripture; to the onslaught by atheist within and without academia and government who regarded Scripture as lacking consistency and literary style and finally; to some churchmen who had grown slack in their study of the Bible because of its uninteresting style. Scripture is a temple for worship not an arsenal for war. Boyle was appalled at the level of bitter debate between branches of the Christian Church on matters relating to a particular interpretation of a text of Scripture and the fact that people would go to war for the cause of that interpretation. The Bible is not an oration of God to men but a collection of composures of very different sorts written over a long period of time primarily to those to whom they were first addressed and to their contemporaries. Boyle was here addressing the criticism that the Bible contained crude sayings of a type not fit for public consumption. He emphasized that such sayings would not have been regarded as crude by the people to whom the book was originally addressed and that these words were not dictated by God but formulated in a particular context by men moved by the Holy Spirit. The variety of compositions in Scripture was necessary, according to Boyle, to meet the needs of a variety of people down through the ages who would read the Scriptures. In spite of the fact that the Bible was written primarily for its first audience Boyle believed that the Scriptures applied to people of all generations and contained some passages particularly pertinent to the future age. We should obtain our opinions from Scripture rather than take them to Scripture since Scripture is the best expositor of itself. I am sorry I can add on this occasion that different texts are made to appear more dark, than otherwise they would, by the glosses and interpretations of some that pretend to expound them. We need to distinguish between the plain sense of the text itself and the metaphysical subtleties given to it. It is not oftentimes so much what the Scripture says, as what some men persuade others it says that makes it seem obscure. Boyle did not dispute that some texts were obscure and that good commentaries and history texts were invaluable for enlightening a text, but he was concerned with the tendency of expositors to impose their ideas on Scripture and make the Scripture say more subtle things than it was designed to say. The Bible would not appear so obscure in parts if the reader could read and understand the text in its original idiom. Boyle mentions the particular difficulty in translating Hebrew phrases into English or Latin phrases. In authorized versions words have been translated rather than idioms or phrases which makes some texts particularly obscure. The other difficulty is that some Hebrew expressions are just not

translatable and no extant Hebrew texts are available to help decipher the kinds of expressions used. Boyle encourages further studies into the Hebrew language and its translation to rectify the problem. Many ideas in the New Testament are based upon ideas established in the Old Testament. A text of Scripture is often not understood on a first or second reading but on third or fourth reading the meaning often emerges. Despite the great variety of books in the Bible Boyle believed that all the constituent books of Scripture would prove a necessary part of the Canon. Scripture makes use of logical and popular arguments to an extent consistent with a due latitude for the exercise of faith. Boyle argues that Paul uses logical argument as solidly as does Aristotle but in some parts if Scripture popular argument is more effective than logical argument. This is because Scripture arguments are often designed to convince believers rather than persuade nonbelievers. Scripture is designed to teach us divinity rather than natural philosophy. Boyle regarded Scripture as primarily instructing us in relation to grace, love, virtue and salvation rather than in relation to the properties of Nature and references to Nature in Scripture are "spoken of rather in a popular than accurate manner" Boyle, ,p. In another source Boyle, ,p. It is interesting to note that as Boyle discusses his understanding of scripture he often uses analogies from the natural world to clarify his meaning. For example, in answering the objection related to the fact that Scripture records ungodly sayings and actions, he recalls that "just as parts of Nature that resemble a diseased part are medical for that part or infirmity, so the record of vicious persons may prove an antidote to vices within" Boyle, ,p. Another example relates to the obscure passages of Scripture. Aristotelianism viewed nature as eternal and so there was no need for a Creator God. According to Jan Wojcik ,p. Thus heavy objects fall to reach their natural place of abode and mercury rising is an evacuated capillary tube because it abhors a vacuum. Boyle was extremely critical of this defied view of Nature because any observed behavior in Nature could be ascribed to its natural tendency and he considered such a view as "injurious to the glory of God and a great impediment to the solid and useful discovery of his works" Boyle,,p. Boyle, on the other hand, considers Nature to have been made of matter and motion according to certain laws by the Creator at the beginning of time and that the job of the natural philosopher was to discover the nature of these laws through experiment. This exercise, according to Boyle, was more likely to bring glory and adoration to God because of his works. In comparison, Boyle describes the followers of Aristotle as using "occult qualities, empty names, to describe Nature and they content themselves to tell us, that Nature does such a thing, because it was fit for her so to do; but they endeavor not to make intelligible to us what they mean by this Nature" Boyle, ,p. Boyle believed that the provision of physical reasons based on matter and motion was likely to prove more intelligible. An example of the difference between Aristotle and Boyle can be seen in the explanations given for the rise of mercury in a barometer tube. If a filled tube of mercury is up-ended in a bowl of mercury the mercury stays suspended in the tube to a height of about 75 centimeters above the level in the bowl at sea level. All the mercury does not fall out of the tube as one might expect. The Aristotelian Schoolmen explained the suspension of mercury in the tube as due to Nature abhorring a vacuum and attempting to fill any possible vacuum space with matter; in this case by mercury. Boyle sought a physical explanations follows. Putting the apparatus in a vacuum chamber he slowly pumped out the air of the chamber and observed the mercury in the tube to fall. On re-admitting air to the chamber the mercury rose again. A physical explanation based on the influence of air pressure, rather than some mystical drive in Nature such as that which abhors a vacuum, proved much more intelligible and successful. Because the mercury rose in the tube due to the outside air pressure according to Boyle, it became possible to use such apparatus to measure air pressure at different heights and positions on the globe and under different weather conditions. It was commonly believed that such inquiries into Nature would lead to atheism because explanations could be given without reference to God. It must be remembered the Aristotelianism had served the church well to this point if time because it provided an explanation for transubstantiation and for the idea of the immortal soul. Boyle argued, however, that study of Nature by experiment would lead to laws of a kind that would demonstrate the goodness, wisdom, and power of God. Why, Boyle argued, would God the Creator "give men the opportunity every seventh day to contemplate God in his works" Boyle, ,p. Experimental philosophy became for Boyle a divine duty because he regarded Nature, like Scripture, as a temple where "man sure must be the priest, ordained to celebrate divine service not only in to, but for it" Boyle, p. The experimental philosophy,

