

Al-kindī, Abū Yuṣuf Yaʿqūb Ibn Ishʿaq Al-sabbah? | Encyclopedia.com

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(*b. ca.* 801; *d.* Baghdad, *ca.* 866)

philosophy, science.

Ancient biobibliographers, as well as writers such as al-Jāhiz, report many legends concerning the life of al-Kindī; but little certain, or even fairly reliable, information has come down to us. Even the years of his birth and death are not definitely known: it was only by collating various data that Muṣṭafāʿ Abd al-Rāziq was able to determine the years given above.¹ It has been established, however, that al-Kindī was descended from a noble branch of the Kinda tribe of Yemen and that he began his education in Kūfa, Iraq, completing it in Baghdad—both centers of intellectual activity. It was in Baghdad that al-Kindī came to the attention of Caliph al-Maʿmūn, who took him into his court and named him to the “Academy” of Baghdad—Dār al-Hikma—with the task of improving the often defective translations made from the Greek. Al-Maʿmūn’s successor, al-Muʿtasim, chose al-Kindī as tutor to his son Aḥmad, on whose behalf al-Kindī wrote several philosophical essays.

Following the death of al-Muʿtasim, al-Kindī’s relations with the court became less close, and they remained that way throughout the caliphate of al-Wāthiq. They improved when the latter was succeeded by al-Mutawakkil. Yet al-Kindī soon fell into disgrace, the victim of such rivals as the mathematicians Banū Mūsā and the astrologer Abū Maʿshar, and of his possible sympathies for the Muʿtazilites, who were persecuted by al-Mutawakkil. During the last years of his life, he remained in relative isolation.

The “first Arab philosopher,” as he was commonly called by the bibliographers, al-Kindī participated in the expansion and dissemination of what might be called the contemporary encyclopedia of knowledge. In addition, he played an important role in the elaboration and definitive formulation of Arabic philosophical and, in some cases, scientific terminology. A particular aspect of his intellectual biography is therefore worth investigating: did he know Greek? Ancient biographers and bibliographers, such as Ibn Abī Usaybiʿa and Ibn al-Qiftī, note that al-Kindī took part in an intense campaign to translate Greek philosophical and scientific works. Nevertheless, an examination of the works translated with his collaboration reveals that his role was less than that of a translator. In the case of certain works of Aristotle translated by Hunayn ibn Ishʿaq, Abū Bishr Mattā Qustā ibn Lūqā, Yahyā ibn ʿAdī, and others, as well as certain writings by Euclid, Ptolemy, and Eutocius, al-Kindī either corrected the Arabic text of an already completed translation, commented upon it, or summarized it. Consequently, we are led to believe that he did not know Greek well enough to translate directly from that language but that he did know enough of the rudiments to correct Arabic translations and, in some degree, to establish the terminology, particularly with respect to philosophical discourse.

Some fifteen philosophical works by al-Kindī have been preserved. Although they are often complex, they can be classified according to their main subjects.

Only four chapters of the *Book of First Philosophy* have survived. It begins with a defense of philosophy (in particular, of the *falsafā* inspired by the Greeks) and then discussed the difference between the sensible and the intelligible, methods of obtaining knowledge, and questions concerning eternity and the body. The last two parts develop a complete dialectic of the one and the many that leads to the designation of the Unique True Being (*al-wāʿid al-ʿaqq*), the Creator. With this text may be grouped the *Letter on the True, First, and Perfect Agent*, which deals with the Creation and the hierarchy of causes, and *De quinque essentiis*, of which we have only a Latin translation; the “five essences” are matter, form, place, motion, and time.

Al-Kindī devoted three letters to demonstrating that the world is finite, not only in space but also in time. (On this point he obviously differed from the Greek philosophers.) These are the letters *On the Demonstration of the Finitude of the Corpus of the Universe*, *On the Quiddity of That Which Cannot Be Infinite*, and *On the Unity of God and the Finitude of the Corpus of the Universe*.

Two of al-Kindī’s texts describe the universe according to its structure and the principal types of causality that obtain in it: *Book in Which the Efficient Proximate Cause of Generation and Corruption Is Explained and Letter in Which the Submission of the Outermost Body and Its Obedience to God Is Explained*. The latter is a physical and cosmological commentary on a passage of the Koran (LV, 6).

