appearing in Muslim Spain within his lifetime. Here, his original tables were studied by *Maslama of Madrid and his pupils whose adaptation, more accurate than the original, adjusted the tables to make them useful to astronomers in the West. This version was then translated by *Adelard of Bath and *Pedro Alfonso, and it is only this Latin version that survives complete whereas in Arabic only selections from the original survive.

Al-Khwarizmi’s two other surviving works are the Geography and the Extraction of the Jewish Calendar. It appears that the Geography represents an important advance over *Ptolemy’s work of the same name. It has been speculated that al-Khwarizmi’s work was based on a world map constructed by a collection of scholars for al-Ma’mun; the Geography represents superior knowledge of the Islamic lands and the areas visited by Muslim traders and merchants. The work on the Jewish calendar is curious. He says that he wrote it because an explanation of that calendar was necessary for those who happen to use it. Its occasion or purpose remains obscure; perhaps it was used by historians and writers trying to reconcile the differences between the Islamic and Christian calculations of the annus mundi.

Al-Khwarizmi wrote several other books which do not seem to have survived: a Book on the Construction of the Astrolabe, a Book on the Use of the Astrolabe, a Book of the Sundial, and a Chronicle which is frequently quoted by later historians.

Al-Khwarizmi is one of the most influential medieval mathematicians and astronomers. While his creativity was inspired by borrowing, the developments, especially of algebra, were his own. Even though he was only one of a circle of savants working in al-Ma’mun’s Baghdad, he is the only one who created a branch of knowledge and gave his name to a process: algebra and algorithm. Because he brought disparate elements together in a new structure of scientific knowledge, others were able to advance the science beyond his foundations. It is fair to characterize his work as more “practical” than “theoretical”: his algebra, his astronomical tables, his geography, and his lost works all fulfill useful purposes. But precisely for this reason his works endured, especially in Western Europe.

See also Astronomy, Islamic; Commercial arithmetic; Geography, chorography

Bibliography


MICHAEL C. WEBER

KILWARDBY, ROBERT

Robert Kilwardby died at the papal court in Viterbo, Italy, on September 11, 1279. Although aspects of his career as an intellectual and churchman are known, nothing is really known about his early life except that he studied at Paris. It would be nice to know if he studied with the natural philosopher Richard Fishacre at Oxford in the early 1240s, for instance: it is possible and some of their ideas are similar. He was teaching in the arts faculty of the University of Paris in the late 1240s but left sometime around 1250 to begin the study of theology. This switch is of great significance when trying to understand his central role in the *Condemnation of 1277. As a member of the arts faculty in the 1240s Kilwardby could not teach theology or touch on theological issues. His reputation as one of the most able commentators on Aristotle during this period still stands: no mean accomplishment for it was only just at this moment that Aristotle was really being read and taught in Christian Europe. Kilwardby would later come to be highly regarded as a theologian and this reputation, combined with his elevation in 1273 to the office of Archbishop of Canterbury, made him a powerful churchman. As a churchman he appears to have been extremely conscientious in his duties—and that was not universally true in the Middle Ages—and known for his piety. He went on a pastoral visitation of his province, for example, despite the invariable hardships of sustained travel in those days.

Among Kilwardby’s most important works are De ortu scientiarum (1250); his Sentences-commentary (1252); and his Letter to Peter Conflans (1277). Perhaps the common theme of these works is an interest in harmonizing oppositions. For example, in a short metaphysical work, De natura relationis, Robert tries to show that a substance can also be a relation. While this claim would confound anyone who had read Aristotle’s Categorias, any reader of his Metaphysics would likewise be amazed at Kilwardby’s argument in his Sentences-commentary that one and the same thing (res) can be genus, species, and individual substances. However, it must not be thought that Kilwardby was dismissive of Aristotle or that he had some perverse cast of metaphysical mind. In fact, intense scrutiny of Aristotle and radical reworkings of his categories of thinking were pretty much the bread and butter of philosophers and theologians in the second half of the thirteenth century. Henry of Ghent and Johannes Duns Scotus are the most famous of Aristotle’s transformers, of course, but like Kilwardby they brought a fundamentally theological vision to bear on Aristotle and alter his categories of thought for deep, thoroughly worked out, theological reasons. Henry and
Scotus were thoroughgoing metaphysicians but Robert often tried to justify his transformations of Aristotle by appealing to biology.

