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THE LIFE AND THOUGHT OF AVICENNA

ABU ‘ALI AL-HUSAIN IBN ‘ABDALLXH IBN SlNA
(980-1037 A,D.)

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TRANSACTIONS

Many valuable lectures are given, papers read and discussed, and oral reviews of outstanding books presented, at the Indian Institute of Culture. Its day is still one of small beginnings, but wider dissemination of at least a few of these addresses and papers is obviously in the interest of the better intercultural understanding so important for world peace. Some of these are published in the Institute's monthly organ, *The Aryan Path ',* then we have two series of occasional papers—Reprints from that journal, and Transactions. The Institute is not responsible for views expressed and does not necessarily concur in them.

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The celebration throughout the world of the Millenary (reckoned by lunar months) of the birth of the great and versatile Arabic scholar Avicenna had been recommended by Unesco, in the interest of greater world cultural unity. The paper published here was especially written by Dr. H. J. J. Winter of the University College of the South West of England at Exeter for the Avicenna Millenary Celebration of the Institute of Culture, held on March 20th, 1952.

The meeting was under the chairmanship of Janab O. S. Nasarulla Sheriff, a Bangalore Advocate well known for his work for Hindu-Muslim unity. Janab Sheriff sketched in his address the background of Arabic thought during the three centuries which led up to Avicenna.

Dr. Winter's essay was read by Shri Shankara Doraiswamy, after which Janab Haneef Jawaid, an advocate of Bangalore, spoke appreciatively of the value of such celebrations of great anniversaries in different countries. He dealt also with the tremendous value of the Arabic contribution to Western thought, bridging as it did the gap between ancient and modern culture. Without it, he said, European development would have been retarded for hundreds of years. Bacon had been the first to praise the Arabs' scientific spirit. Avicenna, with his unquenchable thirst for knowledge, had lived in an enlightened period and had left a vast literary legacy, much of which remained to be translated.

The second speaker, Shri M. Vasudevamurthy, traced a resemblance between Avicenna's theory of the stages in creation and the Hindu teaching on *Purusha* and *Prakriti.* An authority on medicine, mathematics and other sciences, Avicenna had directed his great powers as a logician to seeking the perfect along different lines, which recalled to the speaker the Hindu quest of *Satyam, Shivam, Sundaram,* the true, the auspicious and the beautiful. The vicissitudes through which he had passed had been yet another demonstration of the trials to which genius was too generally subjected by the world.

THE LIFE AND THOUGHT OF AVICENNA

ABU ‘ALI-AL-HUSAIN IBN ‘ABDALLSH IBN SlNA

(980-1037 A.D)

After the death of Aristotle in 322 b. c. no intellect of comparable stature occurs until Avicenna. Such universal genius, transcending all restrictions of race and creed and breaking down all geographical frontiers, belongs to the whole of humanity. Its message endures with time, for it has captured something of the eternal wisdom which is cherished whenever thinking men gather together, though fashions change and dynasties fall. It does not matter very much now that Avicenna died at the height of his brilliance after a life of vicissitude and struggle, and that we might wish his life to have been a little longer, or whether perhaps he was a Turk rather than an Iranian—for any nation likes to acclaim genius as its own: the significance lies in his being received into the select band of the immortals whose fame is undimmed after a thousand years.

So great was the impact of Avicenna’s thought upon the mediaeval world that, as with Aristotle before him, a system was established within which lesser men found the answers to most of their queries, and original research was thereby halted. The urge to break new ground did not manifest itself, until Paracelsus (1493-1541), who in a dramatic incident in a lecture room in the University of Basel burned his copies of the medical treatises of both Avicenna and Galen (so the story goes) before the assembled students. A remarkable attempt at a synthesis of all knowledge is Avicenna's main claim to greatness, but it restricted his experimental researches, in which he was superseded in more limited fields by scholars possessing greater concentration of interest; that he did make some very valuable observations on specific problems is often, therefore, overlooked, and in evaluating his contribution as a whole these observations will presently be taken into account.

Abu ‘Ali al-Husain ibn ‘Abdullah ibn Sina was born at Afshana near Bukhara in 980 A. d. and died in Hamadan in 1037 a. d. His erudition revealed itself early in life, for he was thoroughly familiar with the *Qur’an* and the standard Arabic classics of literature at the age of ten. After eight more years in which he directed his efforts mainly to the understanding of Greek astronomy (particularly Ptolemy's *Almagest),* mathematics (including the *Elements* of Euclid), and deductive logic, and also to Muslim philosophy and jurisprudence, and the advances made upon Greek science especially in medicine, he presently found himself with a reputation as a physician.

