

THE ACHIEVEMENTS OF IBN SĪNĀ IN THE FIELD OF SCIENCE AND HIS CONTRIBUTIONS TO ITS PHILOSOPHY

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Ibn Sīnā is generally known as one of the most important philosophers and physicians, one whose contributions to science and philosophy have attracted numerous studies. This article provides an outline of his philosophy of science which determined the framework for his understanding of natural philosophy. Rather than being of historical interest, the article argues, Ibn Sīnā's philosophy of science is a useful beginning for developing a contemporary Islamic philosophy of science. The article also discusses Ibn Sīnā's importance in the philosophy of health and medicine.

Keywords: Contributions of Ibn Sīnā in various sciences; Islamic philosophy of science; health and medicine in Islam; Ibn Sīnā and contemporary Islamic intellectual thought.

Ibn Sīnā is without doubt the most widely known intellectual figure concerned with science in Islamic civilization. He has, in fact, gained the image of a folk hero, especially in the zones of Arabic, Persian, and Turkic cultures, where numerous stories concerning his exceptional intellectual powers came into being in the form of folktales told by grandmothers to their grandchildren over the centuries. Moreover, his medical heritage is alive wherever Islamic medicine is still practiced, such as in Pakistan and India, and his influence as a philosopher and even theologian is to be felt wherever the Islamic philosophical tradition survives, as in Persia. The sign of respect for him as almost the archetype of the Muslim philosopher-scientist can be seen in the number of hospitals, schools, and centers of research bearing his name from Morocco to Malaysia.

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Islam & Science, Vol. 1 (December 2003) No. 2

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In this essay we shall limit the definition of science to the mathematical and natural, while remembering that Ibn Sīnā also made major contributions to the sciences of language, music, psychology, etc., and even the occult sciences (*al-ʿulūm al-gharībah*), not to speak of the supreme science or metaphysics (*al-ʾilāhiyyāt*) which determined the framework for his understanding of natural philosophy (*al-ṭabīʿiyyāt*). Because of the fame of Ibn Sīnā in both the West and in the Islamic world, numerous studies have been devoted to him and even if we were to limit ourselves to the above given definition of science, it would still be necessary to compose a large work and in fact many volumes to do justice to Ibn Sīnā's contributions to science and its philosophy.¹ Here we shall provide a simple summary based on a lifelong study of his philosophical and scientific works, without claiming to have exhausted the discussion of any of the fields to which he made contributions.

Before turning to specific sciences, it is essential that we deal with Ibn Sīnā's contributions to what in today's terminology would be called "philosophy of science" and the more traditional category of natural philosophy, which are in fact the most important aspects of his scientific legacy, worthy of much more study than has been granted them until now. It is our belief that in this aspect of Ibn Sīnā's work is to be found one of the major cornerstones for the creation of a contemporary Islamic philosophy of science. His discussion of the relation of physics to metaphysics, the meaning of form (*ṣūrah*) in both physics and the biological sciences, the relation between various sciences in the context of the Islamic intellectual tradition and many other subjects dealt comprehensively by this remarkable figure are of great relevance today and are not only of historic interest.

Before Ibn Sīnā, philosophers such as al-Kindī and al-Fārābī had been concerned with the classification of the sciences, which is a matter of great significance for a worldview based on *taḥqīd* and the consequent inter-relation of all branches of authentic knowledge. Ibn Sīnā continued this effort with greater knowledge of particular sciences than his illustrious predecessors and also at a time when the various sciences had developed

1. We have dealt with Ibn Sīnā's cosmology and view of the different sciences in Nasr, S. H. (1993), *An Introduction to Islamic Cosmological Doctrines*, The State University of New York Press, Albany. This edition contains an extensive bibliography of works in European languages dealing with Ibn Sīnā's contributions to the various sciences and cosmology up to 1993.

more fully. His treatise *Fī aqsām al-ʿulūm al-ʿaqliyyah* (*Classification of the Rational Sciences*) as well as his classification of the sciences in his *Kitāb al-shifāʾ* (*The Book of Healing*) are major contributions to a subject of great importance in Islamic civilization, namely the rapport between various sciences, both intellectual and religious.² From the Islamic point of view, an authentically Islamic philosophy of science cannot ignore the relation between various modes of knowing and the sciences which result from them. Ibn Sīnā's contributions to this subject are still of significance and will surely play a role in any serious current effort made to re-create a contemporary Islamic classification of the sciences which would be authentically Islamic.

