

THE DEVELOPMENT OF SCIENCE IN PERSIA (IRAN AND CENTRAL ASIA) DURING THE ABBASID CALIPHATE (750–1258 CE)**Dr. Mehdi Soltanzadeh**

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ABSTRACT

The development of Science during the Islamic golden age was a period of scientific, economic, and cultural flourishing era in the history of Islam, traditionally dated from the 8th century to the 13th century mainly during the Abbasid Caliphate. This period is traditionally understood to have begun during the reign of the Abbasid caliph Harun al-Rashid (786 to 809) with the inauguration of the House of Wisdom (بيت الحكمة) which saw scholars from all over the Muslim world mainly the Persians and other surrounding cultures flock to Baghdad the first capital city of Abbasid Caliphate, the world's largest city at the time, to translate the well-known world's classical knowledge into Arabic and Persian language. The period is traditionally said to have ended with the collapse of the Abbasid caliphate due to Mongol invasions and the Siege of Baghdad five centuries later in 1258.

INTRODUCTION

The Abbasid Caliphate (132–656 AH / 750–1258 CE) marked a transformative era in Islamic history, characterized by political consolidation, cultural synthesis, and unprecedented scientific advancement. Following the overthrow of the Umayyads in 750 CE, the Abbasids shifted the caliphate center eastward from Damascus to Baghdad (founded 762 CE), strategically positioning to Baghdad it near the ancient Sassanid heartland in Persian historical territory. This move facilitated the integration of Persian administrative expertise, Zoroastrian scholarly traditions, and Hellenistic knowledge preserved in Syriac and Pahlavi texts before Islam. In Iranian plateau — encompassing modern Iran, parts of Afghanistan, Turkmenistan, Uzbekistan, and Tajikistan—emerged as a scientific powerhouse, contributing disproportionately to the "Golden Age" of Islamic science.

Persian scholars, often bilingual in Arabic and Persian, dominated fields like astronomy, mathematics, medicine, optics, and philosophy. Institutions such as the House of Wisdom (Bayt al-Hikmah) (البحر الحكمة) in Baghdad drew talent from Nishapur, Merv, Ray, Isfahan, Khujand, Samarkand and Bukhara. Patronage by caliphs like al-Ma'mūn (813–833 CE) and viziers of Persian descent, such as the Barmakids, fueled translation movements and original research of any scientific endeavours. This article explores this development chronologically and thematically, drawing on primary sources like al-Biruni's works, Ibn Sina's canon, and archaeological evidence from observatories. It highlights how Persian scientists from Iran and Central Asia bridged pre-Islamic legacies such as

sassanid zijes and astrolabe (which is an ancient astronomical instrument used for timekeeping, astronomy, and navigation by calculating the position of stars in the sky) with Islamic innovation, influencing global science until the Mongol invasions of 1258 CE.

The Abbasid government began with the caliphate of Abū al-‘Abbās al-Saffāḥ and ended with the death of al-Musta‘ṣim at the hands of the Mongols. They ruled over the Islamic lands as caliphs of the Muslims for nearly 524 years. Historians have divided Abbasid rule— based on the forces of the caliphate, transformations in political conditions, and the flourishing of cultural and intellectual life—into four periods:

First Period: The era of strength, expansion, and prosperity. From the caliphate of Abū al- ‘Abbās al-Saffāḥ until the end of the caliphate of al-Wathīq (132–232 AH / 750–847 CE).

Second Period: The era of the caliphate of al-Mutawakkil until the middle of the caliphate of al-Mustakfī (232–334 AH / 847–946 CE).

Third Period: The era of Iranian Būyid (Buyid) influence. It began in the middle of the caliphate of al-Mustakfī and ended in the middle of the caliphate of al-Qā’im (334–447 AH / 946–1055 CE).

Fourth Period: The era of Turkish Seljuk influence. From the caliphate of al-Qa’im until the death of the Abbasid al-Musta‘ṣim (447–656 AH / 1055–1258 CE).