Well-grounded in the philosophy of Al-Faiabi, and in the Greek classics of medicine existing in Arabic version, he was launched upon 3. Medical career by the invitation of the Samanid ruler Nuh ibn Mansur who requested his services. Other appointments followed, but their duration was very much determined by the flux of history into which his patrons were drawn. Thus he fled from the service of 'All ibn Ma’mun, ruler of Khiva, to escape the clutches of the tyrant Mahmud of Ghazni. Again, thinking that the patronage of Qabus ibn Washmgir of Jurjan, a province at the south-east corner of the Caspian, would enable him to enjoy the quiet and security necessary for further study, he came to that monarch only to learn of his murder almost on Avicenna’s arrival. Taking the road again, he entered the service of the Amir Shamsu’d- Dawla of Hamadan, whom he cured of the colic, and was in such favour that he was promoted to the position of prime minister. Rival factions, however, soon contrived his imprisonment, from which he was only released through a return of the Amir’s colic—such is the whim of arbitrary power!

“Hard work and hard living” were his lot, and when he failed to cure himself in his last

illness, his opponents rejoiced that "neither could his physic save his body nor his metaphysics his soul. ” In the further words of E. G. Browne:•—

> His life at this time { with Shamsu’d-Dawla) was extraordinarily strenuous; all day he was busy with the Amir’s service, while a great .part of the night was passed, in lecturing and dictating notes for his books, with intervals of wine-drinking and minstrelsy.[1]-

He began to write original treatises at the age of 21 and continued this exacting task, whatever the circumstances, almost to the day of his death. He has been well named Ash-Shaykhu’r-Ra’is (The Supreme Master)[2] and Al-Mu'allimu'th-Thani (The Second Teacher, *i.e.* , after Aristotle.[3])

For a time he was baffled by the *Metaphysics* of Aristotle, but was finally able to understand it through a commentary by Al-Farabi which came into his possession: such was his love of learning that he records this significant event with the words:—

> Soon the obscurity of this book was revealed to me, for already I knew it by heart. I drew from it a great joy, and the next day I distributed to the poor alms in abundance, rendering thanks to God.[4]

On his return to favour with Shamsu’d-Dawla, Ibn Sina was urged by Al- Juzjani to write on Aristotle, and he accordingly commenced the third part on Physics of his great philosophical treatise *Kitab al-Shifa'.* He had already written the first book of the *Qanun,* the valuable medical encyclopaedia on which his fame as a scientist now chiefly rests.

When Shamsu’d-Dawla died, his successor pressed the philosopher to accept further political office, but he declined for a time to risk the hazards of courtly connections and retired quietly to the house of the pharmacist Abu Galib, where he completed the Physics and Metaphysics (excepting the chapters on animals and plants) of the *Kitab al-Shifa*, writing some 50 folios a day. But fate could not remain so kind. After a further period of four months in prison (where, however, he still continued to write) Ibn Sina and the faithful Al-Juzjani quitted Hamadan in the disguise of Sufis and reached Isfahan, where they were well-received by the Amir Ala al-Dawla. It is to this Amir's credit that he continued his patronage until Ibn Sina’s death and that under the royal protection Ibn Sina completed the *Kitab al-Shifa*‘ and many other works, including th*e Najat* {an elegant summary of the *Kitab al-Shifa*) and the *Hikmat al-Alai*. An attempt to revive astronomical observations on the part of Ala al- Dawla and Ibn Sina was frustrated by further warfare, but resulted in a short treatise, *Fi alat rasadiyat.*

The great breadth of outlook and elegance of system displayed in many of Ibn Sina’s writings were evident in his daily living: thus, according to Al- Juzjani, he never read a book through but seized immediately upon the difficult or controversial passages and elucidated them; and finally, knowing his end had drawn near, spent the last three days in careful disposal of this world’s goods and the preparation of his soul for the next.

The writings attributed to Ibn Sina in a modern Turkish publication[5] take up 95 pages

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[1] *Arabian Medicine*, by E. G. BROWNE, p. 59. (Cambridge University Press, *1921)*

[2] A title also applied to his illustrious contemporary Abu Raihan al-Biruni,

[3] This name had earlier been given to Al-Farabi,

[4] Recorded by his biographer Abu ’Ubaid al-Juzjani, whom he had met in Jurjan and who served him faithfully for the last 25 years of his life.

