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IBN SĪNĀ AND INDIAN SCIENCE

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Ibn Sīnā (A.D. 980-1038 ; A.H. 370-428) is a great name in the history of science. Known mainly as a philosopher, Ibn Sīnā made important contributions also to logic, sociology, literature, poetry, *etc.*, but his contribution to science is no less inferior to that in other branches. Here an attempt has been made to assess his contributions to science through the Indian perspective.

1. Education

From his childhood Ibn Sīnā had a liberal education and developed a habit of reading books. He read almost all the important works known and available to him in his time and made a special study of the works of Hippocrates, Plato, Aristotle (Metaphysics), Plotinus, Zeno, Euclid and Ptolemy.[1] He also consulted the work of al-Kindī (A.D. 800-873), al-Ṭabarī (A.D. *c.* 846), al-Rāzī (A.D. 865-923), al-Fārābī (A.D. 872-95) and others and collected valuable information from their works.[2]

2. His Works

Ibn Sīnā wrote many important works. Anawati's *Bibliography of Avicenna* published in Cairo in 1950 lists some 276 titles attributed to the great Master.[3] A few important works which are well known and have survived even today may be noted for their scientific and philosophical contributions. These are : *al-Qānūn fiṭ Ṭibb*[4] (Canon or Laws of Medicine), *Kitāb al-Shifā*[5] (Book of Cure, Healing or Remedies), *Najat*[6] (a short version of *al-Shifā*), *al-Adwiyat al-Qalbīyyah* (Cardiac Remedies), *Dānishnāma*[7] (Book of Knowledge), *Kitāb al-Ishārāt wa'l Tanbīhāt* (Book of Theorems and Propositions), Commentaries on Euclid's and Ptolemy's works, *etc.* In his *al-Shifā'*, Ibn Sīnā writes[8] "My aim is to include in it all the fruits of science of the ancient period which I have checked and which are based on outright deduction or induction as accepted by thinkers who have long sought the truth. I have tried to incorporate as much as possible of the entire field of philosophy". From his remarks we can assume that he made a serious attempt to update the knowledge through his experience. Some modern scholars like Arnold Villanova, however, have caught him on the wrong side and criticised him as a professional scribbler. His *Canon of Medicine* was taught in the West as an authoritative manual for instruction for seven centuries and was translated repeatedly in Latin and Hebrew.

This very fact shows that Villanova's charge is pointless, and the work stood the test of time because of its merit. There is no doubt that Ibn Sīnā was a great synthesizer and transmitter of scientific knowledge, if not an original thinker. The work *al-Qānūn* is still known as one of the best books of medicine and *al-Shifā'* as one of the best works of philosophy because of author's range, logical rigour, and the conciseness and lucidity of his expositions. His attempt at formulation, solution of new questions and treatment of the subject have a unified approach, all leading to an organic whole.

3. Contact with Indian Science

Ibn Sīnā never came to India and had no direct contact with Indian science. But Indian science was so widely known and read in Baghdad in his time that his works contain reflections of Indian science like those of his contemporaries. It has now been established beyond doubt that Āyurvedic works (*Caraka Saṃhitā, Suśruta Samhita, Nidāna,* and *Aṣṭāngahṛdaya*) and mathematical and astronomical works (*Surya-siddhānta, Āryabhaṭiya, Brahmaṣphuṭasiddhānta,*and *Khandakhadyaka*) were available in Arabic in the seventh century. During the Abbasid period, Salih ibn Dahn and the Hindu astronomer Mankah were the transmitters of this tradition. Ibn Sīnā writes that there were occasional discussions in his time on philosophy, geometry and Indian arithmetic. His father wanted him to learn Indian arithmetic and sent him to a grocer who was in the habit of using Indian method of calculation.[9] There is evidence that Ibn Sīnā introduced in his work the Indian method of testing the simplest functions by using the number 9 and generalised its use for finding the cubes of numbers. In medicine, he also prescribed *Itrephal*, which is nothing but *Triphala* of Āyurvedic texts. On several occasions he has mentioned *Hubbul Hind* meaning 'Indian pill', *Jawarishul Hind* meaning '*Indian curnam*', *Majanul Hind* meaning '*Indian leham*'. These are only a few of the drugs of Āyurveda mentioned in the *Qānūn.*

4. Glimpses from Ibn Sīnā's Works

Ibn Sīnā's attempts at quantification of knowledge is praiseworthy. A short synopsis together with analysis of some of his contributions is given below.