The Abbasid Shift to Persian Influence compare to Umayyad Arab Supremacy Ibne Ibn Khaldun (1332 -1406 CE) explicitly stated that most scholars in the Muslim world, including scientists and those in religious sciences, were non- Arabs, primarily Persians. He detailed this view in his seminal work, the Muqaddimah. He attributed this to several factors. Science and crafts, he argued, were products of sedentary, urban culture, which had been firmly established among the Persians long before the rise of Islam.

Feature	UmayyadDynasty (661–750 CE)	Abbasid Dynasty (750–1258 CE)
Capital	Damascus (Syria)	Baghdad (Persia)
Geographic Focus	Mediterranean, Arab	Persian, Middle East
Government	Arab-dominated Monarchy	Monarchy with Persian bureaucracy
Social Policy	Discrimination against <i>mawali</i> (non-Arabs)	Inclusive, equal treatment of Arabs & non-Arabs
Main Focus	Political & military expansion	Science, culture, arts, and intellectualism

The Abbasid Revolution (747–750 CE) was spearheaded by Persian mawali (non-Arab converts) and Khorasani armies, leading to a "Persianization" of the caliphate. Abu Muslim al-Khorasani's role underscored Central Asia's military and intellectual contributions. Baghdad's location on the Tigris enabled trade routes linking China, India, and Rome, while Persian bureaucrats like the Barmakids (Yahya b. Khalid, d. 805 CE) managed finances and patronage.

Early Abbasid tolerance attracted Nestorian Christians from Jundishapur, who translated Greek texts into Arabic. By al-Mansur's reign (754–775 CE), the court employed Persian astronomers like Nawbakht. Al-Ma'mun's also established the Bayt al-Hikmah (بيت الحكمة), a library-translation academy housing 400,000 volumes by the 9th century. In Central Asia, the Samanids (819–999 CE) in Bukhara fostered a Persian renaissance, supporting scholars like al-Razi, ibne Sina, Omar Khayyam and al-Farabi. The Buyids (945–1055 CE), another group of Persians, ruled Baghdad de facto, patronizing observatories. This decentralized yet interconnected network—stretching from Merv in central asia to Shiraz in south of persia—propelled scientific output.

How does history works:

old Keyboard for typing machine



Modern Keyboard (same alphabetic position)



Abbasid was following Sassanid?



The Abbasid Caliphate (750–1258 CE)



Sassanid dynasty was the last pre-Islamic Iranian empire, ruling from 224 to 651 CE

The roots of the Golden Age

The scientific florescence witnessed in Persia and Central Asia between the 8th and 11th centuries CE, often termed the Islamic Golden Age, was one of history's most concentrated periods of intellectual advancement. This surge was not a coincidence but the result of a multi-causal historical narrative, where a unique convergence of social, political, and cultural forces provided the necessary and sufficient conditions for science to thrive.

The Abbasid Caliphate, established in 750 CE, fundamentally restructured the Islamic world. The relocation of the capital to Baghdad and the subsequent empowerment of the Persian administrative class integrated the sophisticated, centralized traditions of the Sasanian Empire with the expansive resources and universalist outlook of the new Islamic state. The resultant scientific boom in Persianate lands was driven by five interconnected reasons and mechanisms:

1. Socio-Structural Release: The egalitarian ethical framework of early Islam deconstructed the rigid, hereditary class barriers of the pre-Islamic Sasanian social order. This liberation of human capital

unlocked the intellectual potential previously confined to the noble and priestly classes, suddenly allowing *mawali* (non-Arab clients) and people of diverse backgrounds to access and contribute to higher learning.