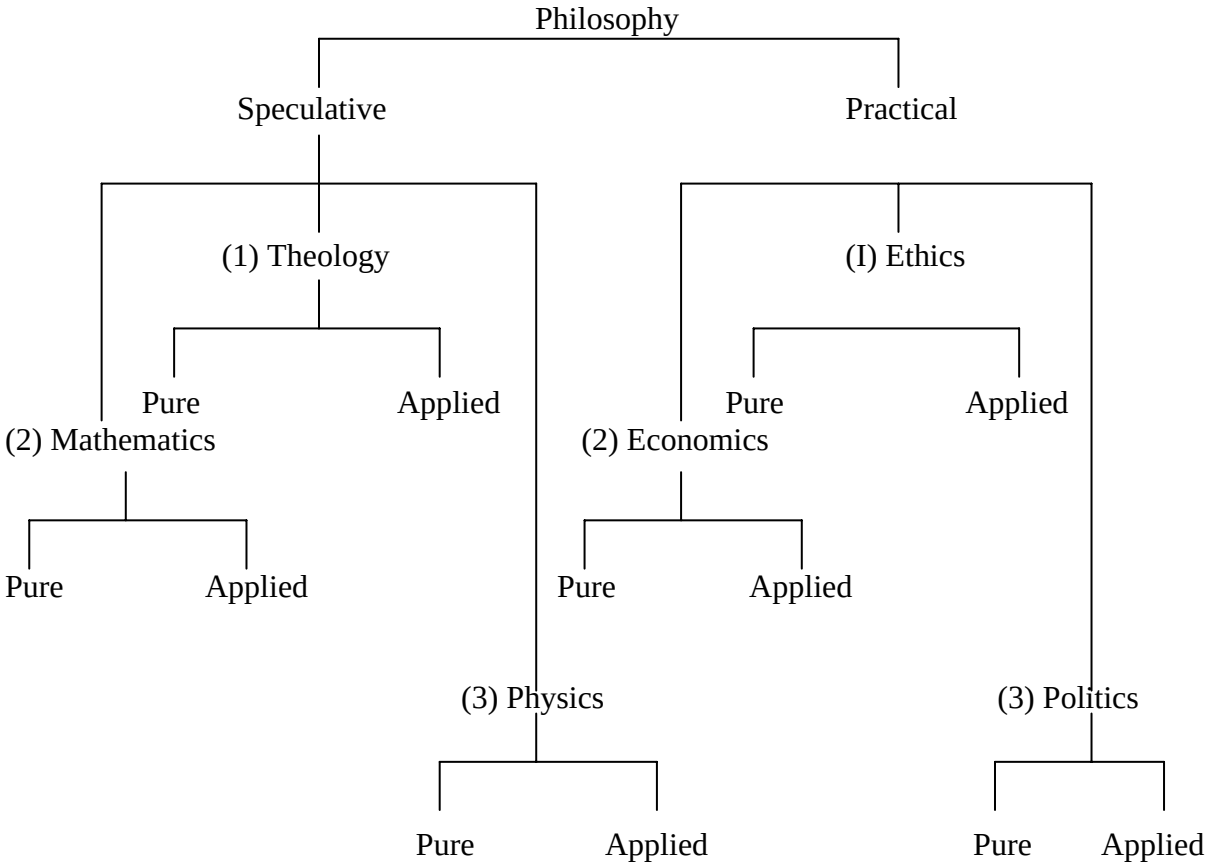
[5] ibn Sina, Sahsiyeti ve eserleri Hakkinda telkikler. Turk tarih Kurumu Yayinlarindan, VII (i) (Muallim Ahmet Halit Kitab Evi, Istanbul, 1937).

and are too extensive to be listed here: the *Qanun* alone occupies the space of a million words. We shall, however, have occasion to refer to the more important ones in the ensuing discussion, which is rendered easier by setting out first of all the system of knowledge to which Ibn Sina and his school, and indeed most mediaeval Islamic philosophers, subscribed.

AVICENNA'S SYSTEM OF KNOWLEDGE

This great synthesis comprised the ideas of Aristotle (as found mainly in his *Metaphysics*), of Neo-Platonism (deriving ultimately from the *Timaeos*), and of Muslim theology and grammar. It represents the best of Islamic thought prior to Averroes (Ibn Rushd). Its doctrine of the existence of God is similar to that held by Al-Farabi, Ibn Sina's predecessor. Theology is given priority as the most elevated of sciences, a characteristic of mediaeval thought and the overriding factor in its claim to unity. Into this all-embracing scheme, based upon an exacting process of logic of which the initial postulate was monotheistic, *i.e.*, one God or Ultimate Principle existent for and of itself, all knowledge was neatly fitted.

The broad divisions are set forth as follows:—



To which we may add the subdivisions in theology, thus:—

Theology Pure:

(*a*) The science of abstract ideas which apply to the whole of Creation, namely, those of existence, single and multiple, identity or similarity, differences and opposites, force and

action, cause and effect.

(*b*) The first principles of all sciences.

(c) God, *i.e.,* the Ultimate Principle, Cause, or Truth, the proof of its existence, sufficiency and sovereignty.