Al-Kindī wrote five very different works dealing with the soul and the intellect. *Letter on the Existence of Incorporeal Substances* demonstrates the existence of souls. *Discourse on the Soul*, written explicitly under the inspiration of “Aristotle, Plato, and other philosophers,” describes in mystical and parenetic fashion, the relations of the soul to the body, as well as its fate. The enigmatic and very brief *Statement Concerning the Soul* apparently deals with the cosmic soul. *Letter on the Quiddity of Sleep and Dreams* gives a psychology and physiology of these phenomena. Finally, *Letter on the Intellect* presents a Neoplatonic interpretation of Aristotle’s noetics.

Letter on the Method of Banishing Sadness recommends that the sufferer apply himself to the only enduring object—the world of the intellect. In this work al-Kindī maintains that sadness can be eliminated through dialectic and through behavior that is marked by resignation, prudence, and the avoidance of situations that might cause sadness—advice that is firmly in the tradition of the moralists of late antiquity. In addition to this letter, approximately 100 opinions and sayings, primarily concerning ethics, are attributed to al-Kindī by the *Muntakhab s̄iwān al-hikma* of Abū Sulaymān al-Sijistānī.

Letter on the Number of the Books by Aristotle and on What Is Needed to Learn Philosophy consists essentially of a catalog of Aristotle’s writings, a program of studies, and a philosophical commentary on a passage of the Koran (XXXVI, 78–82).

Letter on the Definitions and Descriptions of Things poses difficult problems, for among its approximately 100 occasionally enigmatic definitions are some that do not accord with the rest of al-Kindī’s known works.

The writings listed above constitute only a portion of the philosophical opus mentioned by the biobibliographers. Consequently, one cannot hope to give a complete or even adequately balanced account of al-Kindī’s thought. Furthermore, his works, which are never very long, are composed mainly of elaborately presented arguments employing numerous concepts and are thus virtually impossible to summarize faithfully. Nevertheless, some of the major themes of the known works may be indicated.

The first sections of *First Philosophy and Letter on the Books by Aristotle* define al-Kindī’s plan. The former work, dedicated to Caliph Muʿtasim, states that knowledge is built over the centuries through the cumulative efforts of many scholars and asserts the right to the truth, regardless of its source. This portion, which is obviously inspired by Aristotle, sometimes reproduces passages verbatim from his *Metaphysics*. The *Letter* is even more explicitly Aristotelian but specifies that the mathematical sciences are to be studied as preparation for acquiring knowledge of all other subjects. Here we have two traits characteristic of al-Kindī’s thought and work: as a mathematician he often constructs long, closely reasoned arguments of the type found in geometry; and as a *ḥaylasūf* he draws abundantly on Greek sources.

Al-Kindī rarely cites Greek authors other than Plato and Aristotle. He seems, moreover, to be inspired not directly by the former but, rather, by the Platonic tradition. In any case, he owes considerably more to Aristotle, at least in regard to the basic notions of philosophy: the concepts of act and potential, of matter and form, of substance and accident, the four causes, the various kinds of motion, and the fundamental principles of noetics, as well as the basic outlines of Aristotle’s cosmology. A careful reading of the details, however, reveals other influences: Porphyry, the Alexandrian school of the sixth century (as it is known from the works of [John Philoponus](#) and David of Alexandria), Proclus, the Stoics, and probably the *Corpus Hermeticum*. From these sources al-Kindī borrowed certain concepts and themes in noetics, metaphysics, and ethics, such as the relations among intellects, the distinction of the sensible world from the intelligible world, the relation of the many to the one, and the salvation of the soul.

Al-Kindī organized these various elements into an overall pattern of his own invention. Opposing Aristotle, he maintained that the world is not of infinite duration. His speculation on the many and the one led him to posit the One True Being who is the cause of the existence of everything and, as such, is the Creator. The One can in no way be conceived of in the manner of ordinary objects. Al-Kindī explicitly denies the possibility of applying, in this case, the concepts inherited from Greek philosophy—the predicables, the categories, the soul, the intellect—for this being is “above the attributes that the heretics ascribe to him” (*jalla wa-ta ʿalā an s̄iḥāt al-mulhidīn*). The great living creature that is the outermost body (the first sphere) obeys God. On the other hand, the teaching of the philosophers is the same as that of the prophets. The only difference is that the latter proclaim all at once, in concise terms, and by the intervention of the divine will that which the former discover and set forth only through great effort and in the form of long treatises.

