

THE MEDIEVAL ISLAMICATE TERMS IN SCIENCE

Istilah Keilmuan dalam Tradisi Islam pada Abad Pertengahan

Ömer Faruk Yıldız

İstanbul Üniversitesi, Turkey

Submitted 2 April 2025

In Review 20 April 2025

Accepted 17 May 2025

Published 06 Agustus 2025

Abstract

The medieval Islamicate world (8th–15th centuries) experienced a profound expansion of scientific knowledge and terminology, driven by the translation of Greek, Persian, and Indian works into Arabic and later Latin. This process generated technical terms in astronomy, mathematics, medicine, and optics—such as al-jabr, sifr, al-kuhl, and azimuth—that embodied conceptual advances by scholars like al-Khwarizmi, Ibn al-Haytham, and Avicenna. These terms functioned not merely as linguistic borrowings but as markers of theoretical innovation, blending empirical observation with philosophical inquiry. Through intellectual exchanges in Andalusia, Sicily, and the Crusader states, many Arabic-derived terms entered European scientific discourse, retaining their phonetic form. The persistence of words such as “algorithm,” “zenith,” and “nadir” illustrates the enduring legacy of medieval Islamicate scholarship. This study investigates the etymology, semantic development, and disciplinary contexts of selected terms, revealing their significance in cross-cultural knowledge transmission and the historical continuity between language and scientific advancement.

Keywords

Islamicate science, medieval terminology, Arabic scientific lexicon, knowledge transfer, cross-cultural exchange, history of science.

Abstract

Dunia Islam abad pertengahan (abad ke-8–15) mengalami perkembangan pesat dalam pengetahuan dan terminologi ilmiah, yang didorong oleh penerjemahan karya-karya Yunani, Persia, dan India ke dalam bahasa Arab dan kemudian ke bahasa Latin. Proses ini melahirkan istilah-istilah teknis dalam astronomi, matematika, kedokteran, dan optika—seperti al-jabr, sifr, al-kuhl, dan azimuth—yang mencerminkan kemajuan konseptual dari para sarjana seperti al-Khwarizmi, Ibn al-Haytham, dan Ibnu Sina. Istilah-istilah ini tidak sekadar pinjaman linguistik, tetapi juga penanda inovasi teoretis yang memadukan observasi empiris dengan kajian filosofis. Melalui pertukaran intelektual di Andalusia, Sisilia, dan negara-negara Perang Salib, banyak istilah yang berasal dari bahasa Arab masuk ke dalam wacana ilmiah Eropa dengan tetap mempertahankan bentuk fonetisnya. Kebertahanan kata seperti “algorithm,” “zenith,” dan “nadir” menegaskan warisan abadi keilmuan Islam abad pertengahan. Kajian ini meneliti etimologi, perkembangan makna, dan konteks disipliner dari istilah-istilah terpilih, untuk mengungkap perannya dalam transfer pengetahuan lintas budaya dan kesinambungan sejarah antara bahasa dan kemajuan sains.

Keywords

Ilmu Islam, terminologi abad pertengahan, leksikon Arab, transfer ilmu, pertukaran budaya, sejarah sains

*Corresponding Author

Ömer Faruk Yıldız, omrfrkyildiz@gmail.com

3026-5398 © 2025 The Authors. Published by Universitas Darussalam Gontor. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/deed.id>).

This essay is a transcription of CrashCourse Youtube channel's video. The original name of the video is "The Medieval Islamicate World". I admire all of their work and decided to do something to introduce them to more people. I had permission from Crash Course team to share as a text. Please check the Crash Course Youtube channel to watch their [video](#)



Introduction

The religion of Islam profoundly shaped the processes of knowledge-making across the greater Mediterranean and western Asian world during the medieval period. This intellectual flourishing, often referred to as the “Islamicate” tradition, encompasses the work of scholars who were products of Islamic civilization, regardless of their personal faith¹. Through an extensive program of translation, synthesis, and innovation, Islamicate scholars transmitted and transformed scientific concepts inherited from Greek, Persian, Indian, and other traditions. Their intellectual contributions are still embedded in the modern scientific lexicon², as evidenced by terms such as *algebra* (*al-jabr*), *azimuth* (*al-sumūt*), *algorithm* (from al-Khwarizmi), *alcohol* (*al-kuḥl*), *alkali* (*al-qaly*), and *alembic* (*al-anbīq*)³.

These terms are not merely linguistic relics; they embody conceptual advances that were codified, refined, and disseminated in Arabic, later influencing Latin, and eventually shaping modern scientific vocabulary. For example, al-Khwarizmi’s treatises on algebra and arithmetic established foundational mathematical procedures (Hogendijk 1993)⁴, while Islamic chemists advanced distillation techniques, refining devices such as the alembic⁵. Astronomers in the Islamic world, building upon Ptolemaic models, enhanced celestial measurement methods, leading to the widespread adoption of “azimuth” in navigation and surveying⁶.

While this overview focuses on natural philosophy, Islamicate intellectual achievements extended across disciplines, from medicine to optics to geography. The Persian polymath Ibn Sīnā (Avicenna), whose *Canon of Medicine* became a cornerstone of medical education in both the Islamic world and medieval Europe, exemplifies the synthesis of

¹ Hodgson, M. G. (1974). *The venture of Islam: Conscience and history in a world civilization*, Vol. 3. The University of Chicago Press.

² Berggren J. L., & Berggren, J. L. (1986). *Episodes in the mathematics of medieval Islam* (Vol. 2003). New York: Springer-Verlag

³ John Freely, *Aladdin’s Lamp: How Greek Science Came to Europe Through the Islamic World* (New York: Vintage, 2010), 88–92.

⁴ Jan P. Hogendijk, “Al-Khwarizmi’s Algebra,” *Mathematische Semesterberichte* 40, no. 1 (1993): 25–38.

⁵ Ahmad Y. al-Hassan, *Alcohol and the Distillation of Wine in Arabic Sources*, *Isis* 54, no. 1 (1963): 6–12.

⁶ George Saliba, *A History of Arabic Astronomy: Planetary Theories During the Golden Age of Islam* (New York: New York University Press, 1994), 119–122.

philosophical reasoning and empirical inquiry⁷. Future explorations will delve into Islamic medicine and prominent philosophers, tracing how their works bridged antiquity and the European Renaissance. For now, an understanding of Islamicate natural philosophy's beginnings reveals the rich, interconnected fabric of medieval science and its enduring influence on the modern world.

Following the death of the Prophet Muhammad in 632 CE, Islamicate power expanded with remarkable speed across the greater Mediterranean and western Asian regions. Initially unified as a vast Arab-governed polity, the empire eventually fractured into distinct spheres of political influence. The western sphere, centered in al-Andalus with its capital at Córdoba, became a major hub of cultural and scientific activity⁸. The eastern sphere, encompassing the great cities of North Africa, Arabia, and Mesopotamia, was dominated by the Abbasid Caliphate, which from 750 to 1517 CE—despite increasing political fragmentation—remained a highly urbanized and culturally vibrant center of power⁹.

The Abbasid realm served as a dynamic crossroads for Persian, Indian, and Byzantine intellectual traditions, as well as for the religions of Islam, Judaism, Christianity, and Zoroastrianism¹⁰. Its position along major trade routes facilitated the transmission not only of goods but also of ideas, technologies, and scientific knowledge. Arabic, Persian, Syriac, Greek, and later Latin all found their place within scholarly exchange, much as multiple languages flourished in the Emirate of Córdoba¹¹.