(d) The First Intelligence, knowing its essence and origin—since Avicenna postulated that from the One and Indivisible only one being can originate, thereby creating the logical necessity of some intermediary between the unity of God and the multiplicity of the material Universe.

{ *e*) The Second Intelligence, represented by the angels, which may also be regarded as the soul and body of the ninth sphere of the geocentric mechanism of the Universe.

(/) How corporeal substance, celestial and terrestrial, sub serves the higher intelligences and follows them in the scale of Creation.

This scale of Creation will be elaborated presently, together with the various divisions of knowledge in their turn. In the meantime let us note that the division of subjects made by the mediaeval philosophers is not what we would make today, for since Descartes' final severance of physics and metaphysics in the 17th century, a new division made possible by the independent growth of mathematics as a discipline and the perfection of instrumental technique, we have lost that satisfying union with the Divine Intelligence and have moved more and more into the conflicting and transient world of materialism. Will it yet be possible to re-create the mediaeval world upon a higher plane by means of a new synthesis?

Leaving aside this fascinating question, however, and looking back upon our immediate enquiry, we shall find in Avicenna's system that physics is simply one of the divisions of speculative philosophy (or metaphysics if you will), and that the essential core of metaphysics is theology, physics indeed being regarded as third in importance. Again, Avicenna's physics is logical rather than experimental in character, deriving from Aristotle, who made grave errors in that science, rather than from Archimedes, who was the true physicist and engineer of antiquity and made splendid observations *before* theorizing upon them.

The scale of Creation, moreover, as it revealed the unfolding of diversity out of unity, rested in its lower and more immediate manifestations upon the geocentric theory, also of Aristotle, in which the crystalline spheres carried the planets in their revolutions about the earth, and upon the four-element theory whereby material substances were derived from fire, air, water and earth; and both of those theories were swept away at the birth of modern science. We must therefore be prepared to find familiar subjects in unfamiliar surroundings and to be content to leave them there in a splendid unity of which today we may only dream.

Theology Applied:

In this section Avicenna places his conceptions of the future life under two headings, *viz.,* revelation and retribution. He wrote several works on mysticism, such as the *Treatise on Destiny (Risalat al-Kadr),* and mystical allegories such as the *Treatise of the Bird* (*Risalat al-Tatr*) which attracted considerable interest. He believed that the Divine Plan was hidden from reason and that the passage of the centuries heals the wounds caused by events which do not appear to have any reasoned or causal connections. God's purpose is known to Himself and sufficient unto itself.

Avicenna's mysticism is essentially optimistic. In the *Kitab al-Najat* he wrote:—" The whole cause of evil is concentrated within that which lies beneath the sphere of the moon," *i.e.,* in a world of Aristotelian metaphysics with its power and action, and into which evil inevitably enters from time to time as an accident. Souls after death which have in life been too much attached to earthly desires continue to be tormented by them through the

persistence of habit and suffer agonies in the transition; purer souls who have attended to the life of the spirit pass rapidly into the realm of pure essence beyond these pains of the senses. Avicenna believed in the immortality of the individual soul, which at birth entered the body designed to receive it and at death left it for a higher realm to which it adapted itself easily or painfully as described. He denied metempsychosis,

AVICENNA ON METAPHYSICS AND THEOLOGY

Pursuing this central theme into more detail we find an attempt on the part of Avicenna to explain the Universe in all its manifestations, human and divine, terrestrial and celestial, by a scholasticism which is essentially logical, philosophical and, indeed, scientific in character. His system was attacked and forced from its position of eminence by the great mystic Al-Ghazali, 1058-1111 A.D. (who claimed a knowledge of God only through some higher intuition *(wajd)* transcending reason, *i.e.,* the revelation of Sufism), only, however, to be revived still later with a strong Aristotelian element by Ibn Rushd {the outstanding philosopher of Western Islam who died in Marrakesh in 1198 A.D.), and to pass into Latin Christendom as the powerful force of Averroism.

Nevertheless we cannot but admire the ingenuity with which Avicenna proceeds to explain the multiplicity of the world of the senses from the unity of one God. Having postulated one God, and a corollary that from such unity only unity can arise, he endows the First Intelligence with knowledge of itself and of its own origin, God, thereby creating a duality. From this First Intelligence, or intermediary with the world, emerges the Second Intelligence, hence triplicity. So, through the Third Intelligence, identified with the soul and body of the sphere of Saturn, the outermost planet, to the Fourth Intelligence, that of the soul and body of the planet Jupiter, and down the scale of Creation to the soul and body of the Moon, which controls all sublunary things, does God's great influence diffuse to the level of earthly events. Thus the final Active Intelligence is that comprising the human soul and the four elements.