combined with the mathematization of the laws of Nature, became the hallmark of modern Science and has led to the greatest technological achievements in our history. It has been a pity that such achievements seem to have been advanced at the expense of religious commitment, a situation that would have been deplored by Boyle. On what basis then, did Boyle integrate his view of Nature and his view of Scripture? But what does Boyle mean by revelation, reason, and experience? Knowledge communicated by revelation, according to Boyle, could not have been discovered by the use of reason or experience alone. Thus the nature of the infinite God and the prophetic portions of Scripture would fall into this category. By experience Boyle was particularly referring to experimental philosophy in regard to Nature or, for example, the recorded experiences of the apostles in Scripture. Experience thus involves providing evidence for a phenomenon. Reason could refer to common sense reasoning, logical-deductive reasoning, or abstract reasoning. Boyle was adamant that all three elements, revelation, reason, and experience, were required more or less in knowledge generation although the relative contributions of each would change. Abstract reasoning without the benefit of experimental checks would prove fruitless, for example, and experiment without the benefit of deductive reasoning would prove ineffectual. Boyle was clear that the relative contributions of revelation, reason, and experience were different for Science and Scripture. The relative contributions could be illustrated as follows. Whilst revelation plays a dominant role in the major themes of Scripture it plays only a minimal role in the study of Nature. Reason and experience together are the major contributions to the generation of knowledge in Science. Integration of Scripture and Science involves overlapping the triangles to lead to the coexistence of two different forms of knowledge grounded, however, in the same epistemological elements but with different relative contributions. Integration does not force Science to adopt the role of Scripture or Scripture to adopt the role of Science in a one-to-one correspondence. Each is allowed to exist on its own term but in a way that contributes to a more complete view of reality. However, both were essential for achieving an integrated view of reality. It is important to realize, as did Boyle, that the three elements of epistemology do not always lead to the same conclusion. Experience as recorded in the gospels and the writings of Paul confirm the resurrection of Christ although common sense reasoning would suggest it to be an impossible event. Experiment confirms that a 10 kg ball falls to the ground in the same time as a 1 kg ball whereas common sense reasoning would have suggested otherwise. Revelation outlines the eternal goodness of an infinite God that is prepared to die for his creation but reason alone could not suggest the worthiness of such an act. Boyle observed that reason itself was able to conclude that in both fields of knowledge, Science and Scripture, there existed things that were above reason but not against it Boyle, The things above reason could be divided into three categories. This refers to those objects or ideas which are, by nature, not able to be understood because they transcend our finite minds. The nature of the eternal God and the angels fall into this category as does the concept of infinity in Science. The concept of being able to get closer and closer to a point but never going beyond that point after an infinite number of attempts is a difficult one to get the mind around. The concept of infinity is still topical today in such fields as astrophysics Morris, This refers to those things for which there are no apparent cause. Boyle refers here to the difficulty of explaining what holds matter together, what actually causes the human body to move once a conscious decision is made to move it, and also how human memory operates. This is where two propositions which are confirmed to be truthful in themselves are contradictory. Boyle gives example of the controversy about the endless divisibility of a straight line as follows Wojcik, ,p. Since it is manifest, that a line of three foot, for instance, is thrice as long as a line of one foot, so that the shorter line is but the third part of the longer, it would follow, that a part of a line may contain as many parts as a whole, since each of them is divisible into infinite parts; which seems repugnant to common sense, and to contradict one of those common notions in Euclid, whereupon geometry itself is built. How, for example, can God offer free will if he knows in advance what will happen? Boyle was not at all perturbed by the existence of things above reason because this was somewhat expected where finite beings are trying to understand the infinite. Both knowledge system, Science and Scripture, contain such privileged things. I would now like to show how the integration scheme gleaned from Boyle and illustrated in this section using the triangle above might help us in origins debate and the development of chemistry curricula.

Chapter 5 : Robert Boyle Facts

Robert Boyle (). "The Philosophical Works of the Honourable Robert Boyle Esq; Abridged, Methodized, and Disposed Under the General Heads of Physics, Statics, Pneumatics, Natural History, Chymistry, and Medicine.

