

Islamic Scholars and Biology

Martyn Shuttleworth 53.9K reads

History of Biology

The history of biology, built upon the thoroughness and insight of Aristotle and Galen, passed onto the Islamic Scholars, who added information drawn from every corner of the known world.

By the 8th Century, most of Europe was deep in the Dark Ages, with only the Byzantine Empire preserving a few fragments of the ancient knowledge.

Fortunately, the history of biology did not end here, because the Islamic Caliphate provided a stable environment for Islamic scholars, who thrived under the sponsorship of the ruling classes. The Islamic rulers were firm believers in promoting knowledge, and established the famous Houses of Wisdom in Baghdad and Damascus.

This culture of patronage allowed Islamic scholars to study and learn, and they translated many of the Greek texts into Arabic, which would preserve the wisdom of the Greeks and allow it to be passed onto Europe during the Renaissance. The sheer size of the Islamic empire provided access to wealth and raw materials for industry and agriculture. This gave the Islamic world the ability to support a structure of learning and scholarship, the foundation of the Islamic contributions to the history of biology and science.

Most Islamic scholars were free to undertake pure research, ensuring that the explosion in practical techniques was underpinned by advances in philosophy. As with the Ancient Greeks, the Islamic observations on life were closely tied to philosophy and theology.

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The History of Biology - The Islamic Agricultural Revolution

The Islamic scholars developed a strong worldview built upon pure research and often investigated scientific phenomena for the sake of finding answers. However, as with modern society, much of their research was applied science, designed to hone techniques and increase the pool of knowledge in areas that improved everyday life.

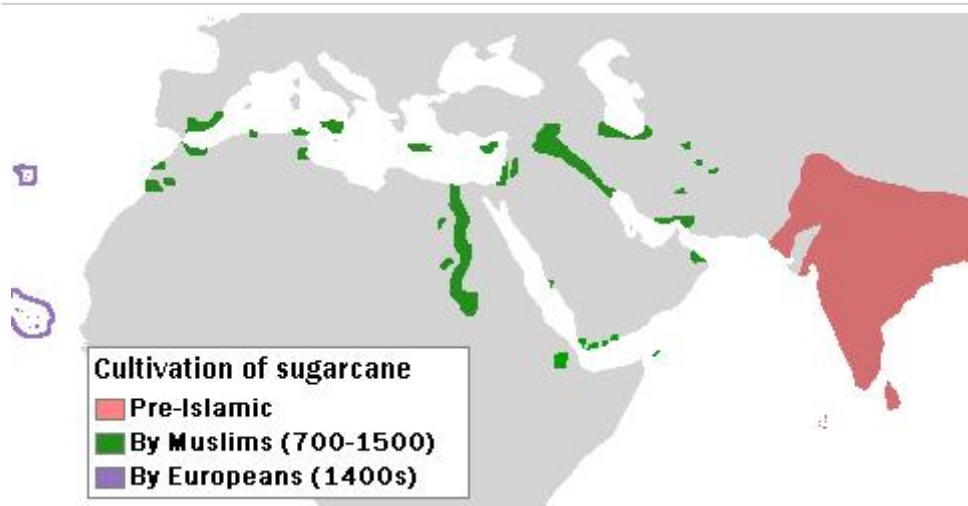
One of these areas was in botany, where much of the research was concentrated upon improving farming techniques and methods, essential in areas where farmers had to contend with thin soil and water shortages. The research of the Islamic scholars fueled the medieval Islamic Agricultural Revolution and developed many techniques that modern farmers still use today, especially in hot, dry regions.

The agricultural science of the Islamic scholars incorporated a two-stage process: The first involved gathering all of the available data and knowledge of farming techniques and the second involved using scientific techniques to improve and refine these processes, publishing the results and disseminating the knowledge far and wide.

An example of the practical uses of the Islamic biology was in the province of Andalusia, Modern Spain, where previous techniques were based upon the Roman model and supported limited subsistence farming. When the province fell under Islamic control, the entire agricultural system was reformed, using advanced irrigation techniques and drawing upon the vast botanical knowledge of the Islamic scholars. From every corner of their empire, the Muslims brought back exotic new species that would thrive in the harsh growing conditions prevalent in the Iberian Peninsula.