From what has been said, it can be seen that al-Kindī established the conceptual framework that remained, on the whole, characteristic of the *falsafa*. It was formed by the union of Greek philosophy, especially in its Neoplatonic version, and Islam. (More precisely, he drew on ideas inspired by the Muʿtazilite *kalām*.) In this scheme prophets and philosophers both teach a doctrine of purification and salvation; by observing this doctrine, the soul, which comes “from the light of God,” can triumph over desire and ascend through the spheres to the “world of the intellect” (*ʿalam*

al-*ʿaql*). The philosophical manifesto in *First Philosophy* concludes with a prayer to God. A close examination of al-Kindī's choice of words shows that he favored terms used in both religion and philosophy.

Al-Kindī was contemporary with the first generation of translators of Greek works into Arabic, including Ustāt, Ibn al-Bitrīq, and ʿAbd al-Masīh ibn Nāʿima, who, respectively, translated Aristotle's *Metaphysics*, *De caelo*, and the so-called *Theology of Aristotle* (which al-Kindī did not attribute to him). His vocabulary comprises many technical terms that have remained in use, as well as some that were not retained. Thus, to designate matter, $\mu\lambda\eta$ he used *hayūlāa* and *mādda* as well as *īn* and *ʿunsur*; and within several pages he employed, to translate the Greek $\phi\theta\iota\sigma\iota\varsigma$ the words *naqs* and *dʿamr*. Al-Kindī took pleasure in exploiting the possibilities offered by verbal derivation. For example, starting from the pronoun *huwa* ("he" or "him"), normally used to designate an existing entity in its most elementary form, he constructed a series of terms that permitted him to express various stages and elements of a creationist ontology: *huwiyya* ("existence"), *tahawwī* ("existentiation"), *mutahawwī* ("existentiated"), and *mutahawwiyyāt* ("existentiated entities").

In this area, as in others, al-Kindī was an innovator but one with an archaic streak. He was soon supplanted by other philosophers and was henceforth cited primarily as a scientist. Thus his name does not appear in the list of *falāsifa* given by Ibn Khaldūm in his *Muqaddima*, and the few passages in this book where he is mentioned concern scientific questions. Al-Kindī is, of course, occasionally cited as a philosopher by Arab authors—for example in a few places in the *Tahqīb al-akhlāq* of Miskawayh and the *Kitāb ʿāl-sa ʿāda wa-l-is ʿād* of Abū I-Hasan al-ʿĀmiri. In addition, the Christian Yahyā ibn ʿAdī wrote a refutation of al-Kindī, and Sijistānī cites him at some length in his *Šiwān al-hikma*. Many of the definitions attributed to al-Kindī are found in the *Muqābasāt* of al-Tawhīdī; and there is a *Refutation of al-Kindī the Philosopher* attributed to Ibn Ḥazm. The biobibliographers—Ibn al-Nadīm, Ibn Juljul, and Ibn al-Qiftī—praise his great knowledge of philosophy. But these scattered traces do not amount to the genuine survival that would have resulted from the establishment of a school; and it appears that al-Kindī never founded one, although he has a direct disciple in Ahmad ibn al-Tayyib al-Sarakhsī.

All things considered, the same may be said of al-Kindī's influence in the Latin West. A few of his treatises were translated in the twelfth century, Albertus Magnus cited him, a few other authors alluded to him, and Giles of Rome devoted a chapter of his *De erroribus philosophorum* to him. (The majority of the "errors" for which Giles reproaches him concern astrology and, more generally, the system of the world.) But this cannot be compared with the massive presence in the Latin [Middle Ages](#) of Ibn Sīnā, al-Ghazālī, [Ibn Rushd](#), or even of al-Fārābī and Ibn Bājja.

Given the present state of knowledge it is difficult, if not impossible, to offer anything approaching a complete, systematic exposition of al-Kindī's scientific work. Encyclopedic in scope, it comprises writings on arithmetic, geometry, astronomy, music, medicine, pharmacology, and other fields. Among the titles cited by ancient and modern biographers are some that have not yet been found; and others have not appeared in a critical edition.² Except for a few short treatises, al-Kindī's scientific writings have not fared as well as his more abundant philosophical works. Moreover, the difficulty of presenting his ideas applies to his scientific as well as to his philosophical concepts; for, to a much greater degree than such successors as al-Fārābī, Ibn Sīnā, and [Ibn Rushd](#), he followed an ancient tradition of basing his philosophical reflection on scientific investigation.³ Consequently, a truly thorough assessment of the scope and limits of his contribution must await considerable further research.

