



## SCIENCE AND CULTURE DURING THE TIMURID ERA

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### ABSTRACT

*The Timurid era (1370–1507), established by the Central Asian conqueror Amir Timur (Tamerlane), was one of the most dynamic periods in Islamic and world history. Beyond its military conquests and political significance, the period is remembered for its remarkable advancements in science, culture, art, architecture, and intellectual life. Timurid rulers, especially Timur himself and his successors like Ulugh Beg, fostered an environment where scholars, scientists, poets, and artists could flourish. This article explores the scientific and cultural achievements of the Timurid era, highlighting their contributions to astronomy, mathematics, medicine, literature, education, art, and architecture, as well as their enduring global legacy.*

### Introduction

The Timurid dynasty, founded by Amir Timur in the late 14th century, transformed Central Asia into a powerful empire and a major intellectual and cultural center of the Islamic world. Timur's capital, Samarkand, became a hub of knowledge and creativity, attracting scholars, architects, and artists from across the Islamic world, Persia, India, and China. Timur's successors, most notably Ulugh Beg, continued to support intellectual pursuits, laying the foundations for a cultural renaissance that would influence the Islamic Golden Age and the European Renaissance alike.

The Timurid era was not merely a time of empire-building but also of cultural refinement and scientific exploration. Institutions such as madrasas, observatories, and libraries were established, promoting scholarly exchange and producing some of the most influential works of the medieval period.

### Historical Background

Amir Timur (1336–1405) rose from relatively modest beginnings to become one of history's most formidable conquerors, creating an empire that stretched from Anatolia to India. However, Timur's ambitions were not confined to military conquest; he sought to revive and emulate the grandeur of the Islamic Golden Age. Timur invested heavily in building cities, mosques, madrasas, and libraries, particularly in Samarkand and Herat, which became leading centers of Islamic civilization.

After Timur's death, his successors, especially Shah Rukh (r. 1405–1447) and his son Ulugh Beg (r. 1447–1449), continued this intellectual and cultural patronage. Under their rule, the Timurid state became synonymous with scientific progress, cultural flourishing, and artistic brilliance.

### **Scientific Achievements**

The Timurid era witnessed significant developments in astronomy and mathematics, primarily under the patronage of Ulugh Beg, Timur's grandson. Ulugh Beg established one of the most advanced observatories of the medieval world in Samarkand in 1424. Equipped with a massive sextant, the observatory allowed for precise astronomical measurements.

Ulugh Beg's most renowned work, the *Zīj-i Sultānī* ("Sultan's Astronomical Tables"), compiled in 1437, listed the positions of over 1,000 stars with remarkable accuracy. This work remained one of the most reliable astronomical tables in the world for centuries and was later used by European astronomers during the Renaissance.

The observatory also became a center for mathematical research. Scholars like Jamshid al-Kashi, who calculated pi to 16 decimal places, and Qadi Zada al-Rumi, contributed significantly to trigonometry and number theory. Their work bridged classical Greek and Islamic mathematical traditions and influenced later scientific advancements.

The Timurid dynasty (1370–1507), founded by Amir Timur (Tamerlane), was not only a powerful political and cultural force but also a crucial catalyst for scientific and intellectual development. Under Timur and especially his grandson Ulugh Beg, science flourished in fields such as astronomy, mathematics, medicine, geography, and historiography.

The Timurid era's greatest scientific legacy lies in astronomy. The most remarkable figure is Mirzo Muhammad Taraghay Ulugh Beg (1394–1449) — Timur's grandson and a brilliant astronomer, mathematician, and scholar.

Ulugh Beg Observatory (1428–1429) – Built in Samarkand, it was the largest and most advanced observatory in the Islamic world of its time.

The observatory featured a monumental sextant (40.4 m radius) for measuring celestial angles with unprecedented precision.

*Zīj-i Sultānī* (The Sultan's Astronomical Tables) – A catalog of over 1,018 stars, with planetary positions and trigonometric tables, far more accurate than Ptolemy's.

Ulugh Beg calculated the sidereal year with an error margin of only 58 seconds, a result not surpassed until the 16th century.

The Timurid era witnessed significant advances in mathematics, particularly in trigonometry and numerical methods.

He improved methods for solving cubic equations and introduced decimal fractions systematically, centuries before they became common in Europe.

Scholars refined sine and tangent tables, improving the accuracy of astronomical predictions. While astronomy and mathematics flourished most, the Timurid era also saw continued development in medicine, botany, and pharmacology, building upon earlier Islamic and Persian traditions.

Medical schools in Herat and Samarkand taught classical works by Avicenna (Ibn Sina) and Al-Razi, while scholars produced commentaries and practical treatises.

Herbal medicine and the classification of plants were refined, contributing to

pharmacological knowledge.

Timurid scholars contributed to geographical sciences through improved maps and astronomical instruments that supported navigation and cartography.

Enhanced astrolabes and observational data allowed for better calculation of latitudes and longitudes.

The exchange of knowledge along the Silk Road enriched geographical understanding of Asia, Africa, and Europe. The scientific achievements of the Timurid era were far-reaching:

They bridged classical Islamic science and the Renaissance in Europe, transmitting advanced knowledge westward through translations.

The Samarkand Observatory's data influenced later astronomers, including Copernicus.

