

## Alexandria: History and culture

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Trencadís ("broken tiles") by Antoni Gaudí

**Summary.** Alexandria has been one of the most important cities throughout history. Born from the mixing of two of the major cultures of Antiquity—Greek and Egyptian—the city has been a melting pot allowing the development of human knowledge from its origins. It was the city where some renowned figures of the Antiquity, and recently several celebrated contemporaneous writers, worked. Hit by the hazards of the history, often violent, nowadays Alexandria seems to reborn, to become again a lighthouse for the science and humanities of the 21th century. Nevertheless, it will be necessary to remain watchful to overcome misunderstanding, intolerance and fanaticism, which threatens almost the entire planet Earth [Contrib Sci 12(2):129-140 (2016)]

**Keywords:** Alexander the Great (356–323 BC) · Hypatia (ca. 355–415) · Constantine Cavafy (1863–1933) · Bibliotheca Alexandrina · Mediterranean Sea

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There are cities that become destinations even before knowing them, walking their streets, exploring their nooks and crannies and contemplating their monuments or what is left of them. Art in all its forms has a lot to do with this as, alongside the memory of reality. Alexandria is one of those cities. A great deal of that essence is distilled in the works of Lawrence Durrell (1912–1990) and his *Alexandria Quartet* [1], Edward M. Forster's (1879–1970) travel guides *Alexandria: A History and Guide* and *Pharos and Pharillon* [4], Constantine Cavafy (1863–1933) and his poetic works, and more recently

Terenci Moix (1942–2003) and his books devoted to Egypt and, especially, to Alexandria [8]. Plunged in the depths of the city, they left us a portrait of a city that they knowingly mythologized.

But there are more, much more: historical characters who modelled the city with their fights and ambitions, but also their desire to establish a place that—beginning with an idealized Greek culture—could become a shared homeland for knowledge, in which philosophy and science could light up the known universe like a beacon, although this universe

This article is a contribution to the InterSection Workshop held at the Institute for Catalan Studies on 28 November 2014, as a part of the *Disputatio of Barcelona 2014*, devoted to "The Mediterranean, bridge of cultures". See also Contrib Sci 11(1):59-74 (2015).



Fig. 1. Alexander the Great, a mosaic at the Naples National Archaeological Museum.

was constrained mostly to the Greek one. Alexandria can boast of having sheltered and bequeathed to us a wealth of knowledge through well-known characters who belong to the universal philosophy, history and science.

In the course of time and occurrences, Alexandria, either as a reality or as an idea, can once again relight the flame that defined it for centuries. In 2002, the *Bibliotheca Alexandrina* was inaugurated; what better achievement to attract and unfold what the best of human mind is capable of achieve?

### Alexander the Great (356–323 BC)

Alexander III of Macedon (Fig. 1), was born in Pella, Macedon and died in Babylon. He was very young when he succeeded his father Philip II of Macedon (382–336 BC), murdered by “friends”. Philip had ensured that his son received an exacting military preparation, although he did not neglect his son’s intellectual training, charged to Aristotle (384–322 BC), also a Macedonian.

His short life was a constant and successful struggle against the Persian Empire. After the conquest of great parts of Asia Minor, Syria and Egypt, he proclaimed himself emperor and began new campaigns which were to make him the owner and master of Central Asia and what is now Afghanistan.

He carried out currency unification, built highways and irrigation canals, and opened the doors to commercial development with geographic expeditions such as the descent of the Indus River and the Persian coast of the Indian Ocean and the Persian Gulf to the mouths of the

Tigris and the Euphrates.

The cultural fusion initiated by Alexander and continued by his successors imposed Greek knowledge and spirit (*koiné*) as the common language and thought. Alexander’s early death at 33 might have been due to malaria, although other causes have been suggested, including poisoning, and not excluding excesses in food and drink, quite usual at those times.

The empire he created fell to pieces shortly afterwards. In the succession fights, Alexander’s wives and heirs died and the empire was divided among his generals (the Diadochi): Seleucus (359–281 BC), Ptolemy (267–283 BC), Antigonos (382–302 BC), Lysimachus (360–281 BC) and Cassander (ca. 350–297 BC). The resulting nations were the so-called Hellenistic States, which, for the following centuries, maintained Alexander’s ideal of transferring Greek culture to the East as eastern cultures were penetrating the Mediterranean [4].