Reverting to the initial division between the realms of speculative “philosophy" and practical “philosophy,” we may note that theology, the divine or first of the sciences (*al-ilahiyat),* together with physics and mathematics, are concerned solely with Truth, whereas ethics, economics, and politics are, according to Avicenna, especially devoted to the working out of the Good or the practice of Goodness in man’s individual conduct and through his various institutions. It will also be seen on reference to divisions (*a)* and (/) of Pure Theology above that there is a direct link between metaphysics, psychology and physics, and that the natural phenomena which we now classify under the last- named and refer to as exclusively a domain of pure science, treating them on a materialistic plane only, result ultimately from higher causes, though in their displaying of multiplicity Avicenna did not regard them as directly of God.

Some of us may, therefore, sympathize either with certain modern scientists and materialists who hold that the field of natural phenomena may be explained *sufficiently* in terms of immediate scientific laws without recourse to any agency outside of them, or with the mystics such as Al-Ghazali, who could not understand how the souls and bodies of the heavenly spheres could emanate from God in accordance with the logical pattern advanced *by* Avicenna,—how indeed this diffusion of Being could be reconciled with the singleness of Allah in the *Qur'an.* Al-Ghazalis reply took the form of a rejection of all logic, all scholastic theology, all intellect; he seized upon intuition as the direct channel of contact with God.

It would be easy to dispense with Avicenna’s system if we were to rely only upon modern science and to judge him entirely from our present position. But this would be not

only unfair, it would simply replace one incomplete system by another, for modern science

alone gives no answer to ultimate problems, and Avicenna and other mediaeval thinkers at least had the merit of attempting total synthesis, even though increased technical equipment now enables us to tear holes in the fabric of their design. We can only understand Avicenna and his Muslim precursors by endeavoring to place ourselves with them in a world anterior to that of modern science, and we shall then perceive more clearly those influences which directly shaped his philosophy. The story is a very long one, and may even take us back to Chaldaean astrology; it will suffice to make a few brief observations.

From the standpoint of science and logic the influence of Aristotle is unquestionable and we have noted how profoundly Avicenna was in sympathy with this objective attitude. But there were already powerful metaphysical and mystical influences deriving ultimately from Pythagoras, who attached significance to certain numbers, and from Plato, who favored form and the expression of the universe in terms of perfect circles and spheres : “ God geometrizes continually. " These metaphysical tendencies grew with the Neo-Platonist (whose ideas, incidentally, assisted the birth of Sufism), whilst men’s minds were deflected still further from the direct observation of nature by Gnosticism. It is worth noting also that at Narran, a Sabian centre in which veneration for the heavenly bodies had existed alongside Greek philosophy and science since the days of Alexander’s campaigns, and from which emerged eminent men of the caliber of Al-Batani, the astronomer, there was still a lively focus of intellectual activity. It is not therefore surprising to find that Avicenna in his attempt at a synthesis of all the knowledge of his time should incorporate into his system diverse properties which to us seem inconsistent and even absurd—crystalline spheres for instance, anthropomorphic, endowed with both soul and body, motivated ultimately by the outermost sphere nearest to God. Moreover, we would expect a strong logical basis to the whole, a basis characteristic of mediaeval scholasticism, a phase in which thinkers successfully squared their science with their faith before the disturbances of the Renaissance of Science, and which was crystallized first in Islam by Al-Ghazali, then in Judaism under the influence of Maimonides, and finally in Christendom by St. Thomas Aquinas.

AVICENNA ON CAUSALITY AND ON PHYSICS

It is convenient to pursue Avicenna’s metaphysics to the lowest level of earthly forces and materials, as suggested by division (*a*) above. We shall find ourselves confronted by subject-matter which lies partially within the province of the modern physicist. In making this transition we encounter also the problem of causality, or cause and effect, which has taxed the ingenuity of philosophers from time immemorial and now interests especially those of us who are concerned with what is called the philosophy of science.

Avicenna's ideas on the nature of cause are an essential part of his conception of the Universe and, without entering into an involved discussion relating to matter and form, genus and species, general and particular, and the various logical subtleties of the scholastics, we may state simply that Avicenna regarded all existing things as having need of causes; he held that, though causes might consist of a chain from the immediate cause to some ultimate cause, the chain ended in the First Intelligence or Necessary Being or Prime Mover, and was finite; and that causes were not cyclic, never returning unto themselves- He did not neglect the scholastic division into material, formal, efficient and final cause, but in a short essay it would appear desirable for us to try to see his whole scheme in broad outline rather than to lose ourselves in detail for, despite the elegant and pertinent manner in which Avicenna frequently expressed himself, the bounds of commentary are unlimited!