Another element of Ibn Sīnā's philosophy of nature is his contribution to logic and the use of logic in the mathematical sciences. As has been shown by A.M. Goichon and others, while Ibn Sīnā used the Aristotelian syllogistic method, he allowed empirical causes to be used as the middle term in a syllogism.³ The dichotomy observed in the West between Aristotelian syllogistic thinking and scientific induction, and empirical knowledge and the attack made by defenders of the latter against Aristotelian reasoning as one finds in Francis Bacon, do not in fact apply to Ibn Sīnā and later Islamic thinkers influenced by him. Thanks to him induction played a different role vis-à-vis deductive thinking from what one finds in the mainstream Western philosophy, and the two complemented rather than opposed each other in Islamic thought. A major twentieth century treatment of the subject of induction by the Muslim philosopher Muḥammad Bāqir al-Ṣadr⁴ is in many ways the authentication and continuation of the philosophical efforts of Ibn Sīnā in this domain.

2. One cannot have an authentic Islamic intellectual tradition without having a tree of knowledge rooted in *taḥḥīd* and branches which are organically related to each other and to the root of the tree. See Bakar, Osman (1998), *Classification of Knowledge in Islam*, Islamic Texts Society, Cambridge.

3. See Goichon, A. M., "L'Unité de la pensée avicennienne" in *Archives Internationales d'Histoire des Sciences*, no. 20-21, 1952, pp. 300 ff. See also Nasr (1993), pp. 188 ff.

4. Tragically put to death in Iraq in 1980, Muḥammad Bāqir al-Ṣadr was one of the most gifted authentic Islamic philosophers of his day. For his discussion of induction see his (1972), *al-Usus al-manṭiqiyyah li'l-istiqrāʾ*, n.p., Baghdad.

The question of induction in logic leads us to the general subject of epistemology and the so-called scientific method of Ibn Sīnā. One of the greatest scientific contributions of Ibn Sīnā was to demonstrate that there are, in fact, not one but many methods of acquiring scientific knowledge, ranging from empirical observation and experimentation, to deduction and demonstration, to intellectual intuition which he called *ḥads*. If anyone carefully studies the history of science in general, including modern science, he will realize how all these methods of knowing have been at play in various stages of scientific discovery, and how shallow and unscientific it is to speak of a single scientific method. Kepler did not discover the laws of planetary motion nor Einstein the theory of relativity nor Heisenberg the uncertainty principle through what ordinary textbooks describe as the “scientific method.”

Today, because of the prevalence of scientism among many modernistic Muslim thinkers, there is a vast body of literature being produced in various Islamic languages on “the scientific method.” Islamic science, however, was based not on one method but several methods for knowing the world about us, and a hierarchy was in fact created within epistemology in Islamic philosophy which also permitted the creation of harmony between various modes of knowing, including revealed knowledge, between what is attained through revelation, intellection and reasoning, and what is known empirically.⁵ Surely this issue is of the greatest importance for the current challenges which modern science poses for Islamic thought, and again the contribution of Ibn Sīnā to the subject is of the utmost significance.

The philosophy of science of Ibn Sīnā includes of course the philosophy of the natural world, one which is of the profoundest order and which is far from having become outmoded, as many modern Muslim thinkers believe. In his natural philosophy, Ibn Sīnā follows to a large extent Aristotle, as far as such basic theses such as hylomorphism and potentiality and actuality are concerned, although his metaphysics is different from that of the Stagirite as far as the meaning of being and the

5. We have dealt with this issue in many of our writings. See for example, “Reflection on Methodology in the Islamic Sciences” in *Hamdard Islamicus*, vol. 3 (1980) no. 3, pp. 3-13. See also Bakar, O. (1999), *The History and Philosophy of Islamic Science*, The Islamic Text Society, Cambridge, pp. 13ff; and Iqbal, Muzaffar (2002), *Islam and Science*, Ashgate, Aldershot.