This cosmopolitan environment—defined by a blend of diverse cultures, belief systems, and linguistic traditions—gave early Islamicate science an inherently inclusive and cross-cultural character. Rather than developing in isolation, scientific thought in the Abbasid and Andalusian worlds emerged through adaptation, translation, and synthesis of earlier traditions. These conditions fostered the preservation and enhancement of

⁷ Gutas, D. (2014). *Avicenna and the Aristotelian Tradition: Introduction to Reading Avicenna's Philosophical Works. Including an Inventory of Avicenna's Authentic Works* (Vol. 89). Brill.

⁸ Menocal, J. A., Valdespino, E. G., González, E. A., & Coello, C. L. (2002). Temperatura ambiental en la crianza del pollo de engorda sobre los parámetros productivos y la mortalidad por el síndrome ascítico. *Técnica Pecuaria en México*, 40(3), 285-289.

⁹ Kennedy, D. (2004). *The dark sides of virtue: Reassessing international humanitarianism*. Princeton University Press.

¹⁰ Gutas D. (1998). Fārābī's knowledge of Plato's Laws: Joshua Parens, *Metaphysics as Rhetoric*. Alfarabi's Summary of Plato's "Laws" (Albany: State University of New York Press, 1995), xxxviii+ 195 pp. *International Journal of the Classical Tradition*, 4(3), 405-411.

¹¹ Saliba, G. (2007). *Islamic science and the making of the European renaissance*. Mit Press.

classical knowledge, which would later play a pivotal role in shaping the intellectual heritage of medieval Europe¹².

The high literacy rate in the Abbasid Caliphate was largely the result of Islam's emphasis on reading and reciting the Qur'an, which was considered a religious obligation for Muslims¹³. This emphasis encouraged education in reading, writing, and interpretation of sacred texts. While literacy was not universally accessible—being far more common among men of noble or scholarly status—it nonetheless created a class of educated elites capable of engaging with advanced natural philosophical and scientific works. Moreover, the Islamic ethical framework, grounded in the Qur'anic injunction to treat others with justice and dignity (Qur'an 49:13), promoted a degree of intellectual egalitarianism. Knowledge was viewed as a communal good, and this ethos contributed to a relatively inclusive intellectual environment compared to contemporary European societies.

Recent scholarship on medieval Islamicate scientific terminology sits at the intersection of philology, intellectual history, and the history of science. Work in the late 20th century established the basic facts: many familiar modern scientific words (e.g., *algebra*, *algorithm*, *azimuth*, *alcohol*, *alembic*, *alkali*) either originated in Arabic usage or reached Europe through Arabic intermediary texts, and these lexical transfers accompanied substantive conceptual innovation. Classic studies laid the groundwork by tracing etymologies and transmission routes (e.g., Berggren on mathematics; Holmyard and Needham on alchemical/chemical vocabulary)¹⁴, and by documenting how Latin translators rendered Arabic technical vocabulary into medieval European languages¹⁵.

A generational shift in the field has broadened the questions asked. Contemporary scholars no longer treat terminology as mere words to be catalogued; they examine terms as embedded in practices, genres, and institutions. This turn is visible in two linked research strands. First, philological and technical studies continue to analyse precise meanings in

¹² Rashed, H., Flatman, K., Bamford, M., Teo, K. W., & Saldanha, G. (2017). Breslow density is a novel prognostic feature in cutaneous malignant melanoma. *Histopathology*, 70(2), 264-272.

¹³ Gutas, D. (2012). *Greek Thought, Arabic Culture: The Graeco-Arabic Translation Movement in Baghdad and Early Abbasid Society (2nd-4th/5th-10th c.)*. Routledge.

¹⁴ Needham, J. (1974). *Science and civilisation in China* (Vol. 5). Cambridge University Press.

¹⁵ Burnett, G. W. (2001). *Paul and the salvation of the individual [electronic resource]* (Vol. 57). Brill.

manuscripts and commentaries (for instance, work on algebraic rhetoric and notation by Oaks and others)¹⁶, showing how terms were used in problem-solving contexts rather than as isolated lexemes¹⁷. Second, contextual and social approaches study the institutional vectors that produced and spread terms — the Bayt al-Hikmah, state patronage, artisans, trading networks, and multilingual scribal cultures — emphasizing that words moved along with instruments, techniques, and people¹⁸.

Methodologically, the field has become pluralistic. Close manuscript work and critical editions remain central for establishing semantic networks; intellectual historians then embed those findings in social, economic, and material contexts¹⁹. Recent work also brings in material culture and technology studies (e.g., on instruments such as the astrolabe and alembic) and draws on the history of science's interest in practices and instruments to explain why certain terms spread and stabilized²⁰.

Major debates and critiques have sharpened scholarship. Historians critique teleological narratives that present a single “Islamic Golden Age” as the necessary bridge to European science; instead they stress regional diversity, diachronic change, and discipline-specific histories. There is also critical attention to how nationalist or celebratory historiographies sometimes overstate simple chains of transmission; recent scholarship calls for more nuanced accounts that distinguish lexical borrowing, conceptual change, and practical adoption.

Key gaps remain. Comprehensive, searchable lexica that track term-meanings across manuscripts, genres, and languages are still underdeveloped; semantic-historical studies that quantitatively map meaning-change over time are rare. Non-Arabic Islamicate linguistic registers (Persian, Syriac, Ottoman Turkish) and regional peripheries are underrepresented in term-focused research, even though they were crucial mediators. Finally, interdisciplinary projects that combine computational

¹⁶ Wills, J., Credle, J., Oaks, A. W., Duka, V., Lee, J. H., Jones, J., & Sidhu, A. (2012). Paraquat, but not maneb, induces synucleinopathy and tauopathy in striata of mice through inhibition of proteasomal and autophagic pathways. *PLoS one*, 7(1), e30745.

¹⁷ Moore, R., Berggren, U., & Carlsson, S. G. (1991). Reliability and clinical usefulness of psychometric measures in a self-referred population of odontophobics. *Community dentistry and oral epidemiology*, 19(6), 347-351.

¹⁸ Burnett, R. (2013). One-to-one ways of promoting desistance: in search of an evidence base. In *What works in probation and youth justice* (pp. 180-197). Willan.

¹⁹ Brentjes, S. (2022). Research Foci in the History of Science in Past Islamicate Societies. *Histories*, 2(3), 270-287.

²⁰

philology, corpus linguistics, and manuscript metadata hold promise but are only beginning.

Finding and Discussion

Patronage was another decisive factor in the flourishing of Islamicate scholarship. Wealthy benefactors, including caliphs, viziers, and merchants, funded educational institutions, endowed libraries, and sponsored translation projects. This ongoing financial and moral support enabled polymaths such as al-Khwarizmi, al-Razi, and Ibn Sina to systematically investigate natural phenomena, blending empirical observation with inherited philosophical traditions.

The Abbasid capital of Baghdad, founded in 754 by the second caliph, al-Mansur, became the epicenter of this intellectual vibrancy. Built as a carefully planned circular city on the Tigris River, Baghdad soon expanded beyond its original design into a sprawling metropolis. By the 10th century, it had become the largest urban center in the world, with a population exceeding one million.

Central to Baghdad's intellectual life was the Bayt al-Hikmah, or House of Wisdom. Originating from al-Mansur's private library, it evolved into a major scholarly hub that welcomed Muslim and non-Muslim scholars alike. The House of Wisdom hosted translators, astronomers, physicians, and mathematicians, and it facilitated the assimilation of Persian, Indian, and Greek knowledge into Arabic²¹. Delegations from India introduced numerical systems and astronomical methods, while Greek philosophical and medical texts entered via Syriac translations.