Although Robert Kilwardby had yet to study theology when he wrote his famous work on the origin and order of the sciences, *De ortu scientiarum* is nevertheless a remarkable presentation of Christian Platonism, a profoundly theological metaphysics, and this despite the fact that Aristotle’s *Metaphysics* is the most cited work within it and second most cited is the *Posterior Analytics*. But this is of a piece with Robert’s interest in reconciliation. Although Robert’s cosmology was thoroughly Platonic, his use of Aristotle was not mere window-dressing. Like Bonaventure, Robert argued that the inner reality of the physical world was music but unlike Bonaventure he wanted Aristotle as one of his authorities for his opinions. Thus Robert was the first to define music, a science that was taught as part of the *quadrivium* in the arts faculty, as *numerus harmonicus*. He derived the idea of music as a mathematical science from Aristotle’s position in the *Posterior Analytics* that music is a subordinate science to *arithmetica*, and so one of the *scientiae mediae*, sitting between mathematics and physics in the hierarchy of the sciences. Robert’s definition became a source for later medieval musical theorists who like him espoused a strongly Platonic cosmology: and it was a fairly common position in the Middle Ages to defend Platonism by the idea that music as a structuring principle of the natural order sat close to the core of reality.

Robert’s commitment to Platonism never left him and was certainly reinforced by his reading of Augustine and taking him as a mentor in theology after 1250. This theologico-philosophical position is the backdrop for Robert’s well-known, and much-debated, intervention in the academic affairs of the University of Oxford. There, in 1277, he condemned a number of propositions ranging from issues in grammar to natural philosophy. Among the issues condemned, and by far the most significant and wide-ranging, was the thesis that there is a single substantial form in man. Robert was a defender of the common position in the Middle Ages that the human being is made up of a plurality of substantial forms. This position was a commonplace in medical literature until the seventeenth century. His 1277 *Letter to Peter Conflans* is a defense of this thesis almost exclusively in terms of medicine and biology, albeit with a strong metaphysical accent. Defending the plurality thesis in this way, with reasoning drawn from embryology, comparative anatomy, and physiology was quite common. Famously, it was not the position held by *Thomas Aquinas*, nor did Thomas draw on biology for his defense of the unicity thesis. Although there is debate about this, a consensus does exist that Robert did take a swipe at his Dominican confrere in 1277 when condemning the unicity thesis. However that may be, what is crucial here is that the plurality position suited Augustinian Platonism and a theology in which a powerful contrast exists between humans as divided in substance and God as utterly one in being. Robert had elaborate theological and scientific reasons for handing down his 1277 condemnations and his action cannot merely be cast as some “conservative backlash” against, or fear of, Arabo-Aristotelian scientism: and sadly, one reads such opinions in a fair chunk of the literature on Robert and 1277.

*See also Aristotelianism; Music theory; Plato*

**Bibliography**

**Primary Sources**


———. *Quaestiones in libros I-IV Sententiarum*. Ed. Johannes
Scheider (I); Gerhard Leibold (II); E. Gössmann, G. Leibold (III); Gerd Haverling (IV). Munich: Bayerisches Akademie der Wissenschaften, 1986–1995.