### Alexandria’s foundation: dream and reality

The Greek presence in Egypt had been a constant for centuries. The country sheltered several well-established Greek colonies. By the 7th or 6th centuries BC, Naucratis, located 72 km southwest of Alexandria, was one of the first commercial Greek settlements.

The Jewish community had settled in the area that later became Alexandria after Jerusalem was taken, in 586 BC, by Nebuchadnezzar II (ca. 634–562 BC), and possibly before. The Jews set up in the city protected by the pagan world’s

tolerance for religious diversity, and created an intellectual focus with a centre for Hebrew studies.

In 332 BC, Egypt was under Persian dominion, although about to fall, vanquished by the liberating troops of Alexander the Great. With some interruption, Egypt had been under Persian rule from 525 to 332 BC, and the last Persian period was marked by numerous insurrections until the arrival of Alexander. His success was due to his showing respect and tolerance towards Egyptian civilization, religion, gods and customs while maintaining his devotion to Greek culture and his zeal in propagating Hellenism [4,7].

In April 331 BC, Alexander reached the coast by going down the Nile. In the delta he chose the little fishing village of Rachotis to found the city that was to have his name. It was a very good choice because the place was sheltered from the river's variations and close enough to allow for the arrival of merchandise to the port.

The construction of the city of Alexandria was in charge of Alexander's architect, Dinocrates of Rhodes (4th century BC). The nearby isle of Proteus, who was called Pharos, was joined to the city by a dike seven stadia long (1285 m) and was, therefore, known as the Heptastadium (*Ἑπταστάδιων*). The construction of the dike gave rise to two ports, the Portus Magnus or great port, the most important of the old city, and the Portus Eunostos or port of good return, which is now the port of Alexandria.

Ships from the Mediterranean and the Atlantic docked in the great port, with riches, commodities piled up on the wharves: bronze, tin, cotton, silks. The construction of the lighthouse was initiated after Alexander's death by his successor Ptolemy I Soter, and finished by the latter's son Ptolemy II Philadelphus on the isle of Pharos about 280 BC. Its architect was Sostrates of Cnidus. Two earthquakes, one in 1303 and another in 1323 destroyed the lighthouse. Underwater explorations in the last few years seem to confirm that many of the remains found at the bottom of the sea belong to the lighthouse. The place is occupied now by the Qaitbay fort, a robust and beautiful Arab construction of the 15th century built as defense and surveillance system.

Dinocrates designed the city according to a hypodamic plan, a system which had been in use since the 5th century BC. This is an urban design characterized by a distribution of streets in straight lines that cross at right angles. Administratively, the city was divided into five districts given the names of the first five letters of the Greek alphabet ( $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ ,  $\epsilon$ ). Palaces were built along the coastline and public buildings in the centre [3]. But Alexander left Egypt to continue his fight against the Persians and died far away. His city which he never saw finished, became a prosperous me-

ropolis during the reign of his successors, the Ptolemies.

## The Ptolemaic period (323–30 BC)

After the fights following Alexander's death in June 323 BC, Egypt was assigned to Ptolemy, son of Lagos, who reigned with the name Ptolemy I Soter. With the Ptolemies, mercenaries that had been part of the army of Alexander arrived from different places. With their families settled in the city and in the country, Persians, Syrians and Jews retained their own characters.

Ptolemy I Soter showed some good qualities as a governor. Besides establishing political alliances, he set himself to the construction and improvement of communications and, most especially, to the magnificence of Alexandria. Apart from the great palace building, work began on the construction of the Musaeum (*Μουσείον*), which was to house the Library, a project entrusted to Demetrius of Phalerum (350–280 BC) and which gathered all the knowledge of the time. In the centre of the city there were the Assembly, the squares, the markets, the religious centres, the baths, the gymnasiums, the stadiums and other public buildings necessary for the customs of the time. Some of these grandiose buildings were finished during the reign of Ptolemy II Philadelphus, responsible for the general aspect the city.

Alexandria soon became the centre of Greek culture and contributed to the Hellenization of the rest of the country. The "Museum" was the greatest intellectual achievement of the dynasty. It was an enormous edification with lecture halls, laboratories and anatomy wing, observatories, library, refectory, park and botanic and zoological gardens. The most important part was the Library. There, Alexandrian grammarians who determined the laws of rhetoric and grammar, geographers who designed maps of the world, and philosophers studied and investigated (Fig. 2).

