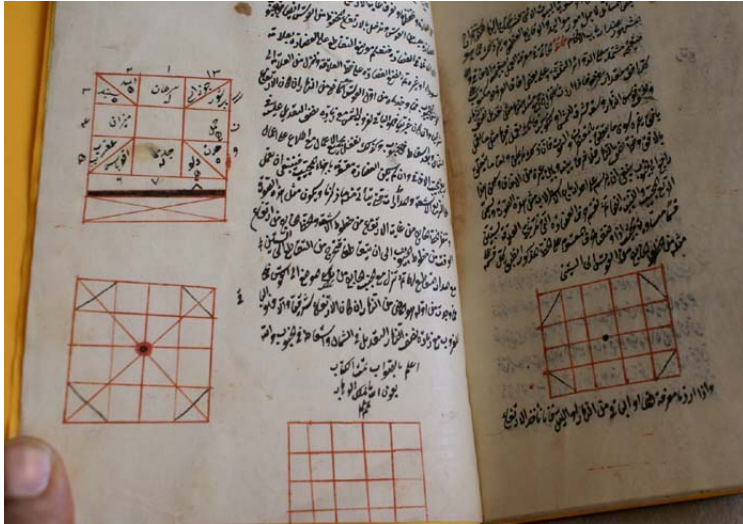


# Science in the Arab World



**Photo: A treatise on the astrolabe by 13<sup>th</sup> century Persian astronomer Nasir al-Din al-Tusi.**

The Arabic contribution to science is monumentally significant. The rise of Islamic science had its acme between the 8<sup>th</sup> to 16<sup>th</sup> centuries, in a period nominally known as the Islamic Golden Age. Arab scientists, writing in Arabic, made staggering breakthroughs which broadened mankind's comprehension of the natural world. Arabic scientific inquiry flourished into major discoveries in the fields of mathematics, physics, astronomy, chemistry, medicine and optics.

Arab scientists of the 12<sup>th</sup> century conducted experiments in their pursuit of scientific inquiry. Using intuition, they made and tested hypotheses, and sought proof to verify their theories. Such experiments were systematic, repeatable, and yielded quantitative measurements. These processes would eventually become known



**Photo: 9<sup>th</sup> century Arab scientists in Baghdad, Iraq.**

as the modern scientific method. Experiment is what differentiated Arabic science from Greek science (which used theory and speculation, as opposed to prolonged experimentation). Today the modern scientific method consists of gathering evidence by way of reasoning, formulating hypotheses and conducting experiments.



Ibn al-Haytham (965-1039) is one of the most notable scientists of the Islamic Golden Age. Known in the West by his Latinized name as Alhazen, he was born in Basra, Iraq (then part of the Buyid Dynasty of Persia). Ibn al-Haytham was a polymath and engineer. He is called the founder of optics because he first discovered the laws of refraction. Among his inventions are the camera obscura and pinhole camera. Because he insisted that theories had to be verified by practice, Ibn al-Haytham is considered the founder of the modern scientific method.

**Photo: Ibn al-Haytham of Basra.**

Astrolabes, were astronomical instruments invented in either ancient Greece or India. The first astrolabe in the Muslim world is attributed to the 8<sup>th</sup> century Persian mathematician Fazari.

Brass astrolabes were developed in Iran (Persia) for navigation and for finding the *qibla* (the direction of Mecca).



**Photo: An 18<sup>th</sup> century Persian astrolabe.**



**Photo: the site of Maragheh Observatory in Iran.**

The 13<sup>th</sup> century Persian astronomer Nasir al-Din al-Tusi of Baghdad is famous for creating a more accurate, earth-centered planetary model after finding flaws with Ptolemy's model of planetary motion. Later, Copernicus drew generously from al-Tusi's model when theorizing that the Earth revolves around the sun. Rasad Kaneh is the name of the ancient 13<sup>th</sup> century Maragheh Observatory that was built for al-Tusi. Today the site is culturally preserved in Iran.



Arab scientists also helped to advance medical knowledge. For example, The 9<sup>th</sup> century Persian doctor Muhammad ibn Zakariya al-Razi (known in Latin as Rhazes) authored an influential multi-volume encyclopedia of all known medical knowledge at the time. His monograph on smallpox and measles was groundbreaking. Razi had a great influence on Western medicine, and he is considered one of the greatest scientists of the Middle East.



**Photos:** A painting (pictured on left) depicts Al-Razi medically treating a patient. Pictured above is Al-Razi's *Book of Medicine* in Arabic.

Another great Arab scientist in medicine was Ibn al-Nafis, a 13<sup>th</sup> century doctor born in Damascus. Al-Nafis pioneered the study of the pulmonary circulation of blood because he was the first to recognize that lungs purify blood.