2. Cultural and Institutional Transfer: The entrance of influential Iranian aristocratic families, such as the Barmakids, into the Caliphate's highest administrative offices facilitated the transfer of the Sasanian patronage model. This included the long-standing tradition of translating and supporting science, exemplified by the famous Sasanian medical and philosophical centre, Gondishapur, whose scholars and methodologies were directly transplanted to the new Abbasid capital.
3. Economic and Political Stability: The vast size and highly efficient taxation system of the early Abbasid Caliphate ensured an unprecedented level of financial wealth and political stability, necessary for funding massive, long-term institutional projects like the Translation Movement and the construction of state-of-the-art observatories.
4. Trade of Paper and Ink (qalam va dakwat) among the traders in central asia particularly in silk road from china to Europe. The growing love and passion of writing among the scholars in khurasan and central asia. (قلم و بی‌دوات – Bau dakwat dan qalam)
5. The heart of the early Abbasid intellectual effort was the systematization of knowledge through the Translation Movement (*harakat al-tarjama*), which marked the transition from passive inheritance to active assimilation and criticism

Under Caliph AlMa'mun (r. 813–833 CE), the Bayt al-Hikmah in Baghdad became the central institutional clearinghouse for this effort. It functioned as more than just a library; it was an academy, a translation bureau, and a research institute. Scholars were salaried and organized into specialized teams to translate, comment upon, and often correct classical texts.

Sources and Mediation: Translations drew heavily on Greek philosophy, mathematics, and medicine (e.g., Ptolemy's *Almagest*, Euclid's *Elements*, and Galen's medical works). Crucially, much of this knowledge was mediated through Syriac Christian scholars (Nestorians and Jacobites), who possessed a sophisticated knowledge of Greek and often served as the primary conduits between the ancient texts and the Arabic language. Persian sources, including Pahlavi texts like the *Khuadāy-Nāmag* (Book of Kings) and Sasanian astronomical tables (*Zij*), were also vital.

The Rationalist Climate: Al-Ma'mun's support for the rationalist Mu'tazilah school, which engaged in systematic reasoning (*'aql*) – ل - to interpret religious dogma, provided a broad, protective umbrella for philosophers and natural scientists. This environment encouraged critical thought and open debate, essential for the progression from mere translation to original research.

Astronomy and Geodesy

The Caliphate's administrative needs drove major advancements in astronomy and applied mathematics. Determining accurate prayer times (*salat*) and the direction of Mecca (*qibla*) required precise knowledge of geography and spherical trigonometry.

Observatories: The establishment of the Baghdad Observatory (c. 828 CE) and later ones, such as those in Damascus, marked the shift from theoretical modeling to empirical data collection. These institutions employed teams to make systematic, continuous observations, leading to the necessary corrections of Ptolemy's astronomical data.

Geodetic Measurement: Al-Ma'mun funded a large-scale project to calculate the circumference of the Earth—a stunning undertaking—by sending two teams to measure the length of a single degree of latitude in the Sinjar desert. The results were remarkably accurate for the time.

The Persianate Scientific Heartlands

As Abbasid centralized power waned, semi-independent Persian dynasties rose to power, ensuring the geographic distribution and continued intensification of scientific activity in the eastern Caliphate. Scientific learning during the Abbasid period was not confined to Baghdad. Across the Persian world, a network of madrasahs, observatories, libraries, and hospitals emerged as hubs of research and teaching. The Academy of Jundishapur continued to flourish into the early Abbasid period, influencing the formation of later Islamic medical schools. The Maragha Observatory (though slightly post-Abbasid, 13th century) represented the culmination of Persian astronomical traditions initiated during the Abbasid golden age. Cities like Nishapur and Bukhara were centers of rational sciences (*‘ulum al-‘aqliyyah*) alongside religious studies (*‘ulum al-naqliyyah*).

The Samanids (Khurasan and Transoxiana - 999–819 CE) ناهلرومرا -

Ruling from Bukhara and Samarkand, the Samanids deliberately fostered a cultural renaissance by championing the New Persian language and patronizing Persianate literature and science. Their courts became magnets for intellectual talent. The Persian scientific achievement was defined by its original contributions, driven by an empirical and methodological rigor that advanced beyond the classical models.

Ibn Sina (Avicenna): Abū 'Alī ibn Sīnā (d. 1037), arguably the most influential physician and philosopher of the Islamic world, received early patronage under the Samanids in Bukhara. His works, including *Al-Qanun fi'l-Tibb* (The Canon of Medicine) and *Kitab al-Shifa'* (The Book of Healing), synthesized Greek, Indian, and Islamic medical and philosophical knowledge, remaining standard texts globally for over six centuries.