He was best known as a natural philosopher, particularly in the field of chemistry , but his scientific work covered many areas including hydrostatics , physics , medicine , earth sciences , natural history, and alchemy. His prolific output also included Christian devotional and ethical essays and theological tracts on biblical language, the limits of reason , and the role of the natural philosopher as a Christian. He sponsored many religious missions as well as the translation of the Scriptures into several languages. In he helped found the Royal Society of London. Early life and education Boyle was born into one of the wealthiest families in Britain. He was the 14th child and 7th son of Richard Boyle, the 1st earl of Cork , by his second wife, Catherine, daughter of Sir Geoffrey Fenton, secretary of state for Ireland. At age eight, Boyle began his formal education at Eton College , where his studious nature quickly became apparent. In he and his brother Francis embarked on a grand tour of the continent together with their tutor Isaac Marcombes. In , owing to the Irish rebellion , Francis returned home while Robert remained with his tutor in Geneva and pursued further studies. Boyle returned to England in , where he took up residence at his hereditary estate of Stalbridge in Dorset. There he began a literary career writing ethical and devotional tracts, some of which employed stylistic and rhetorical models drawn from French popular literature , especially romance writings. In he began investigating nature via scientific experimentation, a process that enthralled him. From until the mids, Boyle remained in close contact with a group of natural philosophers and social reformers gathered around the intelligencer Samuel Hartlib. Scientific career Boyle spent much of â€”54 in Ireland overseeing his hereditary lands, and he also performed some anatomic dissections. In he was invited to Oxford , and he took up residence at the university from c. In Oxford he was exposed to the latest developments in natural philosophy and became associated with a group of notable natural philosophers and physicians, including John Wilkins, Christopher Wren , and John Locke. In he and Robert Hooke , the clever inventor and subsequent curator of experiments for the Royal Society, completed the construction of their famous air pump and used it to study pneumatics. Boyle and Hooke discovered several physical characteristics of air, including its role in combustion , respiration, and the transmission of sound. Other natural philosophers, including Henry Power and Richard Towneley, concurrently reported similar findings about air. Among his most influential writings were The Sceptical Chymist , which assailed the then-current Aristotelian and especially Paracelsian notions about the composition of matter and methods of chemical analysis , and the Origine of Formes and Qualities , which used chemical phenomena to support the corpuscularian hypothesis. Boyle also maintained a lifelong pursuit of transmutational alchemy , endeavouring to discover the secret of transmuting base metals into gold and to contact individuals believed to possess alchemical secrets. He sponsored educational and missionary activities and wrote a number of theological treatises. Boyle was deeply concerned about the widespread perception that irreligion and atheism were on the rise, and he strove to demonstrate ways in which science and religion were mutually supportive. There he set up an active laboratory, employed assistants, received visitors, and published at least one book nearly every year. Living in London also provided him the opportunity to participate actively in the Royal Society. Boyle was a genial man who achieved both national and international renown during his lifetime. He was offered the presidency of the Royal Society in and the episcopacy but declined both. Throughout his adult life, Boyle was sickly, suffering from weak eyes and hands, recurring illnesses, and one or more strokes. He left his papers to the Royal Society and a bequest for establishing a series of lectures in defense of Christianity. These lectures, now known as the Boyle Lectures, continue to this day.

Chapter 6 : Birkbeck | Robert Boyle Project | Works

The Honorable Robert Boyle (January 25, - December 30,) was an Irish natural philosopher who made important contributions to chemistry and physics and established himself as a leading figure in the scientific revolution.

Boyle was the youngest son and, after his sister Margaret died when he was 10, the youngest child of the family. Boyle speaks fondly of his parents, but he could not have known them well. Like many children Boyle had his share of near escapes from serious injury as a child, but the time and Boyle being what they were he saw in each of them the hand of God. He continued to believe in this divine attention, though in a more intellectual realm, throughout his life. The promise seems never to have been broken, and indeed the later Boyle stressed the need to have an examined faith. Boyle felt that more was required of the thinking believer. Leaving Switzerland, Boyle, along with Marcombes and his brother crossed the Alps and entered Italy in September where, in Florence, he spent the winter. Writing about himself in the third person as Philaretus sometimes P. Professing that he never found any such sermons against them, as they were against themselves. Moreover, there was a letter from the Earl, unaware of the mischance affecting the quarterly payment, telling them that, as a result of the rebellion in Ireland, no more money was to be forthcoming: In the event Francis decided to return to Ireland, arriving in time to fight in the Battle of Liscarrol September 3, , at which another Boyle brother, Lewis, was killed. Meanwhile Robert decided that his health and lack of money ruled out a return to Ireland, and his age made soldiering in Holland an untempting and indeed implausible prospect. Cudworth pointed out one expedient reason for the belief: When Boyle arrived back in England in mid at the age of 17 he was quickly reunited with his sister Katherine who seems immediately to have re-adopted the semi-maternal role she had no doubt often played after the death of their mother. She was concerned in a variety of other ways to look after his welfare, both spiritual and worldly. She was, for example, the immediate cause of his getting to know the members of the Hartlib circle. See further, Hunter , chs. He was, in fact, a serious, somewhat priggish young man, though he often gave signs of light-heartedness both as a boy and in later life. Boyle was troubled throughout his life by the fragmentation of Christianity. Boyle was never a student at a university. Nor was he ever a fellow of an Oxford College, though that too has been claimed on his behalf Dutton , 20 , but it was to Oxford that he removed after his time at Stalbridge, and it was there that his interest in natural philosophy flowered. For my part, that I may not live wholly useless, or altogether a stranger in the study of nature, since I want glasses and furnaces to make a chemical analysis of inanimate bodies, I am exercising myself in making anatomical dissections of living animals: On October 12, , Katherine was in Oxford investigating the suitability of possible lodgings for Boyle. In Katherine died, and Boyle, whose health throughout his life had been poor, died the following week. His version of the ontological argument, his proof from the supposed innate idea of God, his proof from the need for an eternal conscious being,[19] and his proof from the need for continuing creation, all found supporters in the later seventeenth century, though the first two were generally held to be unlikely to convince anyone. This distancing was not uncommon at the time. Gassendi, for example, agreed that God is that than which nothing greater can be conceived, but denied the validity of the argument which offers this as its main premise See further Osler , ch. Nor was the argument from innate ideas more popular. After his dialogue character Cuphophron has espoused it, Henry More has his down to earth Hylobares burst out: Well, Cuphophron, you may hug your self in your high Metaphysicall Acropolis as much as you will, and deem those Arguments fetched from the frame of Nature mean and popular: Such arguments were intended to form a large part of a book on atheism, something he worked on throughout his adult life but never published, though parts of it were used in various other works of a theological nature. In the First of these, the Author represents some Reasons why it should not be thought strange if it be found somewhat difficult to demonstrate the Existence of a Deity. The First of these Reasons is, that by reason of the selfe existence and Primity of God, his Essence cannot be Causable. Since God is a Being whose Nature is the most singular of all, there must necessarily belong to him divers things, not to be paralleld. To one of which or both may be referrd the Epicurean Anticipation. The Third section is spent in shewing some of the Reasons why the Arguments proposd in the Second are often unprevalent. And among