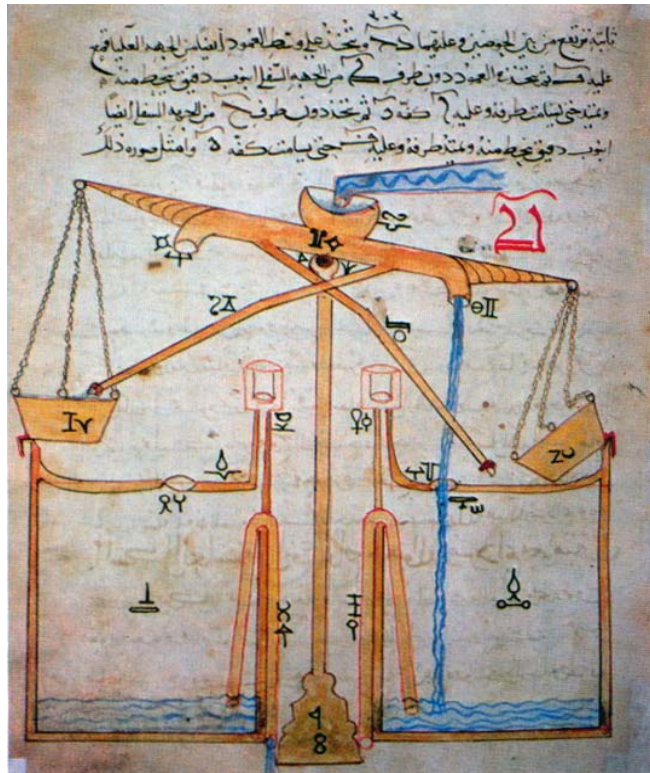
**Photo:** Ibn al-Nafis.



Algebra is one of the Arabic contributions to mathematics. The Persian polymath Muhammad ibn Musa Al-Khawarizmi is considered the “father of Algebra” because his book *Algebra* is the first treatise on the systematic solutions of linear and quadratic equations. The word algebra is derived from *a-jabr*, one of the operations used to solve quadratic equations in his book. Al-Khawarizmi also introduced the decimal positioning system in mathematics.

**Photo (left): An Egyptian phone keypad with Hindu-Arabic numerals and equivalent Arabic-language numerals.**

Among some of the the technologic inventions attributed to Arab scientists and engineers are the parachute, hang-glider, eye glasses, artificial wings, soft drinks, fine glass, modern soap, shampoo, kerosene, mechanical clocks, and programmable humanoid robot. Some of these inventions are attributed to Al-Jazari (1136-1206), a prolific inventor and mechanical engineer during the Islamic Golden Age.



**Photo: Diagram of an Al-Jazari water device.**



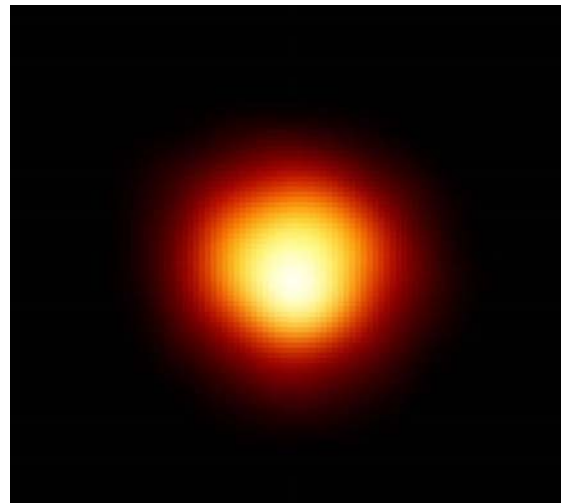


**Photo: Interior of the Al-Karaouine Mosque and University in Fes, Morocco.**

The House of Wisdom in Baghdad was an important scientific center during the Islamic Golden Age. As a library and translation institute, it translated many important foreign works of science and philosophy into the Arabic and Persian languages, thereby enriching Arab scientists and thinkers. Another notable intellectual institution was the University of Al-Karaouine (also called Qarawiyyin), in Fes, Morocco. Founded in 859, the university is one of the primary spiritual and educational centers of the Muslim world and the oldest continuously operating institution of higher learning. According to the Guinness Book of World Records the university is the "oldest existing educational institution in the world." The university curriculum boasts science, math, rhetoric, chemistry, medicine, and jurisprudence (among other areas of study).

Several Arabic words have enriched our scientific lexicon. Among the scientific terms and star names are alchemy, alcohol, alembic, algebra, algorithm, alkali, azimuth, elixir, nadir, zenith, Betelgeuse, Aldebaran, Mizar, and Rigel.

**Photo: the name of the star Betelgeuse is derived from Arabic origins.**



# Additional Resources

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