Nevertheless, two abiding concerns may be detected in the corpus of al-Kindī's scientific writings. The first is that of the commentator, the transmitter of Hellenic scientific works, whose goal is to prepare his readers for the study of philosophy. The other is the completion and, if possible, the augmentation of the body of inherited scientific knowledge. Although sometimes separate, these two preoccupations are frequently commingled. *Kitābfī l-sinā ʿat al-ʿuzmā*.⁴ stems from the former concern; while *De aspectibus*, although a manual of ancient optics—primarily that of Euclid—is conceived with a view to extending and perfecting this older knowledge. Accordingly, if this twofold mission is ignored and attention is restricted to works designed mainly for pedagogical purposes (an error committed by certain historians), then their author is unjustly considered to be no more than a commentator of the Greek texts that inspired them. Nothing better expresses al-Kindī's intentions in this regard than his own words: "It is good... that we endeavor in this book, as is our habit in all subjects, to recall that concerning which the Ancients have said everything in the past, that is the shortest and easiest to adopt for those who follow them, and to go further in those areas where they have not said everything, according to the use of the [Arabic] language and the customs of the time, to the degree that we are able".⁵

Such was the project that al-Kindī sought to realize in the majority of his surviving scientific works. While nothing can be affirmed about him as a mathematician, since the most important texts have not been found, it can be said that he pursued this goal in his works on optics, pharmacology, and music.⁶

This statement is confirmed by his two principal works on optics. While in the *De aspectibus* he reiterates the same idea, in the *Burning Mirrors* he begins with a critique of [Anthemius of Tralles](#) and sets out to finish what the latter had left undone.⁷ Yet, although his ultimate aim occasionally leads him to adopt a critical attitude toward the ancient authorities, al-Kindī remains basically committed to the optical ideas commonly held before [Ibn al-Haytham](#). Essentially a geometer rather than an experimenter, al-Kindī is a prisoner of the traditional approach to the subject, in which no distinction is made between a theory of light and a theory of vision. That is, it was assumed that to see was to illuminate. His criticisms, therefore, are not elements of a reform but amendments to the optics of the geometers—principally Euclid. Nonetheless, his optical writings were read and studied by the Arab physicists as well as by [Roger Bacon](#), John Pecham, and probably Rober Grosseteste.

In *De aspectibus* al-Kindī seeks to demonstrate what Euclid had postulated: the notion of the rectilinear propagation of light and the theory of emission. Although al-Kindī adopted the emissionist point of view, he attempted to demonstrate the rectilinear propagation of light rays on the basis of geometrical considerations about the shadows of opaque bodies exposed to luminous sources and about light passing through slits.⁸ Then, in order to defend the emission theory, he gives new arguments against the ancient theories of vision, notably those of the intromission of forms and of the combined emission-intromission of forms. This critique ultimately amounted to showing the impossibility of reconciling the theory of the intromission of forms, the intromission of totalities not analyzable into their simple elements, and the fact that the perception of an object is a function of its localization in ordinary space. Al-Kindī notes in this connection that if the theory of the intromission of forms were correct, then a circle in the same plane as the eye would be perceived in all its circularity, which is not the case.⁹

Going still further, al-Kindī ultimately rejects the Euclidean theory of emission, amending it in order to make it conform to observed data. For example, he asserts that a visual cone is not formed of discrete rays, as Euclid stated, but appears as a volume of continuous radiations. Much more important than this modification is the idea on which it is based: rays are not geometrical lines, but, rather, impressions produced by three-dimensional bodies; consequently, according to al-Kindī, the ray cannot be considered a one-dimensional geometrical line.¹⁰ Rays are therefore three-dimensional and form a continuous radiant cone. To some degree this critique prepared the way for [Ibn al-Haytham](#)'s distinction between light rays and the straight lines along which they are propagated.