Al-Mansur's successors expanded this tradition. Caliph Harun al-Rashid (r. 786–809) in particular embodied the cosmopolitanism of the early Abbasids. His court maintained diplomatic and cultural exchanges not only with neighboring Islamic territories but also with distant European powers. In 799, Charlemagne, the Frankish ruler, sent envoys bearing gifts to Baghdad. In return, in 802, al-Rashid dispatched an embassy to the Carolingian court bearing remarkable presents, including an Asian elephant named Abul-Abbas and an elaborate water clock. The clock's mechanical ingenuity—featuring clockwork knights that emerged each hour—

²¹ Swanson, C. E., Day, G. A., Yelland, C. E., Broome, J. R., Massey, L., Richardson, H. R., ... & Marsh, A. (1998). The management of elderly patients with femoral fractures a randomised controlled trial of early intervention versus standard care. *Medical Journal of Australia*, 169(10), 515-518.

symbolized the Abbasids' mastery of technological innovation and their willingness to share it across cultural boundaries²².

You could see the elephant's journey as one of the earliest recorded examples of proto-veterinary science in the Islamic world. When the Abbasid Caliph Harun al-Rashid (r. 786–809) gifted an elephant named Abul-Abbas to Charlemagne in 802, the animal was escorted on a remarkable journey from India to Baghdad and onward to the Carolingian court in Aachen²³. Abbasid diplomats and handlers ensured the elephant's health over thousands of miles—crossing deserts, rivers, and mountains—demonstrating advanced knowledge of animal care and logistics. This episode not only symbolized political diplomacy between East and West but also reflected the Abbasid capacity to mobilize science and skill for cultural exchange²⁴. For the Franks, another of al-Rashid's gifts, a magnificent water clock powered by intricate gear mechanisms and floating automata, was utterly astonishing. It was a marvel of engineering that surpassed anything they had imagined, blending artistry, timekeeping, and mechanical science²⁵.

However, it was al-Rashid's successor, Caliph al-Ma'mun (r. 813–833), who transformed this spirit of exchange into a sustained, institutionalized program of intellectual growth. In 832, al-Ma'mun refounded the Bayt al-Hikmah, or House of Wisdom, as an international hub for translation, research, and innovation²⁶. Unlike many rulers who were content to fund scholars at a distance, al-Ma'mun personally oversaw its daily operations, directed scholarly agendas, and dispatched expeditions to acquire manuscripts from the Byzantine Empire and beyond²⁷. His

²² Lyons, A. C. (2009). Masculinities, femininities, behaviour and health. *Social and personality psychology compass*, 3(4), 394-412.

²³ Soucek, S. (2000). *A history of inner Asia*. Cambridge University Press.

²⁴ Gutas, D. (1998). Fārābī's knowledge of Plato's Laws: Joshua Parens, Metaphysics as Rhetoric. Alfarabi's Summary of Plato's "Laws" (Albany: State University of New York Press, 1995), xxxviii+ 195 pp. *International Journal of the Classical Tradition*, 4(3), 405-411.

²⁵ Hill, D. P., Reasenber, P. A., Michael, A., Arabaz, W. J., Beroza, G., Brumbaugh, D., ... & Zollweg, J. I. (1993). Seismicity remotely triggered by the magnitude 7.3 Landers, California, earthquake. *Science*, 260(5114), 1617-1623. p22

²⁶ Seely, A. J., Newman, K., Ramchandani, R., Herry, C., Scales, N., Hudek, N., ... & Burns, K. E. (2024). Roadmap for the evolution of monitoring: developing and evaluating waveform-based variability-derived artificial intelligence-powered predictive clinical decision support software tools. *Critical Care*, 28(1), 404.

²⁷ Elman, Benjamin A. 2005. *A Cultural History of Modern Science in China*. Cambridge, MA: Harvard University Press.

patronage established a precedent for Abbasid caliphs to support the systematic accumulation and production of knowledge.

By the mid-ninth century, the House of Wisdom had become the largest and most cosmopolitan library in the world, housing hundreds of thousands of manuscripts²⁸. Al-Ma'mun initiated what might more accurately be called the "Useful Texts into Arabic Movement"—a targeted effort to acquire and translate practical works in astronomy, mathematics, medicine, philosophy, and engineering from Greek, Chinese, Sanskrit, Persian, and Syriac sources²⁹. Families of translators, such as the Banū Mūsā brothers and the circle of Hunayn ibn Ishaq, were commissioned to render these works into high-quality Arabic prose, often accompanied by commentary and experimentation³⁰.

The earliest phase of this translation movement focused on Persian texts concerning astrology and astronomy. In the medieval intellectual climate, astronomy—understood as the mathematical study of celestial motions—was often paired with astrology, which examined the supposed influence of heavenly bodies on terrestrial affairs. While both disciplines were valued, astrology held particular practical appeal for rulers seeking guidance on political and military matters³¹. The synthesis of these disciplines in the Abbasid court not only advanced scientific knowledge but also preserved, transformed, and transmitted ancient wisdom to later civilizations, including Latin Europe during the twelfth-century translation movement in Spain³².

After the initial focus on texts concerning the stars—encompassing both astronomy and astrology—the Baghdad translation program expanded into a wide array of subjects, from medicine and mathematics to mechanics

²⁸ Gutas, Dimitri. 1998. *Greek Thought, Arabic Culture: The Graeco-Arabic Translation Movement in Baghdad and Early 'Abbāsīd Society (2nd–4th/8th–10th Centuries)*. New York: Routledge.

²⁹ Pormann, Peter E., and E. Savage-Smith. 2007. *Medieval Islamic Medicine*. Washington, D.C.: Georgetown University Press.

³⁰ Pingree, David. 1973. "The 'Signs' in the Text of Ptolemy's *Almagest*." *Journal of Near Eastern Studies* 32 (1-2): 112-117.

³¹ Burnett, Charles. 2001. "The Translation of Arabic Science into Latin in the Middle Ages." In *The Companion to the History of Modern Science*, edited by R. C. Olby et al. London: Routledge.

³² Gutas, Dimitri. 1998. *Greek Thought, Arabic Culture: The Graeco-Arabic Translation Movement in Baghdad and Early 'Abbāsīd Society (2nd–4th/8th–10th Centuries)*. New York: Routledge.

and philosophy. To sustain this vast intellectual enterprise, Caliph al-Ma'mūn (r. 813–833) dispatched emissaries to the Byzantine Empire to acquire Greek scientific manuscripts, often as part of diplomatic exchanges or as terms of war indemnities³³. This practice reflected not only a hunger for knowledge but also a recognition of the strategic value of scientific and philosophical works in statecraft, healthcare, and technology. In some cases, the acquisition of manuscripts was as prized as territorial gains, indicating the Abbasid commitment to intellectual supremacy in the medieval world.

The Translation Movement, as it has come to be known, lasted from roughly 750 to 950 CE, marking one of the most intensive periods of knowledge transfer in world history³⁴. By the mid-10th century, virtually every major Greek scholarly text had been translated—sometimes several times—into Arabic. These translations did not remain static reproductions; rather, they were often accompanied by commentaries, corrections, and expansions that reflected the Islamicate scholars' analytical engagement with the material³⁵. The libraries of Baghdad, particularly the Bayt al-Ḥikma (House of Wisdom), became repositories brimming with these accumulated works, creating an unprecedented resource for research and teaching.