This Islamic Agricultural Revolution also took advantage of developments in other areas, using mathematical and engineering innovations to calculate how to raise water and design productive irrigation systems. The Islamic scholars made use of their knowledge in testing soil types for composition and fertility, grafting trees and implementing selective breeding. In this, they developed their own techniques, but Islamic scholars also scoured the world looking for information, gathering oral histories and techniques from places as far apart as the steppes of

Central Asia and the deserts of North Africa.



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This dissemination of knowledge and the willingness to share is further shown by the translation of the work of Islamic scholars into many languages, including Arabic, Latin, Greek, Syriac, Indian dialects, Farsi and a range of other languages. This ensured that knowledge and ideas could spread quickly and improve farming techniques everywhere. These refined farming techniques, given the agricultural basis of the economy underpinning society, generated the wealth that let the rulers sponsor Islamic scholars, allowing them to develop new agricultural techniques and create a virtuous cycle.

The Islamic advances ensured that the majority of the population could move beyond subsistence farming and grow crops for profit, and access to vegetables and meat all year around improved the health of the population. Whilst tangential to the history of biology, agricultural improvements allowed people to move away from the land, creating a merchant class, another powerful tool for spreading thought and ideas. The work of the Islamic agriculturalists was the major reason for the strength of the Islamic lands, politically, socially and militarily.

Other additions of the Islamic botanists were the introduction of cotton into Europe, giving Mediterranean farmers the chance to grow a cash crop and allowing merchants to export goods to Northern and Western Europe.

History of Biology - Islamic Botanists

When studying the Islamic contribution to the history of biology, a few Islamic scholars made telling contributions in the field, drawing together knowledge from all over the known world. Their systematic classifications and exposing of new plants and techniques to the Middle East and Europe cements their place in the distinguished history of biology.

The Islamic scholar, Al-Dinawari (828 - 896), is one of the leading botanists from this period and his work, 'The Book of Plants,' was a landmark book, earning him the epithet, 'The Father of Islamic Botany.' Like the Greeks and Romans before him, he studied and documented at least 637 plants but, importantly, he related plant evolution and related how plant species developed and diversified over time.

This very important part of botany helped farmers to breed the best and most productive cultivars selectively, a technique that has existed since the dawn of agriculture. He also described the life cycle of plants, including their growth, reproduction and fruiting, making the Book of Plants an excellent reference guide.

In the 13th Century, the Andalusian Islamic scholar, Abu al-Abbas al-Nabati, took the scientific methods [2] developed by the Muslim thinkers and applied them to botany, concentrating upon medicinal plants. Rather than relying upon trial-and-error and hearsay, Al-Nabati believed that empirical techniques [3] and scientific experimentation [4] should be used to test the effectiveness of medicinal plants. This work certainly began the process of removing anecdotal evidence and superstition from the healing arts.

The work of Al-Nabati was soon overshadowed by that of his pupil, Ibn Al-Batar, who wrote a book that became the reference work for botanists until well into the 19th Century. His book contained detailed descriptions of over 1400 plant species, many of them essential food sources or of use as drugs. Importantly, at least 300 of these plants were entirely his own discovery.

Abu Zakariya Yahya Ibn Muhammad Ibn Al-Awwan, a 12th Century Islamic scholar based in Seville, Spain, was one of the most important contributors to the history of biology, namely in the field of agriculture. His Kitab al-Filaha instructed agriculturalists on the care of nearly 600 plant species, including over 50 types of fruit trees. This work discussed the techniques, preferred growing conditions, manure and the diseases and pests afflicting the plants.

Other Islamic botanists concentrated upon documenting new species of plant, with Ibn-Sauri, Al-Kaiwini and Al-Dinawari producing plant encyclopedias, often with illustrations of plants from as far afield as India and Andalusia.