4.1. *Medical Knowledge*

The Qānūn is a medical encyclopaedia in five volumes. The first volume deals with general principles, humoral theory, and temperamental and climatic effect. The second volume, in two parts, discusses the general principles regarding drug action and method of collecting and preserving various drugs and drug products. It also furnishes a list of 760 drugs arranged alphabetically. The third volume deals with symptoms, diagnosis, prognosis and systematic treatment of diseases of different organs. The fourth volume deals with treatment of general diseases like fever, boils, swellings, leprosy, minor surgery, wounds, ulcers, glandular swellings, poisons

and beauty culture. The fifth volume describes special prescriptions and antidotes, methods of preparing pills, pessaries, suppositories, powders, syrups, electuaries, decoctions, confections, elixirs, weights and measures, *etc.*

The *humoral theory* or doctrine of four humours, namely blood, phlegm, bile, and black bile together with temperamental states, namely hot, dry-cold, moist-cold and dry, remained the basis of diagnosis and treatment by Greco-Arab physicians for all diseased conditions. The temperament indicates the state of equilibrium between the four natural properties or four humours. In Hypocratic theory, humoral imbalance is corrected by measured doses of medicaments while Ibn Sīnā believed that restoration of health means bringing the body to a normal balance. For this, he recommended venesection, a number of eliminants and rectifiers among other methods. In Āyurveda also, the humoral doctrine was central to the diagnosis as well as treatment of diseases. The three humours *vāta*, *pitta* and *kapha* were referred to as *tridhātus* when they were in their normal states supporting the bodily functions, and they become *tridoṣas* or vitiating agencies when they are deranged or in a state of imbalance.[10] The Āyurveda recognises the role of *rakta* (blood) along with the *tridhātus* in the maintenance of bodily functions though it was not included as the fourth factor of humoral elements. Treatment was aimed at elimination of deleterious ingredients and replenishment with the harmonious ones, so that *tridoṣas* become *tridhātus* again. All drugs, therapeutic procedures and even surgery are employed towards this end. The origin of this theory in India is very old, its final and allembracing form appears in the *Caraka* and *Suśruta saṃhitās*. Ibn Sīnā's concept of humoral theory is closer to Āyurvedic than to Hypocratic concept.

4.2. *Alchemy*

Ibn Sīnā in his *al-Shifā* remarks[11] : "Alchemy is far behind nature, and cannot catch up with it, although it endeavours to do so. As regards the pretension of alchemists, they can produce no genuine change of species. They can perform good imitations, painting red metal white so that it resembles silver, or yellow so that it resembles gold... But the substance of those metals remains unchanged thereby..." The method of transmutation from baser metal to gold and silver was then widely used in India and Central Asia. Ibn Sīnā was correct in his statement, for it has been proved that baser metals cannot be changed by ordinary heating process without the change of its atomic weight. He gave special emphasis to mercury, similar to Indian and Central Asian practice, and used it for medicinal purposes He viewed gold and silver as the most perfect of substances and prescribed them as excellent medicaments for strengthening the heart and cleansing the blood. He also used salts of some heavy metals for external application—antimony, iron, lead and copper compounds for treating diseases of the eye and some other organs. He gave special importance to mineral water containing salts, gold and silver, for they

were considered to be beneficent to the human organism because of their solvent qualities. A simple substance, he writes, cannot produce other substances, and in a mixture,-one of the components predominates.

4.3. *Physical Concepts*

Ibn Sīnā's creative approach to some problems of physics and mechanics is shown in his *al-Shifā*. Some reflections are also available in his *Dānishnāma*. The *Shifā'* is a philosophical encyclopaedia in four parts, *viz.* logic, physics, mathematics and astronomy, and metaphysics. The book on physics deals with rudiments of physics, motion, properties of bodies as quantity, divisibility, *etc*, the heavens and the universe, existence and decay, meteorology, man and his soul, senses, faculties, and plants and animals. *Dānishnāma*[11a] likewise is a profound exposition of various principal doctrines and problems of logic, metaphysics, mathematics, physics, astronomy and music. Several copies of manuscripts are available in Bankipur Library (Patna), Raza Library (Rampur), India Office Library (London), British Museum (London), *etc.*

Ibn Sīnā defined the movement of a body in terms of two quantities *i.e.* length of its path and time. 'Slow' and rapidity are distinguished by time taken by a body. He says, that which passes in a short time, moves much more quickly. The term like quantity of movement has also been used. Speed depends on what is known as mass in modern times. Speeds of light and sound differ because of different forms of movement of matter. Concepts like 'motive force', 'impulse', 'forced' and 'natural movements' have also been defined. From these definitions he put forward his own theory of the mechanics of movement. He said, "a kind of incorporeal kinetic force or dimension—closely equivalent either to impulse or to kinetic energy", is imparted to the moving body. A similar concept was known in India also.