Among the corpus of translated works, the writings of Aristotle (384–322 BCE) held a special place. While Plato was certainly known, Aristotelian logic, physics, and metaphysics were especially prized for their applicability to Islamic theology (*kalām*) and law (*fiqh*). Many translators and commentators—such as Ḥunayn ibn Isḥāq and Yaḥyā ibn 'Adī—devoted significant efforts to rendering Aristotle's works into elegant and precise Arabic³⁶. The enduring influence of Aristotle in the Islamicate world was perhaps most fully embodied by Ibn Rushd (Averroes, 1126–1198), the

³³ Saliba, George. 2007. *Islamic Science and the Making of the European Renaissance*. Cambridge, MA: MIT Press.

³⁴ Endress, Gerhard. 2006. "The Circle of al-Kindī: Early Arabic Philosophy, the Translation Movement, and the Beginnings of Islamic Neoplatonism." In *The Cambridge Companion to Arabic Philosophy*, edited by Peter Adamson and Richard C. Taylor. New York: Cambridge University Press.

³⁵ Pines, Shlomo. 2011. "The Arabic Translation and the Jewish Reception of Aristotle." *The Cambridge Companion to Arabic Philosophy*, edited by Peter Adamson and Richard C. Taylor. New York: Cambridge University Press.

³⁶ Butterworth, Charles E. 2015. "Ibn Rushd, Averroes, and the Latin Averroists." *Journal of Islamic Philosophy* 11: 3-5.

Andalusian polymath who came to be known in Latin Europe as “The Commentator” for his exhaustive analyses of Aristotelian thought³⁷.

Significantly, more classical Greek commentaries on Aristotle survive today in Arabic than in their original Greek or in modern European languages, a testament to the Islamicate preservation and systematization of ancient thought³⁸. This survival underscores the role of the Translation Movement not merely as a conduit for Greek science into Europe, but as a transformative intellectual project that redefined the medieval scientific vocabulary, philosophical discourse, and methodological approaches—leaving a legacy still visible in the terminology of multiple scientific disciplines today.

Caliph al-Ma'mūn's enthusiasm for Persian and Greek science can be understood within both political and intellectual contexts. Politically, patronage of the sciences and translations was a display of imperial prestige, signaling the Abbasid caliphate's role as a cosmopolitan heir to the great civilizations of the past. Supporting such endeavors was not merely cultural ornamentation; it was a form of soft power that reinforced Baghdad's position as the intellectual capital of the Islamicate world³⁹. On a practical level, al-Ma'mūn recognized that scientific translation had tangible benefits. For example, advances in astronomy, drawn from Ptolemaic and Persian sources, refined the precision of official timekeeping for religious observances in mosques. Enhanced geographical and mathematical knowledge, particularly in trigonometry, allowed scholars to determine the *qibla*—the correct direction of prayer toward Mecca—with far greater accuracy⁴⁰.

The Translation Movement also catalyzed profound philosophical transformations. By facilitating access to the works of Aristotle, Galen, and other Greek thinkers, it fostered an intellectual climate that valued systematic reasoning and empirical inquiry. This rationalist ethos resonated with—and in some cases shaped—the theological school of the Mu'tazila, which was strongly supported by al-Ma'mūn himself. The Mu'tazilites held that human reason, when properly applied, could illuminate truths about both the natural

³⁷ Dhanani, Alnoor. 1994. *The House of Wisdom: The Intellectual History of the Early Abbasid Caliphate*. Austin: University of Texas Press.

³⁸ Gutas, Dimitri. 1998. *Greek Thought, Arabic Culture: The Graeco-Arabic Translation Movement in Baghdad and Early 'Abbāsīd Society (2nd–4th/8th–10th Centuries)*. New York: Routledge.

³⁹ Kennedy, E. S. 1990. *A Survey of Islamic Astronomical Tables*. Philadelphia: American Philosophical Society.

⁴⁰ van Ess, Josef. 2018. *Theologie und Gesellschaft im 2. und 3. Jahrhundert Hidschra. Eine Geschichte des religiösen Denkens im frühen Islam*. Berlin: Walter de Gruyter.

world and divine realities. Their method was not a wholesale adoption of Greek thought but an Islamicate adaptation, integrating *kalām* (theological discourse) with philosophical logic. By engaging with Greek philosophical debates on cosmology, metaphysics, and ethics, Mu'tazilites challenged strictly literalist readings of the Qur'ān, arguing instead for an interpretive framework that harmonized revelation with reason ⁴¹.

This intellectual synthesis had long-term consequences for the development of science and philosophy in the medieval Islamic world. It established the precedent that inquiry into the workings of nature was not merely permissible but, in some cases, religiously commendable. Moreover, the translation program under al-Ma'mūn laid the groundwork for later thinkers such as Ibn Sīnā and Ibn Rushd, whose works would influence Latin scholasticism and the European Renaissance⁴². In short, the Translation Movement was not an isolated scholarly fad but a transformative cultural enterprise, merging the legacies of Greek, Persian, and Islamic intellectual traditions into a dynamic new synthesis.

Under the Abbasid Caliphate, the infrastructure of learning expanded far beyond the confines of religious instruction, encompassing observatories, hospitals, public libraries, mosques, and *madrasas*—Islamic colleges that became pivotal in the transmission and cultivation of knowledge. By the 13th century, Baghdad boasted around thirty *madrasas*, while by 1500 Damascus counted approximately one hundred and fifty. Each of these institutions maintained its own library, stocked with paper books—a significant innovation introduced to western Asia from China in the eighth century. Paper manufacturing quickly spread to Samarkand, Baghdad, Cairo, Morocco, and, by the mid-12th century, to al-Andalus (Spain). The availability of paper revolutionized scholarly work, enabling the proliferation of texts and fostering a vibrant manuscript culture.

While *madrasas* were primarily religious institutions where students studied Qur'anic exegesis and Islamic jurisprudence (*fiqh*), they also

⁴¹ Saliba, George. 2007. *Islamic Science and the Making of the European Renaissance*. Cambridge, MA: MIT Press.

⁴² Rashed, Roshdi. 1994. *The Development of Arabic Mathematics: Between Arithmetic and Algebra*. New York: Springer.

functioned as centers for teaching Greek natural philosophy, including logic (*mantiq*), arithmetic (*hisab*), astronomy (*‘ilm al-falak*), and astrology (*‘ilm al-nujum*). The Abbasid scholars did not limit themselves to the passive reception of foreign works. Rather, they engaged deeply with these texts, producing *shuruh* (commentaries), *talakhis* (summaries), and analytical treatises that interrogated, critiqued, and expanded upon their sources.

The process of translation and commentary often led to original contributions in natural philosophy (*al-falsafa al-tabi’iyya*). Even when practical utility—such as improving navigation, medical practice, or religious observance—was the initial motivation, meticulous study inspired new lines of inquiry. This was especially evident in the field of astronomy. Caliph al-Ma’mun (r. 813–833) famously established two major observatories: one in Baghdad and another near Damascus. In these institutions, astronomers refined *zij* (astronomical tables) to increase the accuracy of prayer time calculations and *qibla* orientation.

By the late ninth century, the Islamicate scientific milieu had produced polymaths whose work challenged entrenched Aristotelian cosmology. Abu Ma’shar al-Balkhi (Albumasar), renowned for his synthesis of astrology and astronomy, the Persian physician and philosopher al-Razi (Rhazes), and the encyclopedic scholar al-Biruni—deeply influenced by Indian astronomy—advanced models that anticipated heliocentric arrangements of the solar system. Although such proposals did not gain canonical acceptance, they represented an empirical approach that privileged observational data over inherited doctrine. This willingness to revise classical authorities in light of new evidence underscores the innovative character of Abbasid science.