Secondary Sources

G.J. McAleer

KINDI, AL-

Very little is known of the life of Abu Yusuf Ya’qub ibn Ishaq al-Kindi, called “The Philosopher of the Arabs”: descended from the south-Arabic tribe of Kinda (hence his name). He was born in Kufa (first capital of the Abbasid empire) in Iraq, around 800. He got his intellectual education first in Basra, of which his father was governor, then in Baghdad, where he carried on his scientific career and where he died, after 866. He was a member of a group of philosophers in the circle of the caliph al-Ma’mun (813–83) and the *Bayt al-Hikma and made some of the early translations of Aristotle, Proclus, and Plotinus from Greek, all of them now lost. Al-Ma’mun’s successor, al-Mu’tasim, appointed al-Kindi as the tutor of his son Almam. Somehow out of favor during the reign of al-Wathiq, al-Kindi regained some favor with al-Mutawakkil before falling into disgrace due to the intrigues of other scientists (the Banu Musa or Abu Ma’shar) who were also his rivals.

Al-Kindi then divided his activities between Kufa, Basra and Baghdad, the three most prestigious cities of the Abbasid empire, centers during the ninth century of an intense intellectual activity, supported by political power: the passage under the Arab domination of non-Arabic-speaking nations, heirs of rich intellectual traditions, induced a fertile cultural and social mixing. Contemporary to the studies of grammar, linguistics and hermeneutics in the schools of Kufa and Basra, the religious speculation, stirred by controversies arising from the confrontation with believers of other religions (Christians, Jews, Zoroastrians...) became more dialectical. At the same time the Arabo-Islamic culture appropriated and developed for its own account scientific and philosophical elements elaborated in Persia, India, and and also Greece: the massive movement of translation of the Hellenistic heritage coincided with the first scientific researches. This century is one of the most brilliant of the universal history.

Al-Kindi is a good example of an encyclopedic thinker, nurtured on Greek thought and, at the same time, involved in the religious controversies of the time, he is the author of a very vast work, of which unfortunately very little is left: while the biobbilographer Ibn al-Nadim (writing approximately one hundred fifteen years after al-Kindi’s death) ascribes to him in his *Fihrist more than two hundred seventy works, no more than thirty have survived. Al-Kindi’s interests embraced almost all sciences, to which he developed, starting from the premises of Greek science, a personal and original interpretation. He is in particular the author of the most substantial work on optics since late antiquity.

Philosophy
Al-Kindi’s philosophy was especially indebted to *Plato and Aristotle, who for him had intrinsically the same doctrine (we recognize here one of the syncretistic aspects of late Greek thought). His philosophy integrates problems and concepts originating in various currents of Neoplatonism (Proclus, Plotinus). His thought is also closely related to kalām, or rational Islamic theology; in particular its mu’tazilite branch, which played an important role in the introduction of elements of Greek philosophy into the Islamic thought, as well as some of the key subjects he studies, such as the unicity of God, man’s free will, and the thesis of the “created” Qu’ran.

Al-Kindi, relying on the principle that reason is an attribute specific to mankind, considers that philosophy has to explain by its own methods the truths expounded in the Qu’ran in a condensed form. Inasmuch as for him, philosophical truth accords on the whole with revealed truth, there is no conflict between reason and religious faith. He develops this thesis in several works, including his First Philosophy and the epistle On the Number of Aristotle’s Books. The central theme is that prophetic science and human science have the same content, the only difference being that the first one is instantaneous, gained without effort or prior knowledge, because it comes from God. First Philosophy contains a violent criticism of those who, under cover of religion, denigrate philosophical speculation.

Most of al-Kindi’s works are epistles (risāla), rather short texts, rigorously organized, dealing with well defined subjects (this style of writing will become afterwards rather common amongst philosophers writing in Arabic). Al-Kindi devotes, inter alia, several epistles to the proof of the finitude of the world in time and in space and to the fact that the infinite exists only potentially (a problem already tackled in his First Philosophy), thus breaking with Aristotle’s cosmology and incorporating some Neoplatonic concepts (such as those found in the Theology of Pseudo-Aristotle or in Proclus’ book on The Pure Good).

Optics
Al-Kindi’s work in the field of optics is double-faceted: while it is directly indebted to Hellenistic optics—most of the Greco-Hellenistic texts on the subject were translated