Al-Kindī still had to explain how perception varies according to the region of the cone considered.¹¹ His position on this question differed from those held by both Euclid and Ptolemy. He assumed that from every point of the eye there emanate radiations along every straight line that can be drawn from these points and from those of the visual field. Thus, a visual cone emerges from every point of the eye.¹² To apply this idea, al-Kindī proceeds by analogy with light emanating from a luminous source and state more clearly that his predecessors—although in a less elaborate fashion than Ibn al-Haytham—the principle of rectilinear propagation.¹³

In the second optical treatise, on burning mirrors or "Irays" al-Kindī first recalls Anthemius' report on how ships were set aflame by burning mirrors during a naval battle:

Anthemius should not have accepted information without proof.... He tells how to construct a mirror from which twenty-four rays are reflected on a single point, without showing how to establish the point where the rays unite at a given distance from the middle of the mirror's surface. We, on the other hand, have described this with as much evidence as our ability permits, furnishing what was mission, for he has not mentioned a definite distance.¹⁴

Al-Kindī's demonstration is based on implicit knowledge of the law of reflection, which stipulates that the angles of incidence and reflection are equal, as well as that the incident ray, the normal, and the reflected ray are all in the same plane.

The desire to extend and improve upon the knowledge of antiquity can be detected in another field that al-Kindī investigated, pharmacology¹⁵. Besides a compilation of medical preparations, *Aqrābādhīn*, he wrote *Risāla fī ma ʿrifā quwwat al- adwiyat al-murakkaba*, which was translated into Latin as *De medicinarum compositarum gradibus investigation*; in it he treats the composition of medicines from a Galenic point of view.¹⁶ In the course of his study he raises the problem of the quantification of qualities and formulates a law the adaptation of which in physics yielded the law named for Bradwardine.

Like the ancient authors, al-Kindī held that the four qualities employed in ancient medical theory (heat, cold, dryness, and humidity) could assume four degrees of intensity. Each degree can be recognized by the effects observable in the patient, and the degrees are ordered along a scale of fixed units of sensation running from the smallest perceptible difference to (in some cases) the destruction of the patient's body. After recalling the opinions of the ancients, al-Kindī turns to completing their task:

"They have not attempted to do as much for the compound medicines: they have not said that a certain compound medicine exists at such and such a degree of heat, cold, dryness, [and] humidity. Now, such knowledge is even more important and more valuable in the case of a compound medicine than in that of a simple medicine".¹⁷ He then sets out to elaborate a theory that will enable him to extend to compound medicines a precise calculus based on an examination of the medicine's composition and on its effect upon the patient. Al-Kindī's fundamental notion is that "the faculties of the compound medicine necessarily increase or diminish according to the variations in the faculties of its components, and that its faculties cannot be reduced to those of one of its components to the exclusion of the others."¹⁸ This

conception is justified by an atomistic doctrine in which al-Kindī seeks “to represent the smallest possible part of the temperate disposition, which is indivisible because of its smallness. There ought to be in it as much heat as cold, since the overall temperate substance is composed of these parts.”¹⁹

In his effort to broaden the scope of the earlier studies, al-Kindī was led to pose the problem of the quantification of the qualities. This occurred when he attempted systematically to link the degrees of intensity of the compound medicine with the numerical changes in the qualitative forces that produce them. Since the qualities remain separate in the medicine, the different parts have separate effects; and since the degree of the medicine’s intensity is determined by the proportion of the qualities, it was possible for al-Kindī to formulate mathematical relationships between the increments in the number of parts—such as heat and cold—and the increments in the effects experienced. He states that the proportion 2:1 of hot parts to cold produces a heat effect of the first degree; the proportion 4:1, a heat effect of the second degree; the proportion 8:1, a heat effect of the third degree; and the proportion 16:1, a heat effect of the fourth degree. In another terminology, the degree of intensity, I , of a medicine is proportional to the logarithm of base 2 of the proportion of one quality to the other: $I \propto \log_2(\text{heat/cold})$.

The influence of this system during the [Middle Ages](#) seems to have been much greater among “physicists” than among physicians. Physicians such as Abu I-Qāsim al-Zahrāwī (Abulcasis) used al-Kindī ideas;²⁰ but his works were difficult for the nonmathematicians among the physicians to interpret. (This opinion was expressed by [Roger Bacon](#)).²¹ The situation seems to have been different, however, for scientists, such as Bradwardine.²²

The intention to advance ancient science is also evident in al-Kindī four known works on music. Although he adopted “a system of nomenclature for the notes and tetrachords in the scale similar to that used in the old Greek theory”²³ he used the letters of the alphabet to designate the notes of the scale – a procedure employed in Europe a century later. Al-Kindī’s musical treatises, which are among the first works on the theory of music written in Arabic, paved the way for such major works as that by al-Fārābī.