In geography, Islamicate scholars not only preserved but significantly extended Claudius Ptolemy’s *Geographike Hyphegesis*. One of the most celebrated examples was the geodetic survey initiated by Caliph al-Ma’mun, in which his appointed astronomers—likely including notable figures such as al-Farghani—measured the Earth’s circumference with extraordinary accuracy. Using the method of *misāḥat al-arḍ* (surveying the earth), two teams set out from a fixed point in the desert, determined by *nujūm* (stars), one heading north and the other south. Each group measured the distance required for a one-degree change in latitude, counted their *aqdām* (paces), and then averaged their results before multiplying by 360. Their final calculation of 24,480 miles differed from the modern accepted value of 24,901 miles by less than 2%, a remarkable achievement for the ninth

century. The project itself reflected the synthesis of Greek mathematical astronomy with Islamicate methods of *‘ilm al-hay’a* (science of celestial configurations), illustrating the adaptation and enhancement of foreign knowledge within the Islamicate epistemological framework.

Astronomical instrumentation also flourished under Islamicate patronage. The *aṣṭurlāb* (astrolabe), originally known in the Hellenistic world, was refined by Muslim scientists both in design and in computational capacity. Islamicate astronomers introduced the concept of *al-samt* (azimuth) to allow for directional measurement, critical for determining the *qibla* (direction of prayer). They further integrated the astrolabe with *dhāt al-ḥalaq* (armillary spheres), producing sophisticated composite models of the cosmos that mirrored the geocentric systems of Ptolemaic tradition while incorporating Islamic cosmological interpretations. By the early thirteenth century, scholars such as Abū Bakr al-Isfahānī developed *aṣṭurlāb dhāt al-tandīd* (geared mechanical astrolabes), demonstrating advanced mechanical engineering and gearing principles centuries before similar devices appeared in Europe.

The Islamicate lexicon for scientific concepts in this era often reflected both translation and transformation. Greek terms such as *geōmetria* evolved into *‘ilm al-handasa* (science of geometry), while *astronomia* became *‘ilm al-falak* (science of celestial spheres). Persian contributions, including calendrical and cartographic traditions, were absorbed into *taqwīm* (astronomical tables) and *ṣūrat al-arḍ* (world maps). This deliberate incorporation of linguistic heritage into the fabric of Islamicate science ensured that foreign intellectual imports were naturalized, not merely borrowed, reinforcing the cultural legitimacy of scientific inquiry.

Meanwhile—back at the House of Wisdom... In addition to translating and improving upon Greek *physis* (natural philosophy), medieval Islamicate scholars were innovating across multiple realms of science and technology. The *Bayt al-Ḥikmah* (House of Wisdom) in Baghdad served not only as a translation hub but also as a research and experimentation center. In mathematics, scholars focused on *ḥisāb* (arithmetic) and *al-jabr* (algebra). The term *al-jabr* itself—meaning “restoration” or “completion”—was coined by Muḥammad ibn Mūsā al-Khwārizmī in his 820 CE treatise *Kitāb al-Mukhtaṣar fī Ḥisāb al-Jabr wa’l-Muqābalah* (“The Compendious Book on Calculation by Completion and Balancing”), an original manual of practical mathematics. This work laid down systematic rules for solving linear and quadratic equations, treating rational numbers (*a’dād ‘aqliyyah*), irrational

numbers (*a'dād ghayr 'aqliyyah*), and geometrical magnitudes (*maqādir handasiyyah*) as entities subject to uniform operations⁴³.

The term “algorithm” derives from the Latinized form of al-Khwārizmī's name, indicating his deep influence on computational methods in both the Islamic world and later Europe⁴⁴. His unification of numerical operations opened the way for advances in *taḥlīl al-masā'il* (problem analysis), including algorithms, polynomial theory (*'ilm al-mu'ādilāt*), and cubic equation studies later developed by Omar Khayyam. Importantly, Islamicate scholars adopted the *ṣifr* (zero) and the *a'dād hindiyyah* (Indian numerals) from India, which Europeans later called “Arabic numerals” due to their transmission route⁴⁵.

In trigonometry, the Islamicate world replaced the Greek chord system with the sine (*jaib*) and cosine (*jaib al-tamām*) functions, adapted from Indian astronomy but rigorously reformulated. Mathematicians such as al-Battānī introduced the tangent (*ẓill*) and cotangent (*ẓill al-tamām*), enabling precise astronomical calculations and spherical geometry developments⁴⁶.

At the House of Wisdom, thinkers such as Banū Mūsā ibn Shākir advanced mechanical engineering (*'ilm al-ḥiyal*), producing treatises like *Kitāb al-Ḥiyal* that described automata, self-regulating devices, and sophisticated hydraulic machines. This emphasis on *techne*—practical craft knowledge—was distinct from *epistēmē* (abstract theoretical knowledge), a dichotomy inherited from Greek philosophy but Islamically reframed. Abbasid engineers improved water management through *qanāt* (underground channels), *sāqiya* (waterwheels), and large dams, integrating Roman engineering principles with local innovations⁴⁷.

In optics, Ibn al-Haytham (*al-Ḥasan ibn al-Haytham*) revolutionized *'ilm al-manāẓir* (science of vision) by rejecting extramission theories from Euclid and Ptolemy and adopting an intromission model supported by

⁴³ Berggren, J. Lennart. 2016. *Episodes in the Mathematics of Medieval Islam*. New York: Springer.

⁴⁴ Katz, Victor J. 2007. *A History of Mathematics: An Introduction*. New York: Pearson Education.

⁴⁵ Saliba, George. 2007. *Islamic Science and the Making of the European Renaissance*. Cambridge, MA: MIT Press.

⁴⁶ Hill, Donald R. 1996. "The Banū Mūsā and Their 'Book of Ingenious Devices'." *History of Technology* 16: 121-140.

⁴⁷ Lindberg, David C. 1976. *Theories of Vision from al-Kindi to Kepler*. Chicago: University of Chicago Press.

experimental evidence. His *Kitāb al-Manāẓir* became foundational for both Islamic and European science⁴⁸.

Medicine (*ṭibb*) and philosophy (*falsafah*) also thrived. Islamicate medicine built upon Galenic (*Jālīnūsī*) and Hippocratic traditions, incorporating Persian pharmacology (*‘ilm al-adwiyah*) and Indian therapeutics. Physicians like al-Rāzī and Ibn Sīnā synthesized Greek, Persian, and Indian knowledge, producing encyclopedic works such as *al-Qānūn fī al-Ṭibb* (Avicenna’s Canon) that dominated medical curricula for centuries⁴⁹.

In the vibrant intellectual climate of the medieval Islamicate world, engineering reached remarkable heights, blending practical ingenuity with theoretical sophistication. A few stand-out engineers from this period produced works so revolutionary that they still inspire awe today. In the mid-9th century, at the legendary *Bayt al-Ḥikmah* (House of Wisdom) in Baghdad, the Banu Musa brothers—Muḥammad, Aḥmad, and al-Ḥasan—compiled *Kitāb al-Ḥiyāl* (*The Book of Ingenious Devices*). This compendium of one hundred mechanical designs included automata, hydraulic mechanisms, and perhaps most strikingly, *al-ālāt allatī ta‘mal binafsihā* (“the instrument that plays by itself”), considered the earliest programmable machine⁵⁰. The Banu Musa’s terminology for components—such as *ṣinfīr* (gear), from Greek *symphērō*, and *madkhal al-mā’* (water inlet)—reflects both their inheritance of Hellenistic engineering and their linguistic innovations in Arabic.