basic ontological question of necessity and contingency is concerned. It must be remembered that, although for a long time Aristotelian natural philosophy was severely attacked, going all the way back to the works of Galileo, the Aristotelian idea of potentiality was resuscitated in modern quantum mechanics by no less a figure than Werner Heisenberg and that both the concepts of potentiality/actuality and *morphos* in the Aristotelian sense are still very much alive in the more profound new interpretations that are being given by certain contemporary scientists of quantum mechanics, not to speak of biology.⁶ One hardly needs to remind contemporary Muslim thinkers seeking to create an Islamic philosophy of science how valuable the contributions of Ibn Sīnā—and for that matter, those of later Islamic philosophers such as Mullā Ṣadrā—are for today's Islamic thinkers.⁷ One should never forget that Ibn Sīnā has provided in his *Kitāb al-shifā'* the most extensive, complete and systematic account of Aristotelian natural philosophy in its Islamic form, more complete than the works of Aristotle himself, and a veritable synthesis which influenced not only later Islamic thought but also much of European scholasticism, especially the thought of Albert the Great and Thomas Aquinas.⁸ Present day Thomistic philosophers seeking to create a new philosophy of nature are very much in debt to the momentous contributions of Ibn Sīnā to the subject, including his contribution to the philosophy of biology, which has

6. See Smith, Wolfgang (1995), *The Quantum Enigma—Finding the Hidden Key*, Sherwood Sugden, Peru, IL; and his (2003), *The Wisdom of Ancient Cosmology—Contemporary Science in Light of Tradition*, The Foundation for Traditional Studies, Oakton, VA.

7. See Dagli, C., "Mulla Sadra's Epistemology and the Philosophy of Physics" in Safavi, S. G. (ed., 2002), *A Comparative Study on Islamic and Western Philosophy*, Salman Azadeh Publications, London, pp. 180-92.

8. There were of course other important schools of natural philosophy in Islam including the Hermetio—alchemical, *Ishraqī* and that of Mullā Ṣadrā, without even touching on the views of scientists such as al-Bīrūnī who opposed certain theses of Aristotelian natural philosophy. See Ibn Sīnā and al-Bīrūnī, *Al-As'ilah wa'l-Ajwibah (Questions and Answers)*, ed. Nasr, S. H. and Mohaghegh, M. (1995), International Institute of Islamic Thought and Civilization, Kuala Lumpur; see also "Ibn Sīnā—Al-Bīrūnī Correspondence", trans. Berjak, Rafik and Iqbal, Muzaffar in *Islam & Science*, vol. 1 (June 2003) no. 1, pp. 91-8. We would be the last person to deny the significance of these other natural philosophers, but their pertinence does not detract from the central importance of the natural philosophy set forth by Ibn Sīnā in several of his works (especially the first book of the *ṭabī'īyyāt* entitled *fann al-samā' al-ṭabī'ī* in the *Shifā'*).

not received as much attention as his discussions of physics and cosmology in general.

Although he was not a major mathematician like the reviver of his philosophy, Naṣīr al-Dīn al-Ṭūsī, Ibn Sīnā made important contributions to the philosophy of mathematics, not to speak of his notable studies of the theoretical and mathematical aspects of music and his role in the criticism of the mathematical astronomy of Ptolemy, which was widely pursued in later centuries by al-Ṭūsī, al-ʿUrḍī, al-Shīrāzī and others. What is important, as far as his contributions to the philosophy of mathematics is concerned, is his discussion of mathematical form in relation to logical concepts and the rapport between formal and mathematical logic. Little work has been done in the Islamic philosophy of mathematics until now. Once such an undertaking is fully accomplished, it will become clear that even in this field, where his mathematical contributions were nowhere near as great as those of other philosophically minded scientists such as Ibn al-Haytham, ʿUmār Khayyām and al-Ṭūsī, Ibn Sīnā nevertheless played an important role in the creation of the philosophy of mathematics as an important branch of the Islamic philosophy of science.

The various aspects of Ibn Sīnā's natural and mathematical philosophy, or what is called today, with a modified meaning, the "philosophy of science", are to be found in the *Kitāb al-shifā'*. This work needs to be studied thoroughly with the view of bringing out his total philosophy of science, including general cosmology,⁹ philosophy of physics, philosophy of living forms and philosophy of mathematics. There is probably no other work in the annals of Islamic thought that is as important as the *Shifā'* from this point of view. It is also in this encyclopedic work that we see for the first time the systematic treatment of the three kingdoms—that is, minerals, plants and animals—in their interrelation with one another, something not found in any single work, nor in such a systematic manner, in any Greek text. Also it is in this book that the idea of the great chain of being is used as the metaphysical basis for the integration of all the different sciences from physics (in the modern sense) to the life sciences to meteorology to astronomy and finally to the science of being beyond the visible world. Although the elements of these ideas had existed among Greek and earlier Islamic philosophers, their synthesis owes its existence to Ibn Sīnā, a synthesis which played a

9. With which we have dealt in Nasr, S. H. (1993), pp. 197 ff.

major role in the later history of science and natural history in both the Muslim world and the West.