Al-Kindī did not neglect other areas of knowledge. He studied optics, using an approach combining both physical and philosophical notions (especially the theory of color), and he investigated topics in geology, meteorology, geography, climatology, geophysics, astronomy, and astrology—considering the last as a science. But he went still further in his research, undertaking studies with a technological aim as well: the making of clocks, astronomical instruments, even of objects such as swords.

Throughout his scientific writings, with varying success according to the subject involved, al-Kindī utilized the same approach: to work through the legacy of ancient science and then to transcend it in furtherance of his twofold aim of advancing both scientific pedagogy and research. His method always combined an empirical strain with a mathematical tendency that led him to seek geometrical or numerical relationships between phenomena. This is perhaps why his influence proved greater among philosopher-scientists and scientists than among the great metaphysicians.

NOTES

1. Mustafā ‘Abd al-Rāzīq, *Faylasūf al-‘Arab*... (Cairo, 1945). 17-20.

2. See especially Ibn al-Nadīm, *Kitāb al-Fihrist*, G. Flügel, ed., I (Leipzig, 1871), 255-261.

3. “The earliest philosophers in Islam were, like the first Greek thinkers, nature philosophers.” J. de Boer. “Zu Kindī und seiner Schule,” in *Archiv für Geschichte der Philosophie*, **13** (1900). 159. 1. Madkour voices a similar idea: that al-Kindī, “belongs principally to the physical science tendency that dominated Islamic philosophical speculation in its early stages.” *La place d’al-Fārābī dans l’école philosophique musulmane* (Paris, 1934), 5. See also A. Cortabarría Beitia, “La classification des sciences chez al-Kindī,” in *Mélanges de l’Institut dominicain d’études orientales* (Cairo), **11** (1972), 50-76.

It is known that al-Kindī wrote a short work, not yet found, entitled *Risāla fī annahu lā tunāl al-falsafa illā bi-‘ilm al-riyādiyyat* (“Treatise in Which It Is Shown That Philosophy Can Be Attained Only Through the Science of Mathematics”). See R. J. McCarthy, *Al-tasānīf al-mansūba ilā faylasūf al-‘Arab*, 9.

4. See F. Rosenthal, “Al-Kindī and Ptolemy,” in *Studi orientalistici in onore di C. Levi della Vida*, II (Rome, 1956), 436-456.

5. See al-Kindī. *Fī l-falsafat al-ūlyā. Edited by ‘Abd al-Hādī Abū Ridā in his collection Rasā’ al-Kindī l-falsafīyya*, I, 103.

6. In *Kitāb al-Fihrist*. Ibn al-Nadīm gives ten titles of works on arithmetic by al-Kindī and twenty-two titles on geometry.

7. *De aspectibus* has been edited by A. A. Björnbo. See A. A. Björnbo and S. Vogl. “Alkindi und Pseudo-Euklid: Drei optische Werke.” in *Abhandlungen zur Geschichte der mathematischen Wissenschaften*, **26**. no. 3 (1912), 3-41. The goal is stated on p. 3 of *De aspectibus*: “Oportet, postquam optamus complere artes doctrinales, et exponere in eo, quod antiqui praemiserunt nobis in eis, et augere, quod inceperunt et in quibus fuerunt nobis occasiones adipiscendi universas bonitates animales, ut de diversitatibus aspectus secundum nostrae possibilitatis mensuram universaliter et demonstrative loquamur....”

Kitāb Ya’qūb Urn Ishdīq al-Kindī fī al-shu’ā’āt (“Treatise on the Burning Mirror”), MS 2048 in Patna, India, has been photographically reproduced by the Institute of Arabic Manuscripts in Cairo as no. 3121 in its series. M. Y. Hāshimī claimed that this MS had been found and then lost. The MS does indeed exist—and he reproduced a photocopy not of the MS itself but of a transcription, without clearly stating that this was the case. In addition, the photocopy has some pages reversed. See Hāshimī. *Propagation of Ray; The Oldest Arabic Manuscript About Optics—“Burning Mirror” From Ya’qūb ibn Ishaq al-Kindī* (Aleppo, 1967). Jean Jotivet and Roshdi Rashed are currently preparing a critical ed. of this text.

8. “Quod vero videmus ex rectitudine finium umbrarum corporum in latitudine et luminibus per fenestras ingredientibus necessario ducit nos ad hoc, ut transitus rudiorum procedentium a corporibus luminosis fiat secundum reetiudinem rectorum linearum.” *De aspectibus*. p. 4.