the Intellectual Impediments the First is, That Atheists often injuriously attribute to the notion of a Deity the fond Opinions or rash Assertions of unskillfull men. Well, that was the plan, and Boyle certainly thought that the design arguments he intended for section two should convince the open-minded. Moreover, he thought, such arguments should particularly convince those who were knowledgeable about nature, who knew enough about the details of the world to be impressed by the intricacy of the presumed workmanship. For since a Miracle is Work limited, and never implies any but a certain and limited Power: I say, at most; because from many Causes concurring there may follow some Work, whose Force and Power is indeed less than the Power of all its Causes put together, but far greater than the Power of any one of them taken singularly Blount , To a large extent Boyle accepted these points. The one is, that the thing be certaine of it selfe and vnchangeable. The persuasive alternative to a demonstration was sometimes styled a proof, but often people spoke of moral demonstrations as opposed to strict, or mathematical, demonstrations. He often mentions the importance of conscience, but concentrates, as far as proofs go, on various design arguments, on arguments based on the incorporeality of the human soul, and on arguments involving miracles. And it must be a very dazzleing Light, that makes an impression upon those that obstinately shut their Eyes against it. For they that would find the Truth, especially in matters of Religion, must be diligent Inquirers after it, and may be strict Examiners of it, but must not beresolved Enemies to it. For Boyle, miracles in particular the miracle of Pentecost were a crucial factor in opting for Christianity. The Christian miracles, he felt, clearly bore the stamp of God upon them. There were, he agreed, other miracles or apparent miracles, but the miracles which purported to establish Christianity were neither false nor diabolical, and they were miraculous. He felt, not that this argument was inappropriate, but that it failed the test empirically: How Charming its Eloquence may be in its Original, I confesse my self too unskilfull in the Arabick Tongue, to be a competent Judge â€¦ but the Recent Translations I have seen of it in French, and â€¦ Latin, elaborated by great Scholars, and accurate Arabicians, by making it very Conformable to its Eastern Original, have not so rendred it, but that Persons that judge of Rhetorick by the Rules of it current in these Western Parts of the World, would instead of extolling it for the Superlative, not allow it the Positive Degree of Eloquence; [and] would think the Style as destitute of Graces, as the Theology of Truth â€¦. Boyle accepts, and indeed uses, the form of the Koran argument: Boyle is ambivalent about the function of miracles. Boyle fastens on two main types of design arguments: First of all God, at a particular, fairly recent, point in absolute time, made matter. Moreover, it ought much to recommend many of the things that Revelation discovers to us, that they are congruous, and if I may so speak Symmetrical to what reason it self teaches us; and this Supernatural Light does not only confirm, but advance and compleat the truths discoverable by the light of nature. See further MacIntosh Unsurprisingly, then, Boyle makes a point of attempting to bring his creation story into line with a literal interpretation of the Genesis story. God, he believes, could have started things off earlier or later, but chose not to. Having created matter, he broke it up and started it moving. Sometimes Boyle says he broke it up by starting it moving. For Boyle and Hooke, that is, a world without laws is not only possible, our world was such a world for a time. Generalizing, we might say that just as points underdetermine equations, so facts underdetermine theories. It should be noted however that for Leibniz, as for a number of his contemporaries, not all such laws need be laws of nature. For Boyle, physical objects do exhibit nomological regularities, but this is a contingent fact about the world, or rather, for Boyle was cautious about generalizing, about the spatio-temporal portion of it we occupy. He agrees, however, that there are laws that are not laws of nature, with the laws of interconnection between body and soul providing, for him, an obvious example. This interconnection also provides a clear example of a state which God constantly preserves. See Anstey a and Inglehart for a full discussion of the issue. His older contemporary Harvey, much admired by Boyle, was in no doubt about the matter, pouring scorn on those who talk As if forsooth Generation were nothing in the world but a meer Separation, or Collection, or Order of things. I do not indeed deny that to the Production of one thing out of another, these fore-mentioned things are requisite, but Generation her self is a thing quite distinct from them all â€¦ Harvey , All this holds for the corporeal universe, as opposed to the three sorts of incorporeal creatures God created or, in our case, continues to create: Elsewhere, however, he offers a more traditional account of the soul as the image of God: The Christian virtuoso considers the rational soul, not barely as it guides the motions of that living engine, we call the body,