Characters as famous as Archimedes (ca. 287–ca. 212 BC), Euclid (ca. 330–ca. 270 BC), Hipparchus of Nicaea (ca. 190–ca. 120 BC); Aristarchus of Samos (310–230 BC); Eratosthenes (ca. 276–194 BC); Apollonius of Perga (ca. 262–ca. 190 BC), and many others were tightly connected to Alexandria (Fig. 2, Table 1).

## The Roman period

Julius Caesar (100–44 BC) took Alexandria in 46 BC, to end the dynastic war between Cleopatra (69–30 BC) and her brother and co-regent Ptolemy XIII (63–48 BC). There are data based on an estimate of Diodorus (90–30 BC) that by

that time (60 BC), the population of Alexandria was about 300,000 inhabitants [10]. However, it appears that these data included only those who had the status of citizens and therefore slaves were excluded. Neither popular or low classes nor craftsmen classes enjoyed citizenship, although they were Egyptians. The whole population, besides Egyptians and Greeks, was formed by Macedonians, Phoenicians, Jews, Romans, Syrians, Persians, Arabs and visitors from other parts of the Middle East.

Caesar attacked the city from the sea, and during the sea-battle a fire started that burned warehouses of books in the port. After assuring Cleopatra on the Egyptian throne, and married her off to her younger brother Ptolemy XIV (ca. 59–44 BC), Caesar returned to Rome where war broke out after his death. Marc Anthony (83–30 BC) travelled to Egypt

to get the queen’s support, but this only fuelled the conflict. Octavius (Caesar Augustus) (63 BC–14 AD) was proclaimed victor after the battle of Actium in 31 BC. Egypt was made a Roman province and became the Empire’s granary, increasing the importance of Alexandria. Later, the city became capital of the Roman diocese of Egypt, a prosperous and cosmopolitan metropolis with several hundred thousands of inhabitants, and also a financial centre.

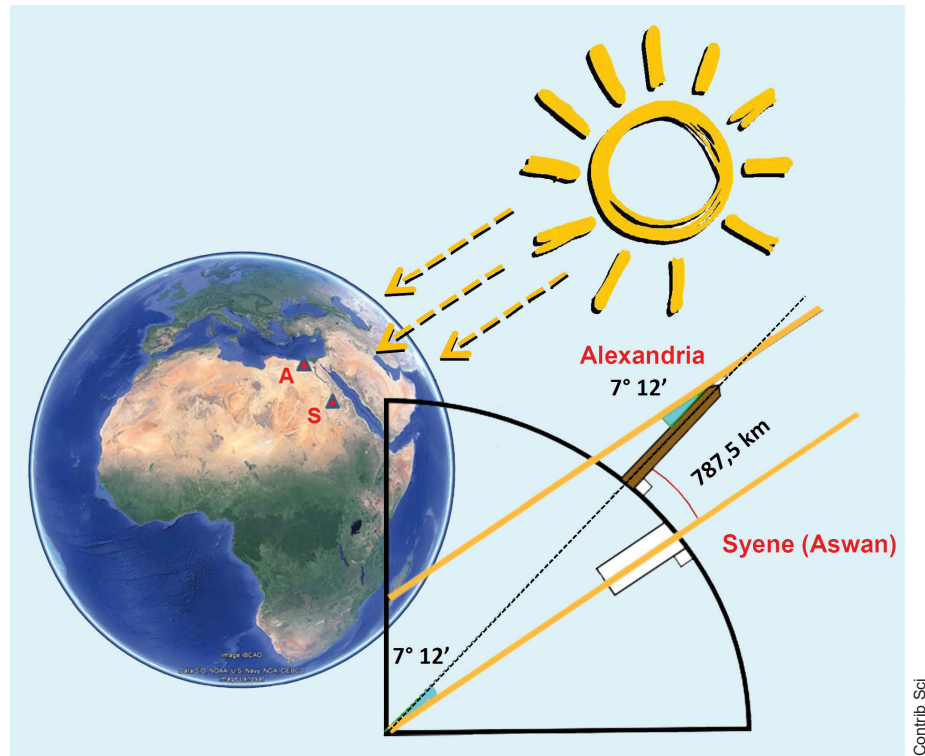
Imperial representation was in charge of a prefect who governed the country and was named by Rome. During the Roman period, the city went through wars, sackings and earthquakes. Natural catastrophes such as the earthquake in 365 made that a good part of the city disappeared under the waters.