The achievements of Avicenna in physics vary greatly in their significance; some are

ingenious { *e.g.*, his corpuscular theory of light and his measuring contrivance similar to a vernier) and recall to us the great minds of the 17th century. Others—in which he is unduly influenced by Aristotle—are useless to science. Thus it is extremely exciting to find in the *Kitdb al-Najat* that " No body begins to move or comes to rest of itself" (a decisive statement of the Principle of Inertia later enunciated by Sir Isaac Newton as the First Law of Motion), that force is measurable only in terms of its effects, *e.g.*, by what it may lift, and that "Time cannot be imagined without movement"; whilst there occurs a disappointing contrast in his explanation of the four elements in the order fire, air, water, earth because of their " natural tendency " to settle in this way—earth being the central or lowest in the universe, according to Aristotle—as against the attempt of certain contemporary Islamic scholars who embarked upon an explanation of atmospheric pressure, which Avicenna opposed.

Three kinds of force were recognized by Avicenna, *viz*, forces which preserve the natural form and position of bodies and restore them if the bodies are displaced, *e.g.*, weight; forces which put bodies into motion or bring them to rest (in which he included the living forces within plants and animals and the human faculties producing action); and forces which produce analogous actions continuously and with no apparent intermediary apparatus, *i.e.*, the souls of the heavenly spheres which move them ceaselessly. In seeking the initial motive agency of the last kind Avicenna returns to a spiritual essence beyond rest and motion, above matter and time, outside of sensual impressions, namely, the soul of the limiting sphere of the Universe as postulated in his system of metaphysics.

Further, although he understood the principles of static's, Avicenna was acute enough to realize that the essential problem was one of dynamics, for in his study of the impact of bodies he thought in terms of dynamic forces acting from within the bodies rather than in terms of forces acting upon them from outside. He understood clearly that for a simple" machine, " " what is gained in power is lost in speed. "

The association of the idea of time with that of motion is also an interesting feature of the physics of Avicenna. In *The Fountains of Wisdom* he wrote: Time.. .has nothing at all to do with rest. It is only by simultaneity that it is measured"; again, physical bodies being already in movement, which is itself in lime, are themselves in time. Following Al-Kindi (who died *c.* 873 A.D.) he regarded time as continuous, being measurable in terms of the "quantity of circular motion" of the celestial sphere, and in the *Kitab al-Najat* he speaks of "quantity of velocity" but never of acceleration. Like Aristotle he thought only in terms of uniform velocity and, by assuming that since time has instants just as number has units, proceeded to divide time as the Greeks had done before him and with the same attendant difficulties.

Avicenna further attempted by scholastic argument to prove the impossibility of a vacuum, that indeed it was merely a name as Aristotle had supposed ; he also attempted similarly to prove the impossibility of infinity, and he rejected atomism in nature.

The classification of the subject of physics by Avicenna is instructive in the light of our present limited but much deeper study imposed by the growth of specialized instruments and methods. Under Pure Physics he placed Being in general, the Prime Mover, the First Bodies, matter and form, motion, the skies, the elements, generation and decay, celestial influences and meteors, minerals, plants and animals, the faculties of animals and man, the soul, the immortality of the soul; whilst Applied Physics was concerned with astrology, medicine, dreams, talismans, physiognomy, charms and alchemy. It must not be assumed, however, because Avicenna made the divisions of Applied Physics in this manner that he necessarily regarded them all as capable of serious scientific investigation; as we shall see presently his views on alchemy were considered advanced for his day, for he dismissed much of that

study as spurious. He is here simply classifying as his contemporaries and forerunners would do; his own system of the universe also lent itself to astrological interpretation, which was a principal feature in the whole of mediaeval thought both Eastern and Western.

Deriving ultimately from the *Timaeos,* astrology was encouraged by Neoplatonic doctrines which, to the majority of mediaeval thinkers, formed a coherent and satisfying picture. Such a picture, interpreted in the light of pre- Renaissance thought, was logical enough, and we would do well not to scoff at it, for even in modern science we have equally glaring inconsistencies. Moreover, nothing significant enough to shake such an orderly system could occur except an event outside of its neat logical framework and of sufficient novelty to bewilder the learned. Three events did occur much later to do this and ta break down the age-long belief in the superiority and perfection of the " celestial " as compared with the " terrestrial *': the determination of the approximate heights of the mountains on the moon by Galileo, who observed the lunar landscape {which orthodox theologians would have preferred to dismiss as an optical illusion) through his new telescope; the unification by Newton of planetary motions, the periodicity of the tides and the falling of the apple from the tree in a universal law of gravitation ; and a similar synthesis effected by the spectrometer of Kirchhoff which identified the constitution of the heavenly bodies with that of the earth. These all assisted in completely sweeping away the most precious hypotheses of scholasticism except monotheism, which, being outside of science, remains our refuge from unbridled materialism.