9. *Ibid.*, props. 7-10.

10. *Ibid.*, props. 12-13.

11. *Ibid.*, p. 23.

12. *Ibid.*, pp. 24-25.

13. “I am ergo exemplificavimus, qualiter quaeque pars corporis luminosi illuminet, quod ei obviat, scilicet a quo est possibile, ut ad ipsum producat lineam.” *Ibid.*, p. 23.

14. *Fīl-shu’ā’at*, fol. 3

15. See the ed. of the Arabic text, with French trans., by Léon Gauthier in *Antécédents gréco-arabes de la psychophysique* (Beirut, 1939).

16. The Latin trans. was printed at Strasbourg in 1531. Sarton suggests that it was done by [Gerard of Cremona](#) and was used by Arnold of Villanova (d. 1311). See *Introduction to the History of Science*, 3 vols. (Baltimore, 1927-1931), II, 342.

17. Gauthier, *op.cit.*, 44.

18. *Ibid.*, 45

19. *Ibid.*, 56-57.

20. See S. K. Harmaneh and G. Sonnedecker, *A Pharmaceutical View of Abulcasis al-Zahrāwī in Moorish Spain* (Leiden, 1963), 61; “Al-Zahrāwī does not go into al-Kindī’s complicated calculations and geometric proportions of degrees of faculties, yet he seems to apply such a system in determining the degrees of faculties expected from mixed drugs or diets containing more than two ingredients, and each with its own degree of humoral faculty or action.”

21. *De erroribus medicorum*, which is *Opera hactenus inedita Rogeri Baconi*, R. Steele, ed., fasc. 9 (Oxford, 1928). 166-167.

22. See M. Clagett, *The Science of Mechanics in the Middle Ages* (Madison, Wis., 1959). 349; and, especially. M. McVaugh, “Arnold of Villanova and Bradwardine’s Law,” in *Isis*, **58** (1967), 56-64.

23. Youssef Shawqi, *Al-Kindī’s Essay on Composition* (Cairo, 1969), 9.

BIBLIOGRAPHY

I. Original Works. No existing ed. includes all of al-Kindi's known works. A group of scholars sponsored by the Centre National de la Recherche Scientifique is currently preparing a complete ed. of the available texts, with French trans, and notes. Some unpublished MSS have already been collected for this project.

Among the existing eds. the most useful are 'Abd al-Hādī Abū Rīda, ed., *Rasā'il al-Kindi l-falsafīyya*, 2 vols, (Cairo, 1950-1953); and Z. Yūsuf. ed., *Mu'allafāi al-Kindī al-mūsiqīyya* (Baghdad, 1962).

For a listing of individual texts, translations in various languages at different periods, specialized bibliographies, biobibliographical data, and both general and specialized studies, see R. J. McCarthy, *Al-tasānīf al-mansūba ilā faylasūf al-'arab* (Baghdad, 1963); and N. Rescher, *Al-Kindī. An Annotated Bibliography* (Pittsburgh, 1964).

II. Secondary Literature. Recent studies include M. Lewey, *The Medical Formulary or Aqrābādhīn of al-Kindī*. translated with a study of its [materia medica](#) (Madison, Wis., 1966); G. N. Atiyeh, *Al-Kindī: The Philosopher of the Arabs* (Rawalpindi. Pakistan, 1966); A. Cortabarra Beitia, "A partir de quelles sources étudier al-Kindī?" in *Mélanges de l'Institut dominicain d'études orientales* (Cairo), **10** (1970), 83–108; J. Jolivet, *L'intellect selon Kindī* (Leiden, 1971); David C. Lindberg, "Alkindī's Critique of Euclid's Theory of Vision," in *Isis*, **62** (1971), 469–489; M. T. d'Alverny and F. Hurdy, "Al-Kindī, *De radiis*" in *Archives d'histoire doctrinale et littéraire du moyen-âge*, **41** (1974), 139–260, which contains a bibliography that, in part, supplements that of Rescher; Alfred L. Ivry, *Al-Kindī's Metaphysics* (Albany, 1974), a translation of al-Kindī's treatise "On First Philosophy." with introduction and commentary; and Michael R. McVaugh, *Amaldī' de Villanova Opera medica omnia, II, Aphorismi de Gradibus* (Granada–Barcelona, 1975), esp. chs. 3 and 6, and app. 1.

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