but as it is a kind of imprisoned angel, that bears the image of God, and is capable of knowing, both ourselves and him; and by a consciousness of her being his production, is capable of acknowledgeing, loving, and obeying him, and referring to his glory all the excellencies she discovers, both in herself, and in the body she is united to; by which just reference, she is, by his goodness, in his divine Son, made capable of becoming incomparably more knowing, than here she is, and eternally happy with him BW, So that whether it be to God or to Chance, that we ascribe the Production of things, that way may often be fittest or likelyest for Nature to work by, which is not easiest for us to understand BW, 3: It follows at once that while simplicity may often be our best guide as to what working hypothesis to choose, we should not think it to be inevitably a reliable guide to truth. Why did God create the universe in this piecemeal way? Or why not suppose that he created the present world as a going concern? First of all, it certainly fits the fact that Boyle has a very limited view of omnipotence. Boyle takes Epicurus to hold that motion is an innate property of matter. How then, asks Boyle, are we to explain the fact that it is lost or changed as a result of collision between particles? Additionally, Boyle notices that no system of laws can offer a complete explanation: Secondly, there are, perhaps, historical reasons. For Boyle is conscious of himself as building on past views, and such views typically treated matter as giving rise to the present world, and, in the case of some past thinkers, at least, as having existed in a constant state for some time before the initiating changes that led to the present world occurred. Probably we do not need to look farther for an explanation for his adopting such a view. God created a material world in time and space, but what kind of matter, what kind of space, what kind of time? His views are worth quoting at length: And if the World be bounded, then those that believe a Deity,[42] to whose Nature it belongs to be of infinite Power, must not deny that God was, and still is,[43] able to make other Worlds than this of ours. And even without supposing any more than one Universe, as all that portion of it that is visible to us, makes but a part of that vastly extended aggregate of bodies: Boyle, that is, sees three distinct possibilities: Moreover the laws, as well as the matter, could have been formed differently by God, and could indeed vary from part to part of the current universe within the universe. Clearly the case of varying laws and the case of varying matter may run into each other, but Boyle treats them as distinct possibilities, and gives as an example the possibility of a combination of conservation and non-conservation possibilities: Such views do not at least amount to a rejection of absolute space and time. In opposition to Epicurus, he argued that there are final causes and in opposition to Descartes, he claimed that in many cases we can have epistemic access to these final causes, though he agreed that we ought not be presumptuous in these matters. According to Boyle, there are four types of final cause that we can know. Third, there are the ends that pertain to the parts of animals and fourth there are human ends BW, Boyle was quite adamant that there are no ends that pertain to inanimate objects. In particular, he rejects any form of immanent teleology in virtue of which material objects are able to direct their behaviour: See Carlin ,

Chapter 7 : Robert Boyle - Richard William Nelson

Who: Robert Boyle What: Father of Modern Chemistry When: January 25, - December 30, Where: Born in Lismore Castle, County Waterford, Ireland Irish natural philosopher Robert Boyle was a major contributor in the fields of physics and chemistry.

Lord Cork, then known simply as Richard Boyle, had arrived in Dublin from England in during the Tudor plantations of Ireland and obtained an appointment as a deputy escheator. He had amassed enormous wealth and landholdings by the time Robert was born, and had been created Earl of Cork in October Boyle received private tutoring in Latin, Greek, and French and when he was eight years old, following the death of his mother, he was sent to Eton College in England. During this time, his father hired a private tutor, Robert Carew, who had knowledge of Irish , to act as private tutor to his sons in Eton. Robert sometimes desires it [Irish] and is a little entered in it", but despite the "many reasons" given by Carew to turn their attentions to it, "they practice the French and Latin but they affect not the Irish". They visited Italy in and remained in Florence during the winter of that year studying the "paradoxes of the great star-gazer" Galileo Galilei , who was elderly but still living in Middle years Robert returned to England from continental Europe in mid with a keen interest in scientific research. Robert then made his residence at Stalbridge House , between and , and conducted many experiments there. From that time, Robert devoted his life to scientific research and soon took a prominent place in the band of enquirers, known as the " Invisible College ", who devoted themselves to the cultivation of the "new philosophy". They met frequently in London, often at Gresham College , and some of the members also had meetings at Oxford. Having made several visits to his Irish estates beginning in , Robert moved to Ireland in but became frustrated at his inability to make progress in his chemical work. In one letter, he described Ireland as "a barbarous country where chemical spirits were so misunderstood and chemical instruments so unprocurable that it was hard to have any Hermetic thoughts in it. An inscription can be found on the wall of University College, Oxford , the High Street at Oxford now the location of the Shelley Memorial , marking the spot where Cross Hall stood until the early 19th century. It was here that Boyle rented rooms from the wealthy apothecary who owned the Hall. The person who originally formulated the hypothesis was Henry Power in Boyle in included a reference to a paper written by Power, but mistakenly attributed it to Richard Towneley. The Royal Society archives holds 46 volumes of philosophical, scientific and theological papers by Boyle and seven volumes of his correspondence. In he was elected president of the society, but declined the honour from a scruple about oaths. He made a "wish list" of 24 possible inventions which included "the prolongation of life", the "art of flying", "perpetual light", "making armour light and extremely hard", "a ship to sail with all winds, and a ship not to be sunk", "practicable and certain way of finding longitudes", "potent drugs to alter or exalt imagination, waking, memory and other functions and appease pain, procure innocent sleep, harmless dreams, etc. He experimented in the laboratory she had in her home and attended her salon of intellectuals interested in the sciences. In the leisure thus gained he wished to "recruit his spirits, range his papers", and prepare some important chemical investigations which he proposed to leave "as a kind of Hermetic legacy to the studious disciples of that art", but of which he did not make known the nature. His health became still worse in , and he died on 31 December that year, [23] just a week after the death of his sister, Katherine, in whose home he had lived and with whom he had shared scientific pursuits for more than twenty years. Boyle died from paralysis. He was buried in the churchyard of St Martin-in-the-Fields , his funeral sermon being preached by his friend, Bishop Gilbert Burnet. In his will, Boyle endowed a series of lectures that came to be known as the Boyle Lectures. Yet he would not avow himself a follower of Bacon, or indeed of any other teacher. On several occasions he mentions that to keep his judgment as unprepossessed as might be with any of the modern theories of philosophy, until he was "provided of experiments" to help him judge of them, he refrained from any study of the Atomical and the Cartesian systems, and even of the Novum Organum itself, though he admits to "transiently consulting" them about a few particulars. Nothing was more alien to his mental temperament than the spinning of hypotheses. He regarded the acquisition of knowledge as an end in itself, and in consequence he gained a wider outlook on the aims of scientific inquiry than had been