The Islamic Scholars, Zoology and Evolutionary Theory

The Islamic scholars, as part of their investigations into biology, resurrected the idea of evolutionary theory first hinted at by Anaximander. The most important contributor to Islamic evolutionary theory, and a leading scholar of zoology, was Al-Jahiz (781 CE - 868/869CE). He wrote a detailed treatise, Kitab al-Hayawan (Book of Animals), which became one of the most important works in the history of biology. [5]

This book contained detailed descriptions of over 350 species of animal, interwoven with poetic descriptions and well-known proverbs. Al-Jahiz was the first scholar to realize the importance of the environment upon animals, and he understood that the environment would determine the health of the animal. Translated into Spanish and annotated by Josep Antoni Sanguer, the Real Academia de Ciencias Exactas, Físicas y Naturales (Yale University) of the Fittest.

Brilliantly, he stated that animals struggled for existence, striving to find food, escape

predation and survive long enough to breed. Thus, the most successful individuals would pass on their traits to their offspring, ensuring that they, in turn, would be more likely to survive everything that the environment could throw at them.

Al Jahiz also related his ideas about food chains, noting that animals would seek food, but they would, in turn, be eaten by predators; this trait continued up the chain. The scholar also understood that chains were not one-dimensional and that animals had more than one food source. As each animal hunted, it was also hunted in turn, as part of the cycle of life.

Crucially, Al Jahiz even applied his theories of inherited characteristics to humans, noting that humans also adapted to their environments, pointing out that darker skinned people generally lived in hotter and drier climates. In a fine example of how Islamic scholars gathered information and improved upon it, he read the work of Aristotle and then added his own ideas and theories.

The contribution of the Islamic scholars to the theory of evolution did not stop there and the 'Encyclopedia of the Purity of Brethren,' a compendium written in the late 10th Century, contained an idea of evolution. The book took non-organic materials as the starting point and wrapped the idea of evolution in terms pertaining to a divine will.

The Islamic scholars believed that God created matter and imbued it with energy. In turn, this evolved into minerals, the highest of which was coral, before becoming vegetation, culminating in the date palm. They believed that the date palm shared some qualities with animals so eventually evolved into low animals. To complete the chain of evolution, the highest animals, apes, became primitive, barbarian men, before becoming civilized men, scholars, saints and finally angels.

Therefore, whilst we now know that this picture was overly simplistic and wrapped within a religious framework, it certainly earns the epithet of a proto-evolutionary theory. Al-Khazini, Ibn Miskawayh, Al-Tusi and Ibn-Khaldun are amongst the other Islamic scholars who wrote volumes of work about evolution, and their work was translated into Latin. As a result, the Islamic evolutionary theory was certainly available to Europeans during the Middle Ages and beyond, and it is not too much of a stretch of the imagination that Darwin [6] would have been influenced by their work.



Other advances in Islamic zoology concentrated upon the raising of livestock and the drive to breed better horses and animals. One of the leading Islamic scholars in this field was Ibn Bakhtishu, a Christian, who wrote an 8th Century treatise called 'The Uses of Animals.' This book contained information about zoology; much of it built upon earlier Greek works, but included a detailed section about animal husbandry.

Al-Damairi, a 13th century Islamic scholar based in Cairo and influenced by Al-Jahiz, wrote a treatise called Hayat Al Hayawan, 'The Life of Animals,' an encyclopedia that contained details of many animal species and became a formative work on the subject.

A few other Islamic scholars deserve mention for their work and direct influence upon European thinking. Abu Ubaidah (728--825 CE) wrote over 50 volumes concentrating upon horse breeding and animal husbandry, most of which later passed into the hands of the Europeans. Ibn al-Awwan's 12th century work, "The Book of Agriculture," contained detailed sections concerning animal husbandry and bee-keeping. Finally, Ibn al-Baytar wrote a book of pharmacology that included details about the veterinary care of animals.

The History of Biology and the Islamic Scholars

There is little doubt that the Islamic scholars contributed greatly to the history of biology and, as well as preserving the knowledge of the ancients, added a wealth of new information. As well as meticulously documenting plant and animal species, they contributed to sophisticated agricultural advances and generated interesting proto-evolutionary theories.

This knowledge would slowly filter into Europe and, as the Islamic Age went into decline, this knowledge became the bedrock of the Renaissance and influenced the thinking of European scholars for many centuries.



Ibn al-Baytar sculpture (Creative Commons ^[7])

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