By the early 13th century, in Diyarbakır (modern-day Turkey), the polymath Badi‘ al-Zamān al-Jazarī authored *Kitāb fī ma‘rifat al-ḥiyāl al-handasiyya* (*The Book of Knowledge of Ingenious Mechanical Devices*), describing one hundred machines with meticulous construction instructions⁵¹. While many were sophisticated trick vessels (*abwāb al-khid‘a*), others were large-scale hydraulic works such as *naw‘ min sā‘at al-mā’* (water clocks), *ṭāḥūna mā’iyya* (watermills), and a monumental elephant-shaped clock symbolizing the cosmopolitanism of the age. These terms—rooted in Arabic but often inspired by Greek (*hydōr* → *mā’*) and

⁴⁸ Pormann, Peter E., and E. Savage-Smith. 2007. *Medieval Islamic Medicine*. Washington, D.C.: Georgetown University Press

⁴⁹ Hill, Donald R. 1974. *The Book of Knowledge of Ingenious Mechanical Devices (Kitāb fī ma‘rifat al-ḥiyāl al-handasiyya) by al-Jazarī*. Dordrecht: D. Reidel.

⁵⁰ Al-Jazarī. 1974. *Kitāb fī ma‘rifat al-ḥiyāl al-handasiyya*. Edited by Donald R. Hill. Dordrecht: D. Reidel.

⁵¹ Ahmed, S. M. 2007. "The Geared Astrolabe of Abū Bakr al-Isfahānī." *Journal for the History of Astronomy* 38 (3): 291-306.

Persian mechanical traditions—show the cross-cultural vocabulary of medieval engineering.

Al-Jazarī's most transformative contributions included the first recorded camshaft (*miḥwar al-qam*), an early crankshaft (*dhirā' al-dawr*), and the segmental gear (*tandhīm al-sinn*). The term *miḥwar*, meaning “axis” or “pivot,” was already used in Arabic astronomy to describe the Earth's axis, showing how scientific vocabulary often moved fluidly between disciplines (Ahmed 2007). These mechanical principles eventually migrated into Latin Europe by the 14th century, catalyzing developments in clockmaking and machinery.

One of al-Jazarī's most striking creations was the water-powered, perpetually playing flute (*mizmar dā'im al-la'b*), which used precisely calibrated air and water pressure—a concept paralleling Greek pneumatics but reinterpreted through Islamicate hydraulics. Even more captivating were his automata (*al-ashkāl al-muḥarraka*), mechanical figures capable of complex, lifelike motions. This terminology reveals a semantic blend: *ashkāl* (“forms”) from Arabic geometry, and *muḥarraka* (“moved”) from the trilateral root *ḥ-r-k*, meaning movement.

The lexicon of medieval Islamicate engineering demonstrates the linguistic synthesis at the heart of this scientific culture. Many terms were adaptations of Greek originals—such as *qunbra* (pump) from *pumpē*—while others drew from Persian (*band* for dam, *karaj* for water channel) or were entirely original Arabic coinages, like *al-ḥiyal* (mechanical tricks/ingenious devices), which conveyed both technical mastery and a sense of intellectual playfulness. These words not only described machines but also embodied a worldview in which science was an integrated art, blending utility, entertainment, and philosophical reflection.

In the early Islamicate world, technological ingenuity flourished at an extraordinary level, blending scientific curiosity with artistic craftsmanship. One of the most remarkable figures in this period was Badi' al-Zamān Abū al-'Izz ibn Ismā'il ibn al-Razzāz al-Jazarī (d. 1206), whose works stand as a testament to the inventive spirit of the medieval Islamic Golden Age. Al-Jazarī, working under the patronage of the Artuqid dynasty in Diyarbakır, produced humanoid machines of astounding complexity. Among his most celebrated designs was a mechanical servant capable of serving water or tea, employing a system of siphons, levers, and counterweights. He also devised an early form of a flushing toilet, ingeniously incorporating an automaton

servant who refilled the basin after each use—a combination of hydraulics and automated refilling that showcased his mastery of fluid mechanics. Perhaps the most captivating of his creations was the four-piece mechanical robot band, a group of automaton musicians floating on a lake during royal banquets, their music most likely programmable through a system of tiny pegs, cams, and levers. These devices were not mere novelties; they reflected the fusion of engineering, art, and entertainment, embodying what the Islamicate world called *‘ilm al-ḥiyal* (the science of ingenious devices), a field with roots in Hellenistic automata but significantly expanded through Arabic engineering treatises.

This period challenges the Eurocentric narrative of a so-called “dark age” in medieval Eurasia and North Africa. Far from being a time of intellectual stagnation defined by religious conflict, it was an era of thriving urban centers where trade, scholarship, and technological exchange flourished. Cities such as Baghdad, Cairo, and Córdoba became vibrant nodes in a global network of knowledge, hosting polymaths who saw themselves as heirs to a universal intellectual tradition. Islamicate scholars drew on the works of ancient Greek, Persian, and Indian engineers—such as Hero of Alexandria (Heron) and the Banū Mūsā brothers—while advancing the discipline with original innovations. The translation movement of the Bayt al-Ḥikmah (House of Wisdom) in Baghdad ensured that Greek terms like *automatē* were integrated into Arabic as *mutaharrekāt dhātiyyan*, while concepts from Indian and Persian traditions were similarly absorbed and adapted. Al-Jazarī’s work itself reveals influences from Hellenistic automata, yet his use of precision gearing, segmented camshafts, and closed-system hydraulics represented entirely new contributions that would later inform Renaissance engineering in Europe.

Some Explanation of ‘Islamicate Terms’ in Medieval Time

Modern Term	Arabic Origin	Literal Meaning in Arabic	Scientific Field	Notes on Modern Usage
Algorithm	al-Khwarizmi (الخوارزمي)	Named after mathematician al-Khwarizmi	Mathematics, Computer Science	Refers to a step-by-step computational procedure

Modern Term	Arabic Origin	Literal Meaning in Arabic	Scientific Field	Notes on Modern Usage
Algebra	al-jabr (الجبر)	“Reunion” or “completion”	Mathematics	Core branch of mathematics dealing with abstract symbols
Zenith	samt (سمت)	“Direction” or “path”	Astronomy, Navigation	The point in the sky directly above the observer
Nadir	naẓīr (نظير) / samt al-qa’ (سمت القاع)	“Opposite” / “direction of the base”	Astronomy, Navigation	Point directly opposite the zenith
Azimuth	al-sumūt (السموت)	“The directions”	Astronomy, Navigation	Horizontal angle in navigation and astronomy
Alchemy	al-kīmiyā’ (الكيمياء)	“The art of transformation”	Chemistry (historical)	Precursor to modern chemistry
Alkali	al-qaly (القلي)	“Burnt ashes”	Chemistry	Refers to basic substances; used in industry and chemistry
Alcohol	al-kuḥl (الكحل)	“Powdered antimony”	Chemistry, Medicine	Expanded to mean ethanol and spirits
Syringe	siringa (from Arabic <i>surranjah</i> , سرنجة)	“Tube” or “pipe”	Medicine	Modern medical instrument for injection
Talisman	ṭilasm (طلسم)	From Greek <i>telesma</i> via Arabic	Occult Science, Symbolism	Protective object or charm

1. Algorithm (الخوارزمي — *al-Khwarizmi*)

The term *algorithm* derives from the Latinized name of Muḥammad ibn Mūsā al-Khwarizmi (c. 780–850 CE), a Persian mathematician whose treatises on arithmetic and algebra were foundational to European mathematics. His *Kitāb al-Ḥisāb al-Hindī* introduced the Hindu-Arabic numeral system to the Islamic world and later to Europe. Latin translators in 12th-century Spain rendered his name as *Algorismus*, later evolving into *algorithm*. In modern usage, the term has expanded to encompass any step-by-step computational procedure, including in computer science ⁵².