enjoyed by his predecessors for many centuries. This, however, did not mean that he paid no attention to the practical application of science nor that he despised knowledge which tended to use. Illustration of Excerptum ex collectionibus philosophicis anglicis His first book on the subject was The Sceptical Chymist, published in , in which he criticised the "experiments whereby vulgar Spagyrists are wont to endeavour to evince their Salt, Sulphur and Mercury to be the true Principles of Things. He endorsed the view of elements as the undecomposable constituents of material bodies; and made the distinction between mixtures and compounds. He made considerable progress in the technique of detecting their ingredients, a process which he designated by the term "analysis". He further supposed that the elements were ultimately composed of particles of various sorts and sizes, into which, however, they were not to be resolved in any known way. He studied the chemistry of combustion and of respiration , and conducted experiments in physiology , where, however, he was hampered by the "tenderness of his nature" which kept him from anatomical dissections , especially vivisections , though he knew them to be "most instructing". Theological interests In addition to philosophy, Boyle devoted much time to theology, showing a very decided leaning to the practical side and an indifference to controversial polemics. At the Restoration of the king in , he was favourably received at court and in would have received the provostship of Eton College had he agreed to take holy orders, but this he refused to do on the ground that his writings on religious subjects would have greater weight coming from a layman than a paid minister of the Church. Moreover, Boyle incorporated his scientific interests into his theology, believing that natural philosophy could provide powerful evidence for the existence God. He also attempted to tackle complex theological questions using methods derived from his scientific practices. In Some Physico-Theological Considerations about the Possibility of the Resurrection , he used a chemical experiment known as the reduction to the pristine state as part of an attempt to demonstrate the physical possibility of the resurrection of the body. Throughout his career, Boyle tried to show that science could lend support to Christianity. Boyle supported the policy that the Bible should be available in the vernacular language of the people. He was a pioneer studying races, and he believed that all human beings, no matter how diverse their physical differences, came from the same source: Boyle also extended the theories of Robert Hooke and Isaac Newton about colour and light via optical projection in physics into discourses of polygenesis , [29] speculating that maybe these differences were due to " seminal impressions". Taking this into account, it might be considered that he envisioned a good explanation for complexion at his time, due to the fact that now we know that skin colour is disposed by genes , which are actually contained in the semen. The following are some of the more important of his works: A continuation of his work on the spring of air demonstrated that a reduction in ambient pressure could lead to bubble formation in living tissue. This description of a viper in a vacuum was the first recorded description of decompression sickness.

Chapter 8 : Robert Boyle: Book of Nature & Book of Scripture â€“ science meets faith

The phrase in English appears, for example, in Robert Boyle, A Free Inquiry into the Vulgar Notion of Nature, collected in The Philosophical Works of the Honourable Robert Boyle Esq (), Vol. 2, The concept was known long before Boyle.