Religious power was represented by the patriarchs.

**Table 1.** Several scholars who developed all or part of their activities in Alexandria

Name	Epoque*	Main contributions
Euclid	ca. 330–ca. 270 BC	One of the great mathematician. His work <i>Elements</i> is a mathematical synthesis that includes theorems, constructions and mathematical proofs. He established that, for a point outside a line it is possible to draw only one parallel.
Herophilos of Chalcedon	335–ca. 255 BC	Founder of the medical school of Alexandria. Important anatomical discoveries. He described bloodstream and brain anatomy.
Aristarchus of Samos	310–230 BC	He advanced the heliocentric model and, consequently, was precursor to Nicolaus Copernicus (1473–1543). He devised a method to calculate the distances from Earth to the Sun and the Moon.
Eratosthenes of Cyrene	ca. 276–194 BC	Chief librarian of the Library. He measured the tilt of Earth’s axis, made geographic maps and made a precise measurement of the Earth’s circumference.
Hipparchus of Nicaea	ca. 190–ca. 120 BC	He is credited with the calculation of the precession of the equinoxes and the first catalog of stars classified by the magnitude of its brightness. Developed charts of the movements of the Moon and the Sun. He is considered the father of trigonometry.
Hero of Alexandria	ca. 10–ca. 70	He wrote on mechanics, mathematics and physics. He invented mechanical devices as the <i>aeolipile</i> (steam engine) and the <i>dioptra</i> (geodetic instrument). In pneumatics, he gives details of self-moved machines (which would be described today as “robots”) with performance by hydraulic pressure.
Claudius Ptolemy	90–168	His major work in 13 volumes known as <i>Almagest</i> had great influence in astronomy up to the Renaissance, with the figures of Nicolaus Copernicus (1473–1543) and Johannes Kepler (1571–1630).
Claudius Galen	130–200	In Alexandria, he learned anatomy and physiology. In Rome he was physician of Marco Aurelio (121–180). He wrote many treatises and described the “Antonine plague” (smallpox or measles?), a pandemics that was spread in Rome by soldiers of the campaigns in the Near East.
Theon of Alexandria	ca. 335–ca. 405	Director of the Museum. His knowledge of astronomy and mathematics allowed him to write comments about the <i>Almagest</i> of Ptolemy, Euclid’s works and theories that combined astronomy and music. Father of Hypatia, who received his teaching and collaborated with him.
Hypatia of Alexandria	ca. 355–415	Mathematician, astronomer and philosopher. None of her works, <i>Astronomical Canon</i> , <i>Commentary to Arthmetica</i> by Diophantus nor the <i>Conics of Apollonius</i> have been preserved. She collaborated with her father on the comments on the <i>Almagest</i> . She is credited with the design or construction of an astrolabe and a hydroscope.

\*Due to lack of data, there are discrepancies between authors on the years of birth and/or death of those scholars.



**Fig. 2.** Eratosthenes' estimation of the dimensions of the Earth. During the summer solstice he observed the sun shadow projected on two sites in Egypt (a gnomon in Alexandria and a pit in Aswan), distanced approximately 800 km and located in the same meridian. His calculation was rather accurate, taking into account the actual circularity of the planet, ca. 40,000 km. (Sketch by M. Berlanga.)

Once established Christianity, Egypt became the center of one of the most important Christian communities of the Empire. The Patriarch of Alexandria had the maximum prestige and influence, together with his counterparts in Jerusalem, Antioch, Constantinople and Rome. But Rome's power in the hands of the prefect seemed conditioned by struggles and intrigues from the religious hierarchy. During the 4th and 5th centuries, the doctrinal conflicts and power struggles among the patriarchies, especially between Alexandria and Constantinople, were constant. As in other places, Christians in Alexandria suffered persecution in the early days of their faith until it was tolerated, spread across the Nile valley and, later, proclaimed official religion of the Roman Empire by Constantine I the Great (272–337).