THE LOGIC AND MATHEMATICS OF AVICENNA

In the province of Pure Mathematics Avicenna placed the four subjects— arithmetic, geometry, astronomy, and music—which constituted the quadrivium, and included, in the four branches of Applied Mathematics corresponding in order to them, the Hindu methods of calculation and algebra ; the geometry of surfaces, certain aspects of dynamics and hydraulics, weights and balances, measuring instruments, and mirrors; the compilation of astronomical and geographical tables; and the study of the organ and other musical instruments.

Mathematical scholars in Islam selected the more obvious and practical features of Hindu arithmetic and algebra and put them to good use, but they were mainly influenced by the Greek geometrical outlook with its convincing deductive sequence, especially as displayed in Euclid. The geometry of ratios when associated with the ratios of the musical intervals produced by a stretched string, a subject first studied by Pythagoras, aroused considerable interest and was taken up in a most competent manner in the theory of music advanced by Avicenna. His work superseded the *Kitab al-musiqi* of Al-Farabi, hitherto the best Arabic treatment of musical theory. Al-Farabi was already familiar with the minor and major thirds as consonances, and Avicenna dealt with the doubling of the third, fourth, fifth and octave, and made a study of harmony. He investigated the consonant series (1-J-n) /n in which n = 32 produces the quarter tone, and stated that when n = 33 the intervals begin to sound similar and by n = 45 the ear is unable to distinguish them. This represents a notable contribution to the mathematical theory of music.

Underlying Greek geometrical proof is the syllogism of deductive logic by which one proceeds from the general to the particular through a major and a minor premise to a conclusion of limited application. The directness of the Greek classification and reasoning appealed to both mathematicians' arid grammarians, and with Avicenna and the other thinkers of Islam logic was an active instrument which was at once a method of progress and a criterion for the detection of error. Avicenna's logic is precise and clear, and notable for its elegance of style. In the *Kitab al-isharat wa'l4anbihdt* he says that logic is a means which

enables a man " to pass from things present in his mind to things absent which result from them, ” and in fact there was no weakness in the deductive processes of the mediaeval scholastics, so meticulously did they argue within them ; their errors were in the premises, which in science were frequently faulty because of the absence of accurate measuring instruments designed to provide specific data from which to reason.

Avicenna makes much of matter and form, genus and species, definition and demonstration, and interprets in his own way the eight books of Aristotle and the *Isagogic* of Porphyry, proceeding from an enquiry into the meaning of terms and abstractions and their classification and range of validity (as in the *Categories),* to the nature and treatment of propositions and of demonstrations and the fitness of premises (as in the *Analytics),* as far as the detection of errors, reasoning from probabilities (dialectic), opinion and persuasive discourse (rhetoric), and the nature of poetry or imaginative writing.

He distinguishes in the *Kitab al-Najat* between the cold reasoning of the intellect according to which, for instance, the whole is greater than a part, and reasoning which “ starts from premises in which the imagination supports it ” and where there is a “great wealth of the examples equivalent to an induction,” namely in matters of faith, justice, or beauty. Muslim philosophers generally made a distinction, as in the treatises of the Brethren of Sincerity (Ikhwan al- Safa') of Basra, between definition (*hadd)* and description (*rasm).* Avicenna, however, realized the purely relative value of such terms, for in the *Kitab al- isharat wa’l-tanbihat* he states that a thing is completely defined only by its *genus,* giving the essential properties common to all the members of that genus, *together with* the accidents which constitute its difference from them, in other words, a blending of the general with the particular; and then adds in the *Kitab al-Najat* the query—How in fact can such a thing be defined by essential„ properties common to a whole genus when its distinguishing properties peculiar to itself are regarded in the light of non-essential accidents within that genus? And further (in the *Isharat)* when we do define a triangle as a plane figure of which the internal angles total two right angles it conveys a meaning only to geometricians. Not the least of Avicenna's contributions to logic and metaphysics are his succinct statements clarifying as by a flash of inspiration the verbose and interminable arguments of other Muslim scholars.