The impetus theory of motion of *Vaiśesikas* (3rd century B.C.), specially *Praśastapada*[12] (5th Century A.D.), defines that motion means change of position. Motion is not a mere displacement (*somyogavibhaga*) but is endowed with specific directional properties (*digviśiṣṭa-kāryāramabhakaivam*). *Vega* has been rendered as speed or momentum[13] and has been defined as one of the causes of motion. It has been admitted by *Praśastapada* which says that *Vega* is generated in five corporeal substances (earth, water, fire, air, and wind) by efficient causes without going into the details of the causes. This has been explained by the commentators, Vyomaśivācārya and Śrīdhara. In India, no attempt was made on time-displacement relationship. This is traceable in the works of Ibn Sīnā, and in the works of a few other Arab philosophers. On reasoned argument Ibn Sīnā's concept appears closer to impetus theory which was rediscovered by William Ockham, Jean Buridan and others.

4.4. *Method of Longitude*

Ibn Sīnā's method for finding geographical longitude mentioned in his *Message* appears to be lost. *Al-Bīrūnī* was acquainted with the *Message* and analysed it in his *Geodesy*. His method runs as follows[14] : "The difference between calculated and observed positions of the moon is translated into the difference in local times at the two localities, and that will be the difference in their geographical longitudes". The very similar method of longitude difference between two places was used in ancient Indian astronomical texts. Pṛthudakasvamin (A.D. 864) in his commentary on the *Khandakhadyaka* (Chapter 1, Rule 15) explains that the *Khandakhadyaka* explains that the longitude differenec between two places can be obtained by the time difference of a lunar eclipse in minutes and expressing the same in *Yojanas*. He explains the rule in the case of Kurukṣetra where the eclipse is observed $1\frac{1}{2}$ ghatikas after the calculated time for the meridian of Ujjayinī. The longitude difference between Kurukṣetra and Ujjayinī therefore works out to $(3 \times 4800)/(2 \times 60) = 120$ *yojanas* (one day = 60 minutes or *ghatikas* or *nādikas* ; earth's circumference = 4800 *yojanas*). Bīrūnī[16] has quoted this method and noted Kurukṣetra is 120 *yojanas* east of Ujjain.

5. Conclusion

Ibn Sīnā's works made a considerable impact on Indian science and philosophy and were introduced along with *Unāni ṭibb* after the establishment of the Muslim rule in India. Akbar gave patronage to many scholars and his court became a house of intellectuals including physicians and surgeons. One of his Persian physicians in the court, known as Hakim Ali, who came to India from Gilan and became a personal attendant-cum-physician to Emperor Akbar, wrote a commentary, *Sharh-i-Qānūn* on Ibn Sīnā's *al-Qānūn* in Arabic during Akbar's reign. This is also mentioned by Jahangir in his *Tuzuk*. He gave the meanings of the words used in the original *al-Qānūn* along with its derivatives and inner meaning and collated information from Āyurvedic texts. Another commentary on al Qānūn was written by Hakim Fatḥullah Shirazi who rendered his work into Persian.[16] *Al-Qānūn* began to be studied with zeal only when it was introduced as a text-book in the Madrasa system of education. But the works of Ibn Sīnā did not affect the large segment of Indian populations, Hindu or Muslim, as it did in the West. The main reason perhaps lies in the fact that the medical lore was almost certainly prolifereated less through medical establishments, like hospitals or dispensaries, than through local practising hakims. A few copies of *al-Qānūn*, *al-Shifā'* and *al-Najat* are available in different Oriental libraries in India. *Al-Qānūn* has also been translated into Urdu in India.[17] Apart from these works, two commemoration volumes have also been published, one by Syed Tajuddin under the auspices of the Golden Jubilee Celebrations of Muslims Educational Association of South India, Madras, in 1955, and the other, by Iran

Society, Calcutta, in 1956. Since India has connections with Arabic literature for over a thousand years, Indians are proud on this occasion for having an opportunity to pay tribute to the great philosopher scientist, Ibn Sīnā.

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