II

Ibn Sīnā was not only the most famous of all Muslim philosopher-scientists, he was also the most celebrated medical authority in the classical Islamic world as well as in the medieval West. His contributions to medicine, pharmacology and related subjects are immense, and need separate treatment if one is to do justice to all that Ibn Sīnā accomplished in these domains. What we wish to emphasize here is the philosophy of medicine that he expounded on the basis of the synthesis of Hippocrates, Galen, Indian and pre-Islamic Persian medicine as well as earlier Islamic physicians such as al-Ṭabarī and al-Rāzī and Islamic teachings about health and related subjects. What is health? What is illness? These are questions that are difficult to answer in the framework of the prevalent mechanistic view of modern medicine. For Ibn Sīnā, however, his philosophy of medicine provided a clear answer to these questions. The human being possesses levels of reality situated in the vertical hierarchy of body, soul and spirit. On the horizontal level, the body of the human microcosm also possesses elements and natures which combine to form the human corporeal reality. Health is equilibrium and balance between elements of both the horizontal and vertical dimensions of the human microcosm and illness is loss of this equilibrium. Moreover, to be healthy it is necessary that an equilibrium be established with one's environment and in one's diet and manner of living, or what is today called lifestyle, as well as between one's physical and one's psychological states, and finally between the soul and the spirit and ultimately with God. All of these realities and their harmonious relation play a role in human health, as the loss of harmony between them is instrumental in bringing about illness.

Ibn Sīnā formulated an elaborate philosophy of what is today called holistic medicine.¹⁰ In his treatment of illness he did not shun any means that he considered to be effective. While providing herbal and mineral medicaments, he also used psychosomatic medicine as well as what is

10. This is contained most of all in the first book of his famous *al-Qānūn fī'l-ṭibb* (*Canon of Medicine*). See Avicenna, *A Treatise on the Canon of Medicine, Incorporating a Translation of the First Book*, trans. by Gruner, O. (1930), Luzac, London; and Shah, M. H. (1966), *The General Principles of Avicenna's Canon of Medicine*, Navid Clinic, Karachi.

today called spiritual healing. If formulated in a contemporary language, Ibn Sīnā's philosophy of medicine is bound to be readily accepted in a world in which there is so much interest in holistic medicine. Moreover, Avicennian or Islamic medicine will certainly have as wide an appeal in the West as acupuncture, Tibetan and Ayurvedic medicine if presented correctly by competent practitioners of this all-important school of medicine. This also holds true for the Muslim world itself, where, except for the Indo-Pakistani Subcontinent, the practice of Islamic medicine was gradually reduced to "folk medicine" by the early 14th/20th century. The remarkable success of the two brothers, Ḥakīm 'Abd al-Ḥamīd and Ḥakīm Muḥammad Sa'īd in creating the Hamdard centers in Delhi and Karachi after the partition of India bears witness to the ever-living importance of the medical heritage of Ibn Sīnā.

Ibn Sīnā did not, of course, create only a grand synthesis containing a total medical philosophy. He also made major specific contributions to medicine and pharmacology. This included everything from discerning meningitis as a distinct illness, the contagious nature of tuberculosis, the real cause of asthma and the significance of the optic nerve, to experimenting with and subscribing many drugs for various illnesses. The vast pharmacopoeia of Ibn Sīnā includes of course many earlier sources, but there are also many drugs for which he is directly responsible. Ibn Sīnā also emphasized the importance of public health. For him as for other authorities of Islamic medicine, the most important medical action is to prevent disease through public health and diet rather than cure it after disease has already infected the patient. His combination of diet and medicaments and consideration of the two to be complementary is not unique to him, and characterizes Islamic medicine in general, but he himself made major contributions not only to the exposition of the idea, but also to prescribing specific diets in combination with various drugs. In Islamic medicine the line between various food substances and what we call drugs or medicine today is thin, and the use of food materials with medical properties and medicinal substances with nourishing qualities is common. Ibn Sīnā's contribution to the creation of this harmonious interplay between dietary and medical usages and regulations is central, and he left that as a legacy for later Islamic medicine and even traditional cuisines of the Islamic world.