AVICENNA AS A FOUNDER OF MEDICAL SCIENCE AND PSYCHOLOGY

We have already seen how Avicenna classified medicine as a branch of physics. His comprehensive studies of the subject, however, were of such importance that he ranks with Hippocrates, Galen and Susruta as one of the men who helped to build a whole science with its own discipline and methods. The persistence of his teaching for so long made possible a Firm Bridge across which passed the original Greek medical knowledge, together with Islamic and Indian accretions, to the whole of the medical schools of Europe. The *Qanun fi'l-tibb* superseded the works of Galen, the *Kitab al-Hawl* of Rhazes, and the *Kitab al-Maliki* (an encyclopaedia written for the Buwayhid Sultan, 'Adud al-Dawla by Haly Abbas) and, being the essential basis of medical curricula in the Italian universities, was the chief instrument of this transference of knowledge. It had been translated into Latin at Toledo by Gerard of Cremona in the 12th century a d. under the title *Canon Avicennae libri quinque,* a Hebrew version was completed in the year that Columbus discovered America, and even in 1473 it had been printed in part at Milan, to be followed by other similar editions from Padua and Venice. The *complete* Latin of Gerard of Cremona came into print at Venice, 1544, and Louvain, 1658; whilst the first Arabic edition produced in the West was that of Rome, 1593, which had also the *Kitab al-*

Najat added to it. A Venice edition of 1582 included an Arabic-Latin glossary of medical terms compiled by the Italian physician Andrea Bellunese who had practiced in Damascus.

The *Qdnun* is divided into the five sections relating respectively to general principles of medicine, simple drugs, anatomy and diseases of particular parts of the body, diseases such as fevers, tumours, ulcers, which, initially localized, tend to spread, and finally compound medicines. Its encyclopedic character would, however, render even a long list of topics quite inadequate to describe it; for instance, it contains an account of the spread of diseases by water and through the soil, an intelligent approach to the treatment of nervous disorders and a *materia medica* of no less than 760 drugs.

Nor does this vast treatise exhaust all that our author wrote about medical science. Manuscripts on at least 15 other subjects exist, *e.g.,* on cardiac drugs, and on certain chapters in Hippocrates, and there are poems on various aspects of medicine, including one relating to fevers and tumours. Opthal- mology aroused considerable interest amongst Muslim physicians because of the prevalence of eye diseases in the East, so that Avicenna also made a special study of the eye and its functions. His theory of vision, in which light leaves the object perceived, and entering the eye in the form of a cone of rays creates an image within it, was similar to the theories of Ibn Al-Haitham and Al- Biruni, and amongst the best thus far suggested.

Although the ultimate force {*kuwah)* in the psychology of Avicenna was metaphysical and he interpreted the soul as a collection of faculties superimposed upon the body and rendering it complete and fully aware, the more immediate aspects of his psychology were useful contributions towards the study of that subject as a distinct academic discipline. He divided the genus " soul " into three species, those of plant and animal, and the human intelligence, each having its own range of properties; thus the plant kingdom was characterized by three faculties—generation, nutrition and growth. To these were added in the animal kingdom the appreciation of particulars and voluntary movement, whilst with man there developed also free-will and the making of generalizations. The senses perceive only particulars, but the intellect frames these into generalizations or universals, the internal faculties involved in this process being the formative, the cognitive, opinion and memory.

OTHER STUDIES OF AVICENNA

At the lowest end of this ladder of nature there are the minerals and matter and these immediately lead us to consider Avicenna in his r61e as a geologist and a chemist. His work on minerals, together with Aristotle's *Meteorological* and a pseudo-Aristotelian treatise *Liber de elementis,* formed the main source of geological knowledge for the Christian encyclopaedists of the 13th century. Avicenna tended to follow Jabir in believing that the metals were composed essentially of sulphur and mercury or two principles resembling them in properties. Since he regarded the color of a metal as a superficial quality or an accident unrelated to the fundamental nature of the metallic species, he repudiated the possibility of the transmutation of the base metals into gold. This view was in advance of his times, and it must in fairness be stated that in the eyes of his contemporaries it did not seem to fit all the facts; so, in spite of Avicenna, alchemy remained essentially mystical in character and in the course of the Middle Ages made few significant steps towards exact chemistry.

Avicenna also completed a work on morality *(Risalat al-akhlak),* wrote poems, and has left us some interesting correspondence between himself and Al- Blruni on scientific

questions.[6]

It remains only to say a few words by way of conclusion. They are words of warning and of praise. In the first place, we are not in a position yet to Judge Avicenna fully. His output was vast, and there exists much valuable material in[7] Arabic and Persian manuscripts requiring careful translation and evaluation. Perhaps the best general account we possess is Baron Carra de Vaux's *Avicenne* (Paris) written over half a century ago. It is fine, scholarly prose, full of meaning, and I am greatly indebted to it; yet it omits the medical side entirely. Secondly and finally, what we do know of Avicenna is sufficient to occupy most modern scholars a lifetime and to justify, in the words of Max Meyerhof, that "pious veneration" which to this day "surrounds the tomb of the great physician and philosopher at Hamadan."

[6] See however, O.C. Gruner, A Treatise on the Canon of Medicine of Avicenna, London, 1930. Also G. Sarton, Introduction to the History of Science, Vol I. Baltimore, 1927.

[7] Legacy of I slam, Oxford University Press (1931) P. 330.