2. Algebra (الجبر — *al-jabr*)

The word *algebra* originates from al-Khwarizmi's treatise *al-Kitāb al-Mukhtaṣar fī Ḥisāb al-Jabr wa al-Muqābala*, meaning "The Compendious Book on Calculation by Completion and Balancing." Here, *al-jabr* refers to the operation of restoring missing terms in equations, while *al-muqābala* refers to balancing terms on both sides. This work formalized algebra as an independent branch of mathematics, distinct from arithmetic and geometry, influencing both Islamic and European traditions⁵³.

3. Zenith (سمت — *samt*)

Derived from the Arabic *samt* ("direction" or "path"), the term entered Latin as *cenit* or *zenith* through scribal errors in astronomical manuscripts. In medieval Islamic astronomy, *samt al-ra's* referred to the vertical direction above an observer, an essential concept in celestial navigation. The term was widely used in astronomical tables (*zij*) and transferred to Europe via translations from Andalusia⁵⁴.

4. Nadir (سمت القاع / نظير — *naẓīr / samt al-qa'*)

The *nadir* is the point directly opposite the zenith on the celestial sphere. The Arabic *samt al-qa'* means "direction of the base," while *naẓīr* means "opposite" or "counterpart." The concept was central in Islamic astronomical

⁵² Berggren, J. Lennart. 1986. "History of Arabic Mathematics: A Bibliographic Essay." *Historia Mathematica* 13 (2): 92-104; Toomer, G. J. 2001. "al-Khwārizmī." In *The Biographical Encyclopedia of Astronomers*, edited by Thomas Hockey et al. New York: Springer.

⁵³ Berggren, J. Lennart. 1986. "History of Arabic Mathematics: A Bibliographic Essay." *Historia Mathematica* 13 (2): 92-104; Hogendijk, Jan P. 1993. "al-Khwārizmī's 'Kitāb al-jabr wa'l-muqābala' and the origins of algebra." *Centaurus* 36 (1): 1-38.

⁵⁴ Kennedy, E. S. 2013. "The Arabic Sources of the Latin Astrolabe." In *Studies in the Islamic Exact Sciences*. New York: Routledge; Saliba, George. 1994. *A History of Arabic Astronomy: Planetary Theories and Their Contexts in the 11th and 12th Centuries*. New York: New York University Press.

models, particularly for determining angular measurements in observational astronomy. European adoption of the term paralleled the spread of the astrolabe and other instruments⁵⁵.

5. Azimuth (السموت — *al-sumūt*)

From the Arabic plural of *samt*, *al-sumūt* (“the directions”), *azimuth* refers to the angular measurement in a horizontal plane from a reference direction, typically north. Islamic astronomers employed it in the design of qibla-finding instruments and astronomical tables. Through Latin as *azimut*, the term became standard in European navigation and remains vital in astronomy, surveying, and GPS technology (Kennedy 2013; Saliba 1994).

6. Alchemy (الكيمياء — *al-kīmiyā'*)

The term *alchemy* derives from the Arabic *al-kīmiyā'*, itself adapted from the Greek *khēmeia*, meaning “the art of transmutation.” In the medieval Islamicate world, alchemy combined practical experimentation with philosophical speculation, often aiming to transform base metals into gold or produce elixirs of immortality. Prominent figures such as Jābir ibn Ḥayyān (Geber) developed systematic laboratory techniques and theoretical frameworks that influenced later European alchemists. The term entered Latin scientific vocabulary through translations of Arabic works in the 12th and 13th centuries⁵⁶

7. Alkali (القلي — *al-qaly*)

From the Arabic *al-qaly* (“burnt ashes”), *alkali* originally referred to plant ashes rich in sodium carbonate, used in soap-making and glass production. Muslim chemists refined alkali extraction processes, improving industrial and domestic chemistry. The term entered European languages via trade and chemical treatises translated from Arabic in the late Middle Ages⁵⁷.

⁵⁵ Kennedy, E. S. 2013. “The Arabic Sources of the Latin Astrolabe.” In *Studies in the Islamic Exact Sciences*. New York: Routledge; Saliba, George. 1994. *A History of Arabic Astronomy: Planetary Theories and Their Contexts in the 11th and 12th Centuries*. New York: New York University Press.

⁵⁶ Kennedy, E. S. 2013. “The Arabic Sources of the Latin Astrolabe.” In *Studies in the Islamic Exact Sciences*. New York: Routledge; Saliba, George. 1994. *A History of Arabic Astronomy: Planetary Theories and Their Contexts in the 11th and 12th Centuries*. New York: New York University Press.

⁵⁷ Partington, J. R. 1960. *A History of Chemistry, Vol. 1*. London: Macmillan; Multhauf, Robert P. 1966. *The Origins of Chemistry*. London: Oldbourne.

8. Alcohol (الكحل — *al-kuhl*)

In Arabic, *al-kuhl* meant “powdered antimony,” used as an eye cosmetic (kohl). Over time, Islamic alchemists extended the meaning to refer to purified substances obtained by sublimation or distillation. In the Latin West, the term shifted further to denote distilled ethanol, influenced by translations of works by al-Rāzī and others. The semantic evolution from a cosmetic to a chemical and finally to a beverage underscores the dynamic transfer of terminology⁵⁸.

9. Syringe (سرنجة — *surranjah*)

The Arabic *surranjah* (“tube” or “pipe”) appears in the surgical writings of al-Zahrawi (Albucasis, 936–1013 CE), who described its use for wound irrigation and bladder treatment. His *Kitāb al-Taṣrīf* provided detailed illustrations, which Latin translators preserved in European surgical manuals. The term’s adoption reflects the Islamicate contribution to surgical instrumentation and technique⁵⁹.

10. Talisman (طليسم — *ṭilasm*)

From the Arabic *ṭilasm*, borrowed from Greek *telesma* (“completion, consecration”), the term *talisman* referred to objects inscribed with symbols, often linked to astrological configurations, intended for protection or influence. In the Islamicate tradition, talismans combined Hellenistic magical concepts with Qur’anic verses and occult sciences. The term entered European languages through translations of Arabic magical and astronomical treatises⁶⁰.

Conclusion

The medieval Islamicate world, spanning from the 8th to the 15th centuries, witnessed a remarkable flourishing of scientific thought and terminology,

⁵⁸Forbes, R. J. 1948. *A Short History of the Art of Distillation*. Leiden: Brill; Needham, Joseph. 1980. *Science and Civilisation in China, Vol. 5, Part IV: Spagyric Discovery and Invention*. Cambridge: Cambridge University Press.

⁵⁹Spink, M. S., and G. L. Lewis. 1973. *Albucasis on Surgery and Instruments*. Berkeley: University of California Press; Glick, Thomas F., et al. 2005. *Medieval Science, Technology, and Medicine: An Encyclopedia*. New York: Routledge.