For him, nature and scripture were "two great books" written by the same Author. He regarded the scientific study of nature as a religious act through which one could understand more of the attributes of the Creator. Thus, in his view, science and religion play mutually compatible roles, revealing complementary truths. He called upon others to pursue and become proficient in both. His younger contemporary, Isaac Newton , was likewise committed to both science and religion. After studying at the college for more than three years, he traveled abroad with a French tutor and spent nearly two years in Geneva. During his stay in Geneva, Boyle had a dramatic "rebirth" experience through which he made a deeper commitment to his Christian faith than mere acceptance of a religious doctrine. In keeping with his character, he renewed the commitment on a cloudless, serene day, with the understanding that a promise made in fear was not as serious as one made with calm intention. In addition, he later emphasized the need for each individual to have an examined faith rather than accepting a faith on the basis of what one is taught as a child in a believing home. Such speculations naturally led him to consider the manner in which invisible forces might interact with material objects in the visible world. Middle years Boyle remained on the continent until the summer of Apparently, politics and war made it difficult for him to receive his allowance. Back in England, he rejoined his sister Katherine, who had been a maternal figure for him. Their father soon died, leaving him the manor of Stalbridge in Dorset, together with estates in Ireland. In at Stalbridge, Boyle dedicated his life to scientific study and research. He soon took a prominent place in the band of inquirers known as the "Invisible College," who devoted themselves to cultivation of the "new philosophy. Some of the members also met at Oxford, and Boyle took up residence in that city in An inscription can be found on the wall of University College on High Street at Oxford, marking the spot where Cross Hall stood until the early s. At this site, Boyle rented rooms from the wealthy apothecary who owned the Hall. As a result, in , they produced the "pneumatical engine," or "machina Boyleana," and started a series of experiments on the properties of air. He concluded, among other things, that air has elasticity and weight and exerts pressure. He also reported that sound cannot traverse a vacuum, and air is necessary for creatures to live and materials to burn. On a more fundamental level, his experimental results led him to think of matter as composed of minute particles that he called "corpuscles. Title page of The Scepitcal Chymist In , Boyle published The Sceptical Chymist as a dialog in which he argued against the blind acceptance of authority in matters of science and demanded that the question "why? In addition, he strongly advocated the "proof" of results that are claimed to demonstrate a particular principle. For Boyle, the so-called "new philosophy" was experimental science. His scientific investigations and the sheer volume of his experimental records put him well beyond the philosophical or speculative natural philosophers. It should be noted, however, that his call for "healthy skepticism" in science was not an original idea. It followed similar developments in the history of astronomy and medicine Bruno, The revolution in chemistry advocated by Boyle was a call for a systematic organization of experiments and the knowledge gained thereby. His advocacy must have deeply impressed his student Nicholas Lemery, who published a systematic chemistry text, Cours de Chemie. This book was widely used in the study of chemistry for the next 50 years. In , he was elected president of the society, but he declined the honor based on a scruple about oaths. He ceased communications with the Royal Society and advertised his desire to be excused from receiving guests "unless upon occasions very extraordinary," on Tuesday and Friday forenoon, and Wednesday and Saturday afternoon. In the leisure thus gained, he wished to "recruit his spirits, range his papers," and prepare some important chemical investigations that he proposed to leave "as a kind of Hermetic legacy to the studious disciples of that art," but he did not make known their nature. In , his health worsened and he died on December 30 of that year, just a week after that of the sister with whom he had lived for more than 20 years. He was buried in the churchyard of St. Personal side In person, Boyle was tall, slender, and of pale countenance. His constitution was far from robust, and throughout his life he suffered from feeble health and

low spirits. His scientific work procured him an extraordinary reputation among his contemporaries. At the same time, his private character and virtues, the charm of his social manners, his wit and powers of conversation endeared him to a large circle of personal friends. He was never married. His writings are exceedingly voluminous, and his style is clear and straightforward, though undeniably prolix. Yet he would not avow himself a follower of Bacon or any other teacher. On several occasions, he mentioned that he refrained from any study of the atomic and Cartesian systems, and even Novum Organum itself, though he admitted "transiently consulting" them about a few particulars. His desire was to keep his judgment as open as possible with any of the modern theories of philosophy, until he was "provided of experiments" to help him evaluate them. Nothing was more alien to his mental temperament than the spinning of hypotheses. For Boyle, the acquisition of knowledge was an end in itself. This, however, did not mean that he paid no attention to the practical application of science nor that he despised knowledge that tended to be used. He had a lot to say about experimenting as a means to gain knowledge about the natural world. In addition, he seemd to have been the first natural philosopher to establish that the suppositions employed in setting up an experiment must be validated before proceeding with the experiment itself. In his written works, Boyle brought together practical and philosophical elements Sargent, He demanded that the experimenter think about what he is trying to understand and clarify his methods before starting on the experimental work. In addition, the investigator was expected to devise instruments with which to perform the experiments. For example, he and Hooke had produced a version of the vacuum pump that they used in exploring the pressure and compression of air. In the field of physics, Boyle investigated the expansive force of freezing water, specific gravities of materials, refractive powers, crystals , electricity , color , and hydrostatics. For all that, chemistry was his peculiar and favorite area of study. He investigated the chemistry of combustion and respiration, and observed many of the properties of the gas that Lavoisier would later call "oxygen. In , he was instrumental in obtaining the repeal of the statute of Henry IV against multiplying gold and silver. Nonetheless, he was clearly motivated by the quest for truth rather than by the desire for gold. In The Sceptical Chymist and other works, he rejected ideas inherited from the ancient Greeks, including Aristotle, about the elements of matter being such things as air, earth, fire, and water. Moreover, he criticized the "experiments whereby vulgar Spagyrists are wont to endeavor to evince their salt , sulphur , and mercury to be the true Principles of Things. Boyle advanced the view of elements as the undecomposable constituents of material bodies, and that the elements were ultimately composed of various types of corpuscles particles that could not be resolved into smaller parts in any known way. In addition, he understood and defined the distinction between mixtures and compounds, and he made considerable progress in the means of detecting their constituentsâ€”an approach that he called "analysis. He saw the study of nature through science as an act of worship, or a religious act, because through these studies, people could gain an understanding of the Divine attributes. Some religionists feared the study of nature would lead people away from God-worship and toward nature worship. Boyle, on the other hand, thought of nature and scripture as "two books" written by the same Author and teaching complementary truths. Instead, he saw the book of nature as worthy of glorifying God by study. In fact, to neglect the study of nature would be an insult to the Creator. In , he could have received the provostship of Eton College had he taken religious orders, but he refused to do so on the grounds that his writings on religious subjects would carry greater weight coming from a layman than a paid minister of the Church. As a director of the British East India Company , he spent large sums to promote the spread of Christianity in the East. He contributed liberally to missionary societies and to the expenses of translating the Bible or portions of it into various languages. In his will, Boyle endowed a series of lectures that came to be known as the Boyle Lectures. He intended them to be a means of defending the Christian religion against those he considered "notorious infidels, namely atheists , theists, pagans , Jews , and Muslims. References Birch, Thomas ; reprinted The Works of the Honorable Robert Boyle. The Landmarks of Science. Robert Boyle and His Alchemical Quest. Robert Boyle and the Philosophy of Experiment. Shapin, Steven and Simon Schaffer Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life.