Al-Biruni: Abū Rayhān al-Bīrūnī (d. 1048), a polymath of staggering breadth, began his career under local rulers in Central Asia (Khwarazm).

His work, *The Determination of the Coordinates of Positions for the Correction of Distances between Cities*, demonstrated mastery of geodesy and geography. He also proposed a heliocentric model of the solar system as a mathematical possibility, anticipating Copernicus by centuries.

Al-Khwarizmi: Authored *Kitab al-Jabr wal Muqabala* (The Compendious Book on Calculation by Completion and Balancing), which provided the first systematic solution for linear and quadratic equations, thus establishing Algebra as an independent mathematical discipline. He also formalized the use of Indian numerals (which became known as "Arabic numerals" in the West) and the zero placeholder.

Al-Razi: Applied a highly empirical approach to medicine. In his *Kitab al-Hawi* (The Comprehensive Book), he recorded clinical cases and detailed his own observations. He was the first to differentiate smallpox from measles based on clinical symptoms. In chemistry, he pioneered practical laboratory techniques and opposed the theoretical alchemical doctrines of Jabir ibn Hayyan.

Al-Biruni: Developed a highly accurate method for calculating the Earth's radius and circumference using trigonometry and the measurement of mountain heights—an innovation in applied physics. He also invented a hydrostatic balance to accurately determine the specific gravity of various substances.

Omar Khayyam (1048–1131), though living slightly after the Abbasid zenith, continued the Khurasani mathematical legacy. His *Treatise on Algebra* extended geometric solutions to cubic equations, anticipating later European developments.

Jabir ibn Hayyan (Geber), though of disputed ethnicity, is often associated with Persian scholarly circles in Kufa and Tus. He is considered the father of early chemistry (*al-kimiya*). His systematic study of substances, distillation, and crystallization laid the foundations for modern chemistry.

Al-Farghani (Alfraganus), from Ferghana in Central Asia, wrote *Elements of Astronomy on the Celestial Motions*, a text that influenced both Islamic and European astronomy. His works were later translated into Latin and studied by scholars like Copernicus.

The Barmakid family, originally Buddhist administrators from Balkh who later converted to Islam, were among the most significant patrons of this movement. Under their patronage, numerous works on philosophy, medicine, astronomy, and mathematics were translated into Arabic.

Conclusion: The Legacy

The development of science in Persia plateau under the Abbasids was a powerful demonstration of how political stability, economic resources, and socio-cultural liberation can fuel intellectual progress. By the time of the Seljuq conquests in the mid-11th century, which saw a gradual shift in state patronage towards orthodox religious schooling (e.g., the Nizamiyya schools), the foundation of modern science had already been laid. The rigorous methodology, empirical observation, and critical

synthesis achieved by Persian and Central Asian scholars during this period were transferred to Europe, primarily through Spain (Al-Andalus) and Sicily, where Arabic and Persian texts were translated into Latin. This legacy formed the intellectual capital that would later power the European Renaissance and Scientific Revolution, confirming the Abbasid era in Persia as a vital hinge point in global intellectual history.

The development of science in Persia and Central Asia during the Abbasid Caliphate was not merely a phase of translation or preservation; it was an age of synthesis, innovation, and institutional creativity. Persian scholars transformed Greek, Indian, and indigenous scientific traditions into a coherent and dynamic body of knowledge that defined the Islamic Golden Age. Their contributions in mathematics, astronomy, medicine, chemistry, and philosophy were the product of a deeply interconnected intellectual environment supported by patronage, translation, and cross-cultural dialogue. In many ways, the Abbasid Persian scientific tradition represents one of humanity's greatest collective achievements in rational inquiry and intellectual exchange.

The Mongol invasion of the 13th century and the fall of Baghdad in 1258 marked the end of the Abbasid Caliphate, but not of Persian scientific tradition. Many Abbasid-era institutions and manuscripts were revived or continued under later dynasties, such as the Ilkhanids in Tabriz, the Timurids in Herat and Samarkand, and later during the Safavids in Isfahan.

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