Theodosius I the Great (346–395) had made Catholic Christianity the religion of the state by the Edict of Thessalonica in 380, imposing Nicene orthodoxy. This provoked a reaction from both the pagans and the different interpretations of Christianity, all of them officially considered heresies to be prosecuted and eradicated. In the following decades, great controversies continued among the different factions of Christians, which became very violent. At the same time, neo-platonist philosophers, such as Hypatia,

were subject to great pressure.

The Coptic Church came about as the result of a schism in which the Patriarch of Alexandria, Timothy Aelurus (?–477), excommunicated the rest of the patriarchs in 457. Once separated from the rest of the patriarchies, Alexandria preserved Christian belief and doctrine in its oldest form, handing it down from generation to generation, according to the apostolic doctrine and rites.

### Hypatia of Alexandria (ca. 355–415)

Hypatia was born, lived and died in Alexandria. A year of birth initially proposed for 370 has been revised to 355. Her death happened in March 415 [2]. A member of the Neo-Platonist School, she stood out in philosophy, mathematics and astronomy and led an ascetic life. She formed a select school of Christian and pagan aristocrats, among them the philosopher Synesius of Cyrene (373–414), the grammarian Hesychius of Alexandria (4th century), and Orestes, prefect of Alexandria.

Daughter and disciple of the astronomer Theon of Alexandria (ca. 335–ca. 405), also a prominent scholar, Hypatia wrote on geometry, algebra and astronomy, improved the design of

a primitive astrolabe and invented a densimeter. She died at 45 or 60 (depending on the correct date of her birth), lynched by a mob in the framework of christian hostility against declining paganism and political struggles between different factions of the church, the Alexandrian patriarchate and imperial power, held in Egypt by the prefect Orestes (Fig. 3).

Damascius (ca. 460–540), Neo-Platonist philosopher and last leader of the Athenian School, forbidden and shut down by Justinian I (483–565) in 529, said of Hypatia that she was fair and wise besides possessing the highest virtue in the art of teaching.

**Hypatia's School.** About the year 400 AD Hypatia became leader of the Alexandrian Neo-Platonists, centering her teaching on Plato (ca. 427–347 BC) and Aristotle. Her house was a school where students from all parts of the Roman world arrived, either pagan or Christian, attracted by her fame. Among them was Synesius of Cyrene (future Bishop of Ptolemaida, from 409 to 413). We have data on Hypatia thanks to his correspondence, both with her and with his fellow-students.

Hypatia's friends and disciples venerated her. Despite her paganism, she had the esteem and protection of these intellectual Christian elites. Orestes allowed himself to be advised by her in political and municipal affairs.

Theophilus (?–412), Patriarch of Alexandria between 385 and 412, had as much influence among the city's upper classes as Hypatia herself and had immense power. In 391 he ordered the destruction of the city's pagan temples, among them the Mithraeum and the Serapeum, which caused bloody disturbances between pagans and Christians. Most of the 4th century had been full of bloody riots. Theophilus died on 17 October 412, and Cyril (ca. 370–ca. 444) reached the patriarchy. He continued Theophilus' policies, i.e., pressure against pagans, heretics and Jews, support to the great monastic communities, cultivating the alliance with Rome and opposition to the growing influence of the Patriarchy of Constantinople, intimately allied to the imperial throne.

Different acts, such as the Patriarch's persecution of the Novatians, caused confrontation and hostility between Theophilus and Orestes, the prefect (maximum imperial military authority) on the city. There were also riots against the Jews during those years. Although Orestes wished to protect them, after a series of extremely violent riots, Cyril expelled the Jews. The rupture between the Patriarch and the imperial representative was complete. Hypatia had been "respected" during the frequent disturbances between pagans and Christians in Theophilus' days, even during the destruction of the temples and sculptures of the gods. But when Cyril rose to the patriarchy, everything changed.