Chapter 9 : Birkbeck | Robert Boyle Project | Boyle's works in chronological order

The young Robert Boyle was fascinated by Galileo's belief that mathematics is the language of the world around us. The behavior of planets and pendulums, and the fundamentals of music and mechanics, could all be understood using mathematics.

Notes to Robert Boyle 1. Boyle discusses some of the reasons for his dislike of system building in The Excellency of Theology, BW, 8: A strange Chemical Narrative, BW 9: For discussion of this piece see Ihde and Principe Between God and Science Hunter Michael Hunter has pointed out the same suggestion coming from Meric Casaubon: Thus, knowledge is a divine favour, science and research divine service, the connecting link with divinity. Grace from above meets human aspiration for knowledge from below. Natural research is the search for God. Such doubts were not less common in the seventeenth century than in any other. Birch, Life, Birch , I: Boyle to his father, 25 May, ; Maddison , Glanvill, in Sadducismus Triumphatus Glanvill , argued the same point at length. See further, Hunter ; Jacob ; and Prior For further details, see Maddison , 61, and Hunter , 65f. See also Underdown , The beginning of this duct is the cisterna chyli. The first publication of the discovery was made by Jean Pecquet in in his Experimenta nova anatomica, though he remarked that he made the discovery some years earlier. In the following year Johannes van Horn published the same discovery, having apparently made it independently Foster , Thanks to Andrew Cunningham for this and other information concerning the history of medicine. For details see Opie and Opie , See further Berman The various clerical tracts and published sermons are often philosophically unsophisticated but are nonetheless interesting. See, among others, Charnock , Dove , Edwards , and Pelling See further MacIntosh For Boyle, as for most of his contemporaries, there are laws that are not laws of nature, with the laws of interconnection between body and soul providing, for him, an obvious example. This interconnection also provides a clear example of a state which God constantly preserves: See also BW, These are the muscles m. The tendons of m. Thanks to Andrew Cunningham for drawing these works to my attention. Conjecturedâ€”the edge of the page is torn away. Now, Cleanthes, said Philo, with an air of alacrity and triumph, mark the consequences. First, By this method of reasoning, you renounce all claim to infinity in any of the attributes of the Deity. For as the cause ought only to be proportioned to the effect, and the effect, so far as it falls under our cognisance, is not infinite; what pretensions have we, upon your suppositions, to ascribe that attribute to the divine Being? Aristotelian principles were held to be necessarily true, though garnered from experience. I mean for example that astronomical experience supplies the principles of astronomical science â€¦. Similarly with any other art or science Pr An, 46a Berman points out Berman , 7, and 44 n 11 that the concentration on insects is not uncommon, but it is worth noting that many seventeenth century writers emphasized the meanness and contemptibility of insects whereas Boyle genuinely admires the workmanship involved. The virtuoso, he often emphasizes, is, by reason of his expertise, in a better position than the uninformed to see the strength of such design considerations. Boyle makes this point in a number of places. The point was generally accepted. Earlier Descartes had remarked that the laws of nature simply were the laws of mechanics les regles des Mechaniques â€¦ sont les mesmes que celles de la nature, Discourse V, AT 6: Leibniz thought it was a conceptual truth that the universe was lawlikeâ€”whatever happened was the law that governed things or, in particular, that thing. However, as noted earlier, he too agreed that, in practice, we should search for intelligible, that is, corpuscular, laws. For further discussion see Sleigh , ff. In the seventeenth century these laws were generally felt to be, from a human point of view at least, the result of arbitrary decisions by God. The view was still common in the mid-eighteenth century when the American Samuel Johnson wrote: See further BW 8: In an earlier tradition time and the angels, along with the heavens and the earth, were co-created, so that there was never a time when the angels did not exist. On this issue see MacIntosh , , and Descartes, Principles of Philosophy, 3. Boyle argues that this is generally true for scientific explanation, not just for explaining the beginning of the universe. The philosophical implications of this point are discussed by Michael Polanyi in Polanyi , Something is heteroclite if it is unusual or in some way anomalous. See further, BW 9: For suggestions that Boyle did reject absolute space and time see McGuire , , and Alexander , Substantial forms are useless for

scientific explanations, and they have as well a number of internal difficulties see, e. However, Boyle does not on this account rule out substantial forms altogether: Strictly, Leibniz distinguished between momentum, mv, and mv2, that is, twice the kinetic energy.