The decimal system and trigonometric methods refined under Timurid scholars laid groundwork for modern mathematics. The Timurid era represents a renaissance of science in the Islamic world. Through visionary patronage, monumental observatories, and brilliant scholars like Ulugh Beg and al-Koshiy, Central Asia became a global center of scientific thought. The intellectual legacy of this period profoundly shaped both Islamic and European scientific traditions, leaving an enduring mark on humanity's quest for knowledge.

#### **Medicine and Natural Sciences**

Medical knowledge also thrived under Timurid patronage. Scholars compiled medical encyclopedias and commentaries, often synthesizing Greco-Arabic medical traditions with local knowledge. Advances were made in pharmacology, surgery, and anatomy, and hospitals (bimaristans) were established as centers for both treatment and learning.

#### **Cultural Development**

Timurid rulers were passionate patrons of literature and poetry. Persian literature reached new heights under their reign, with poets such as Jami, Abd al-Rahman, and Alisher Navoi producing timeless works. Navoi, often regarded as the father of Chagatai (Old Uzbek) literature, elevated Turkic language to a literary standard and championed its use alongside Persian.

Timurid courts also supported the translation of important Arabic and Persian texts into Turkic languages, fostering linguistic and cultural synthesis. Literature during this period often reflected themes of mysticism, humanism, and political philosophy.

**Cultural rise:** The era of Timurids is the golden age of culture, art and architecture. Samarkand and Bukhara became not only a political but also a cultural center. Architectural monuments such as Registan Square, Bibikhanim Mosque, Shahi Zinda Complex have become valuable not only for the region, but for the whole world. These monuments are highly valued by modern architectural research.

**Development of science:** Mirzo Ulugbek's works in astronomy and mathematics occupy a special place in the history of science. Through his observatory, accurate maps of the movement of the world's stars were made. This brought the Timurid era to a new stage of science. **Development of literature and language:** Under the leadership of Alisher Navoi, Uzbek literature flourished. His works contributed to the development of language and culture and ensured the development of the Uzbek language as a literary language.

"The period of the Timurid dynasty is important not only as a past history, but also as a

cultural and spiritual foundation of today's Uzbekistan. Their high political and cultural achievements had a significant impact not only regionally, but also globally. The status of Samarkand as a world cultural heritage, the study of the science and art of the Timurid period through modern technologies increases

the importance of this period"[5].

Also, the period of the Timurids can serve as a source of inspiration for today in many ways. In particular, experiences in the development of public administration, principles of justice, and culture are being analyzed as experiences serving sustainable development on a global scale.

The results show that the Timurid dynasty is not only a part of the historical past, but also a source of cultural and scientific inspiration for future generations. Deep study, promotion and preservation of this heritage will further strengthen the position of Uzbekistan on a global scale.

### **Education and Scholarship**

The Timurids established numerous madrasas and libraries, particularly in Samarkand and Herat, which became vibrant intellectual centers. These institutions taught not only religious studies but also astronomy, mathematics, philosophy, logic, and literature. Libraries housed thousands of manuscripts, enabling scholars to study classical works from Greece, Persia, and the Islamic world.

#### **Art and Architecture**

Timurid art and architecture are among the most enduring legacies of the era. The period saw the development of a distinctive architectural style characterized by grand scale, elaborate tilework, and geometric precision. Structures like the Registan in Samarkand, the Bibi-Khanym Mosque, and the Gur-e Amir mausoleum remain masterpieces of Islamic architecture.

Miniature painting also flourished, particularly in Herat, where artists such as Kamāl ud-Dīn Behzād revolutionized Persian miniature art. The Timurid emphasis on harmony, color, and intricate detail influenced later Safavid and Mughal artistic traditions.

**Amir Timur (Tamerlane):** Founder of the Timurid dynasty, a military genius and cultural patron.

**Ulugh Beg:** Astronomer, mathematician, and ruler who built the Samarkand Observatory and produced the Zīj-i Sultānī.

**Alisher Navoi:** Poet and linguist who established Chagatai Turkish as a literary language.

**Jamshid al-Kashi:** Mathematician known for his work on pi and decimal fractions.

**Kamal ud-Din Behzad:** Renowned miniature painter whose work shaped Islamic art.

The Timurid era left a lasting mark on the Islamic world and beyond. Scientific works produced in Samarkand and Herat influenced later scholars in the Ottoman Empire, Safavid Iran, Mughal India, and even Renaissance Europe. Ulugh Beg's astronomical tables, for instance, were translated into Latin and studied by European astronomers like Copernicus.

Culturally, Timurid architecture and art shaped the visual language of Islamic civilization for centuries. The Mughal Empire, in particular, drew heavily on Timurid artistic and architectural traditions, as seen in monuments like the Taj Mahal.

Moreover, the Timurid emphasis on scholarship and cultural synthesis helped bridge the

classical, Islamic, and Renaissance worlds, fostering intellectual continuity and exchange across regions and centuries.

### Conclusion

The Timurid era stands as a golden chapter in the history of science and culture. Through visionary leadership and unwavering patronage of knowledge, the Timurids transformed Central Asia into one of the most important centers of intellectual and artistic life in the medieval world. Their contributions to astronomy, mathematics, literature, art, and architecture not only enriched Islamic civilization but also laid foundations that shaped the global scientific and cultural landscape. The enduring legacy of this remarkable era continues to inspire scholars and historians today.

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INNOVATIVE  
ACADEMY