**Death of Hypatia.** It seems that a rumour began to spread among the Christians of Alexandria that the cause of the discord between Cyril and Orestes was the influential Hypatia. During Lent, a group threw itself on the philosopher while she was in her carriage. The historian closest to the facts, Socrates Scholasticus (ca. 380–450), does not make Cyril directly responsible but does link him to the murder of Hypatia [5]. In his own words: "envy sharpened its arms against her... as she quite often met with Orestes; this caused against her, in the Christian community, the calumny that it was she herself who did not allow Orestes to approach friendship with the bishop" [5]. And so some belligerent individuals led by Peter, a reader, conspired to stalk the woman when she was coming home from somewhere: "they dragged her out of her litter and hauled her to the church called Caesareum and, after stripping her, they killed her with pot shards, quartered her limbs and took her to the place named Cynaron, where they set fire to them" [5].

Christopher Haas concludes that, with the available sources, it is not possible to know if it was Cyril who organized the attack, or if his followers took the initiative as they had done in a previous attack on Orestes. Maria Dzielska, however, notes that even if Cyril was not directly responsible of the crime, he did instigate the campaign against her, to fight the imperial prefect and his political faction, contrary to the Patriarchy [2].

No works by Hypatia have been preserved: instruments, designs, and writings. All we know of them, and of her life, we know from her contemporaries, mainly the correspondence of Synesius and the *Suda* encyclopædia. Synesius attributes to Hypatia the invention of the astrolabe, although earlier astrolabes preceded Hypatia's model and her own father was famous for his treatise on them. In fact, in the 2nd century, Claudius Ptolemy (90–168 AD) wrote his 13-volume work, the *Almagest*, in which astronomical explanations, descriptions of astral positions, and the calculations for the construction of the astrolabe appear. Later, Hypatia and her father worked to correct the calculations in the *Almagest* and the first astrolabe (Figs. 3).

## Muslim Egypt

The conquest of Egypt by the Muslims under Amr ibn al-As (?–663) starting in 641 had several periods until it was definitely installed in 646, and Alexandria was still one of the major Mediterranean metropolises. An inventory attributed to the commander Amr ibn al-As [4], on entering the city, and sent to Caliph Umar ibn al-Jattab (581–644), describes that he found



**Fig. 3.** *The School of Athens*, one of the most famous frescoes that Raphael (Raffaello Sanzio, 1483–1520) and his school made for the Pontifical Palace in the Vatican between 1509 and 1511. While art historians had generally accepted that the figure wearing in white and standing behind Pythagoras represented Francesco Maria della Rovere, a nephew of Pope Julius II, other more modern scholars, mainly mathematicians, have considered that an illustration evoking Alexandria between the 4th centuries BC and AD (Ptolemy and Euclid are represented there) should include also Hypatia, and have identified her with the figure in the square [Abbott KS, Abbott S (2011) Conjecture and proof: A case of shifting identities in Raphael's School of Athens. In: Sarghangi R, S'equin C (eds) Proceedings of Bridges: Mathematics, Music, Art, Architecture, Culture. Tessellations Publ., Phoenix, Arizona, pp 527-530].

in Alexandria “4000 palaces, 4000 baths, 12,000 oil merchants, 12,000 gardeners, 40,000 Jews and 400 theatres and places for entertainment”. Ibn al-Qifti (ca. 1172–ca. 1248) asserts in his *Chronicle of the wise* that the Great Library was destroyed at that moment, but that was not so. Although the Arabs destroyed many books, neither the Great Library nor the smaller Serapeum library existed at that time, they having disappeared because of the civil wars between Romans, natural disasters and fanaticism of the different doctrines.

An Byzantine fleet landed in Alexandria at the beginning of 645 to re-conquer Egypt, but that army was defeated by the superior Arab forces, and in the end retreated. After a new, long siege, the Arabs took the city for the third time in 646, destroying it mostly to avoid the Byzantines entrenching themselves by way of the sea. This was the end of 975 years of Alexandria’s belonging to the Greco-Latin world [7].

After a long decline, Alexandria had a rebirth as a great metropolis during the Crusades and enjoyed a flourishing period thanks to commerce. In 1365 the city was taken and sacked by the Crusaders led by king Peter of Cyprus (1328–1369). It was to become the centre of spice distribution until the Portuguese opened the Cape route in 1498, which

marked a commercial decline, aggravated by the Turkish invasion.