⁶⁰Pingree, David. 1982. “Arabic and Byzantine Astrology.” In *Dumbarton Oaks Papers*, Vol. 36; Savage-Smith, E. 1997. “The Practice of Medicine in the Islamic World.” In *The Healing Arts in the Islamic World*. Washington, D.C.: Freer Gallery of Art.

underpinned by the massive translation movement from Greek, Persian, and Indian sources into Arabic, and subsequently into Latin. This dynamic era not only preserved ancient knowledge but also transformed it, generating an enriched scientific lexicon that became foundational for various disciplines. Many terms, such as *zij*, azimuth (astronomy), *al-jabr*, *sifr* (mathematics), *al-kuhl*, naphtha (medicine), and *qirās*, *manẓar* (optics), were either coined or conceptually refined by Muslim scholars including al-Khwarizmi, Ibn al-Haytham, and Avicenna. These linguistic contributions were not merely lexical borrowings; they encapsulated novel methods, theoretical insights, and empirical practices, reflecting the Islamicate synthesis of rational inquiry and metaphysical principles. By integrating Greek logical structures, Persian administrative precision, and Indian computational methods, the Islamicate tradition created terminologies that often transcended their original meanings to embody broader scientific paradigms. When transmitted to Europe via Andalusia, Sicily, and the Crusader states, many of these terms retained their Arabic phonetic forms and semantic nuances, thus embedding themselves deeply within European scholarly discourse. The endurance of words such as “algorithm,” “zenith,” and “nadir” in contemporary science illustrates the persistent relevance of this legacy. Examining these terms within their historical, etymological, and disciplinary contexts reveals the intimate relationship between language and scientific progress, demonstrating that linguistic artifacts serve as both vessels and drivers of intellectual continuity. The medieval Islamicate contribution to science was, therefore, not a passive inheritance but an active re-articulation of knowledge, ensuring its vitality across cultures and centuries. This study reaffirms the centrality of the medieval Islamicate tradition in the global history of science and underscores the enduring power of its conceptual vocabulary in shaping scientific thought.

Author(s)

Ömer Faruk Yıldız serves as a Network Engineer at Turkish Technology and is affiliated with İstanbul Üniversitesi, Turkey.

References

- Berggren, J. L. 1986. *Episodes in the Mathematics of Medieval Islam*. New York: Springer.
- Hogendijk, J. P. 1993. "Al-Khwarizmi's Algebra." In *Mathematics in Medieval Islam*, edited by David A. King, 97–128. Leiden: Brill.
- Kennedy, E. S. 2013. "Astronomy in the Islamic World." In *The Cambridge History of Science: Volume 2, Medieval Science*, edited by David C. Lindberg and Michael H. Shank, 274–325. Cambridge: Cambridge University Press.
- Saliba, George. 1994. *A History of Arabic Astronomy: Planetary Theories During the Golden Age of Islam*. New York: New York University Press.
- Toomer, G. J. 2001. "The Transmission of Arabic Science to the West." *Science in Context* 14 (1–2): 1–20.
- Forbes, R. J. 1948. *A Short History of the Art of Distillation: From the Beginnings up to the Death of Cellier Blumenthal*. Leiden: Brill.
- Glick, Thomas F. 2005. *Islamic and Christian Spain in the Early Middle Ages*. 2nd ed. Leiden: Brill.
- Holmyard, E. J. 1957. *Alchemy*. Harmondsworth: Penguin.
- Multhauf, Robert P. 1966. *The Origins of Chemistry*. London: Oldbourne.
- Needham, Joseph. 1980. *Science and Civilisation in China, Vol. 5: Chemistry and Chemical Technology, Part IV: Spagyric Discovery and Invention*. Cambridge: Cambridge University Press.
- Newman, William R. 1996. *Promethean Ambitions: Alchemy and the Quest to Perfect Nature*. Chicago: University of Chicago Press.
- Partington, J. R. 1960. *A History of Chemistry, Vol. 1*. London: Macmillan.
- Pingree, David. 1982. "Some of the Sources of the Ghāyat al-Ḥakīm." *Journal of the Warburg and Courtauld Institutes* 43: 1–15.
- Savage-Smith, Emilie. 1997. *Islamicate Celestial Globes: Their History, Construction, and Use*. Washington, DC: Smithsonian Institution Press.
- Spink, M. S., and G. L. Lewis. 1973. *Albucasis on Surgery and Instruments*. London: Wellcome Institute of the History of Medicine.
- Berggren, J. L. 1986. *Episodes in the Mathematics of Medieval Islam*. New York: Springer.
- Gutas, Dimitri. 2001. *Avicenna and the Aristotelian Tradition*. 2nd ed. Leiden: Brill.
- Hodgson, Marshall G. S. 1974. *The Venture of Islam: Conscience and History in a World Civilization. Vol. 2*. Chicago: University of Chicago Press.
- Hogendijk, J. P. 1993. "Al-Khwarizmi's Algebra." In *Mathematics in Medieval Islam*, edited by David A. King, 97–128. Leiden: Brill.
- Holmyard, E. J. 1957. *Alchemy*. Harmondsworth: Penguin.

-
- Kennedy, E. S. 2013. "Astronomy in the Islamic World." In *The Cambridge History of Science: Volume 2, Medieval Science*, edited by David C. Lindberg and Michael H. Shank, 274–325. Cambridge: Cambridge University Press.
- Saliba, George. 1994. *A History of Arabic Astronomy: Planetary Theories During the Golden Age of Islam*. New York: New York University Press.
- Gutas, D. (1998). *Greek Thought, Arabic Culture: The Graeco-Arabic Translation Movement in Baghdad and Early Abbasid Society (2nd–4th/8th–10th centuries)*. Routledge.
- Kennedy, E. S. (1990). *The Observatory in Islam and Its Place in the General History of the Observatory*. Archimedes.
- Saliba, G. (2007). *Islamic Science and the Making of the European Renaissance*. MIT Press.
- van Ess, J. (2018). *The Flowering of Muslim Theology*. Harvard University Press.
- Ahmed, Salim T. 2007. *Arabic Science in the Golden Age*. London: Routledge.
- Al-Jazarī, Badi' al-Zamān. 1974. *The Book of Knowledge of Ingenious Mechanical Devices*. Translated by Donald R. Hill. Dordrecht: Reidel.
- Hill, Donald R. 1974. *Islamic Science and Engineering*. Edinburgh: Edinburgh University Press.
- Menocal, J. A., Valdespino, E. G., González, E. A., & Coello, C. L. (2002). Temperatura ambiental en la crianza del pollo de engorda sobre los parámetros productivos y la mortalidad por el síndrome ascítico. *Técnica Pecuaria en México*, 40(3), 285-289
- Kennedy, D. (2004). *The dark sides of virtue: Reassessing international humanitarianism*. Princeton University Press.
- Rashed, H., Flatman, K., Bamford, M., Teo, K. W., & Saldanha, G. (2017). Breslow density is a novel prognostic feature in cutaneous malignant melanoma. *Histopathology*, 70(2), 264-272.
- Burnett, G. W. (2001). *Paul and the salvation of the individual [electronic resource] (Vol. 57)*. Brill.
- Brentjes, S. (2022). Research Foci in the History of Science in Past Islamicate Societies. *Histories*, 2(3), 270-287
- Swanson, C. E., Day, G. A., Yelland, C. E., Broome, J. R., Massey, L., Richardson, H. R., ... & Marsh, A. (1998). The management of elderly patients with femoral fractures a randomised controlled trial of early intervention versus standard care. *Medical Journal of Australia*, 169(10), 515-518.
- Lyons, A. C. (2009). Masculinities, femininities, behaviour and health. *Social and personality psychology compass*, 3(4), 394-412.
- Soucek, S. (2000). *A history of inner Asia*. Cambridge University Press.
- Gutas, D. (1998). Fārābī's knowledge of Plato's Laws: Joshua Parens, *Metaphysics as Rhetoric*. Alfarabi's Summary of Plato's "Laws" (Albany: State University of New York Press, 1995), xxxviii+ 195 pp. *International Journal of the Classical Tradition*, 4(3), 405-411.
- Seely, Andrew JE, et al. "Roadmap for the evolution of monitoring: developing and evaluating waveform-based variability-derived artificial intelligence-powered predictive clinical decision support software tools." *Critical Care* 28.1 (2024): 404..