Furthermore, the widespread influence of this remarkable figure whom the West called "The Prince of Physicians" caused many of these ideas to spread to Western medicine and to remain prevalent until the

rise of mechanistic science and medicine in the 11th/17th century. It is strange that now that many of these traditional ideas are being revived in the West, Ibn Sīnā is not being given his dues as one of the main authors of the thesis that food is also medicine for the body and medicine can be food, and that the effect of the two are complimentary and interrelated.

III

A few words must also be said about Ibn Sīnā's contributions to the other sciences besides medicine, and the disciplines of the philosophy of science, cosmology and natural history. The *Kitāb al-shifā'* is not only the first work in which the three kingdoms in natural history, as they later became known, were treated together systematically, it also contains the most extensive discussion of geology and the mineral kingdom of any classical Islamic work. Besides having analyzed the structure of a meteor, Ibn Sīnā dealt with the formation of sedimentary rocks and the role of earthquakes in mountain formation. He displayed clear awareness of the possibility of seas turning into dry land and vice-versa and was therefore able to give a correct explanation for the discovery of fossils on mountain tops. Regarding the formation of metals, while rejecting the possibility of alchemical transmutation, he accepted the Jābirean sulphur-mercury theory which he combined with the mineralogical theories of Aristotle and Theophrastus. His works and those of Muslim scientists who followed him played a very important role in the later development of chemical theories which grew out of the alchemical worldview, once the symbolic and spiritual significance of alchemy was forgotten. It must be recalled, however, that although Ibn Sīnā created a synthesis of ideas concerning the nature of the mineral and metallic states, the transformation of alchemy to chemistry proceeded him and was accomplished by Muḥammad ibn Zakariyyā' al-Rāzī (ca. 250-313/854-925).¹¹ In any case, the contributions of Ibn Sīnā to several aspects of geology and mineralogy are significant in the history of these sciences.

From the point of view of the later development of modern science, perhaps the most important scientific contribution of Ibn Sīnā, outside the field of medicine, was to dynamics and the study of projectile motion. Aristotle had discussed the question of projectile as against natural

11. See "From the Alchemy of Jābir to the Chemistry of Rāzī" in Nasr, S. H. (2001), *Islamic Life and Thought*, ABC International Group, Chicago, pp. 120-3.

motion, and had come up with theories for its explanation which were already criticized before the rise of Islam by John Philoponos. Ibn Sīnā was fully aware of the views of Aristotle on this matter and was, like Philoponos, critical of the Stagirite on this subject. Ibn Sīnā developed the theory of *mayl* (the Latin *inclinatio*), according to which, whenever a body is in projectile motion in opposition to its natural motion, an “inclination” is created in it to return to its natural place and motion, and this causes it to move until that *mayl* is spent. Ibn Sīnā’s views were added to those of Ibn al-Haytham, who spoke of momentum, as well as the theories of Ibn Bājjah and others, and they played a critical role in showing the weakness of Aristotelian physics in explaining projectile motion and in preparing the ground for Galileo’s rejection of that physics. The language of these Muslim philosophers can be detected in Galileo’s *Pisan Dialogue*.¹²

IV

Ibn Sīnā’s greatest significance for the sciences, as far as contemporary Muslims are concerned, is his natural philosophy, or, in modern parlance, philosophy of science, and medicine. Today the Islamic world is in dire need of developing its own natural philosophy rooted in the deepest teachings of the Islamic revelation and fourteen centuries of a living Islamic intellectual tradition. The contributions of Ibn Sīnā are indispensable in order to accomplish this task successfully. No amount of scientism wrapped in piety by certain contemporary Muslims can prevent Ibn Sīnā’s philosophy, including his philosophy of nature, from remaining as a very important component of the still living Islamic intellectual tradition. After over a thousand years, Ibn Sīnā still has a great deal to teach us, not only about logic, philosophy and medicine but also about science itself, about how to be an authentic Islamic scientist, and about how to integrate the sciences of nature into the total scheme of knowledge in such a way as to preserve *tawḥīd* and to prevent a partial knowledge of the relative from eclipsing and marginalizing the knowledge of the Absolute, the attainment of the knowledge of Which is the ultimate goal of human existence.

12. See Moody, E. A., “Galileo and Avempace” in *Journal of the History of Ideas*, vol. XII (1951) no. 2, pp. 163-93; (1951) no. 3, pp. 375-422; and Nasr, S. H. (1999), *Islamic Science—An Illustrated Study*, Kazi Publications, Chicago, pp. 139-40.