When in July 1798 Napoleon Bonaparte (1769–1821) entered the city, what he found was a semi-ruined town of only 7,000 inhabitants. Mehmet Ali (ca. 1769–1849) reconstructed it in the 19th century, turning it once again into the great Egyptian port. The 11th of June 1882, a xenophobe movement exploded in Alexandria which extended to other cities in the Nile Delta, and during which some 200 foreigners were murdered. The people as well as the army, were annoyed at foreign interference—England, France, Turkey—mainly due to financial and political problems.

The conflict had its origin in the arrival of English and French ships at the port of Alexandria to oppose a coup against their governor, the Khedive Tewfik Pasha (1852–1892) who, in fact, had been named under the influence of foreign countries. The British fleet bombed the port in July 1882, which caused a great fire and the sacking of the ruins by the population. The later landing of a large British army restored order, giving rise to the British protectorate over Egypt in September that same year, a situation that was kept up until 1946. The step from kingdom

to republic was taken after a coup d'état in 1952 and the proclamation of Gamal Abdel Nasser (1918–1970) as president in 1953.

## Father Nile

The Nile is fed by two major tributaries, the White Nile and Blue Nile. The White Nile, which originates in Rwanda, runs through the great African lakes, flowing north from Lake Victoria. The Blue Nile starts in Ethiopia, in Lake Tana, and flows through southern Sudan. Both White and Blue join in Khartoum, in the south of the Great Rift Valley. The total length of the river is about 6800 km and for many years has been considered the largest river in the world. In recent times, this category seems to be discussed in favor of the Amazon. The Nile empties its water and sediment into the Mediterranean, forming one of the largest deltas covering an area of about 22,000 km<sup>2</sup>. Woodward et al. state that the course of the Nile is submitted to the influence of the large structures, either natural or artificial, including dams, faults and geological contacts [13]. This fact is common to all large rivers. The coastal zone of the Nile Delta goes from Alexandria to Port Said, a distance of 240 km. The current configuration of the Nile dates from the Cenozoic Era. It is suggested that initially there could have been a number of separate continental basins, each taking one of the main Sudanese cracks, including the White Nile and Blue Nile cracks. The basins would not be interconnected until the sinking was concluded and sediments could fill the basins.

The search for the sources of the Nile inspired imagination and action of explorers that did not hesitate to undertake the adventure despite difficult conditions, both natural and sociopolitical because of the authorities and governments, kings, hierarchs and native populations of the surrounding. Two persons are considered the first Europeans to have reached these sources. One of them is the missionary Pedro Páez (1564–1622), a **Spanish Jesuit that after suffering a long captivity in Arabia went to Ethiopia, reaching its objective, Lake Tana and Blue Nile, around 1621.** The second one was James Bruce (1730–1794), a Scottish that served as British consul in Algiers. This was the starting point for his passion as an explorer: he arrived in Alexandria in 1768 on his own, and with great difficulty, like his predecessors, proposed himself to reach the sources of the Blue Nile, which he would reach around 1770.

Since millennia, landslides have been pushing ahead the immense wetlands forming the Delta. The ancients knew of seven or more arms of which two remain near Rosetta and



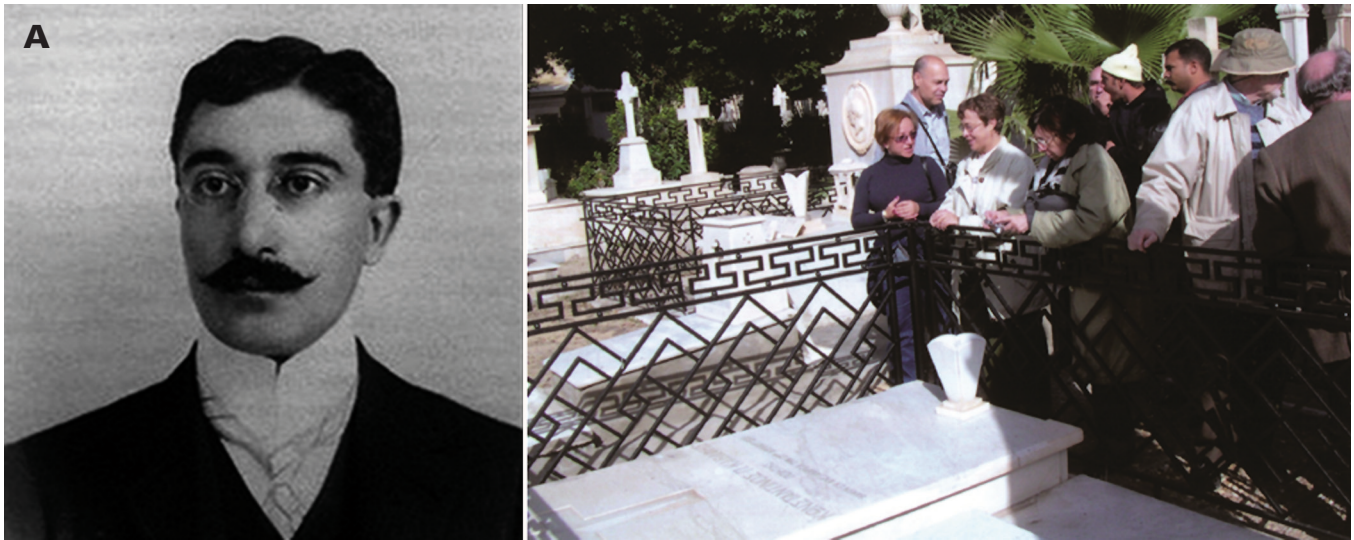
## About the author

Carmen Chica (Malaga, Spain, 1948). Psychologist. Autonomous University of Barcelona (1978), Master in Science Communication (2000). Management of research projects and scientific exchange. Translator of books and articles of history and philosophy of science. Author of a book of education psychology (Ed. Herder) and of articles on culture and science for the public as well as book-reviews. Author-editor of a book about Lynn Margulis. Organizer of international scientific meetings. Member of the team of the Catalan Foundation for Science and Innovation (2000–2011) for activities focused on science dissemination like Science week, promotion of scientific and technical studies, like the program Enginycat, and European projects for science dissemination. Managing coordinator of the journal *International Microbiology* and editor-collaborator of *Contributions to Science*. Lover of animals.

Damietta. Rosetta—the Delta city where the famous stone was found with an engraving text in Demotic, ancient Egyptian hieroglyphs and Greek—, was threatened after the construction of the Aswan Dam, which interrupted the regular supply of Nile silt. Various projects were undertaken to find solutions. Otherwise, life in Egypt and Sudan without the Nile would not have been possible.

Two authors, Alan Morehead [9] and William Golding [6] wrote their experiences traveling along the Nile. Morehead emphasizes the poetic vision in the description of the river and its landscape, even in the most adverse situations. Golding offers a perspective that covers his journey down the Nile





**Fig. 4.** (A) Constantine Cavafy (1863–1933). (B) The grave of Constantine Cavafy in the Greek cemetery of Alexandria. A special and emotional visit to the scene evoking the poet and his poems by representatives from the Institute for Catalan Studies, directed by Ricard Guerrero, and from the Autonomous University of Barcelona, directed by Pere Villalba. (The author of this article is the second woman from the left.) (Photograph by M. Piqueras.)

recalling his trip honestly and humorously, and shares his feelings about Egypt's past and present. Despite the 20-years difference between both works, the sound impression produced on both authors was the same.

## Egypt and Alexandria today

In 2013, the population of Egypt was estimated to be about 84 million, with a density of 84 inhabitants/km<sup>2</sup>. The two main cities are Cairo and Alexandria, with about 11 and 4.5 million inhabitants respectively. Egyptian economy is based on agriculture, mainly cotton, livestock, rice, and other products. It has deposits of oil and gas. Tourism is a major source of income for the country. The Nile River runs nearly 1600 km through Egyptian territory and represents the most important contribution to agriculture. There are more than sixty universities in the country, either public or private teaching and doing research in virtually all scientific, technological and humanistic disciplines. Notable is the Egyptian presence in the literature with famous authors, Naguib Mahfouz (1911–2006) being the highlight to have received the Nobel Prize for Literature in 1988, but there are many others.

The Alexandria of the 21st century is a modern city that still has its hypodamic layout. It is a commercial centre, hub of textile and chemical industries, mechanical and naval construction and banking centre. The construction of the Aswan Dam in 1964 gave Lake Nasser, a vast reservoir with

a maximum water level of 183 m over sea level. In 1978 another canal was built, which was given the name Sadat, NW of Lake Nasser through Wadi Toshka. The idea was that levels of water higher than 178 m, which had given rise to the formation of several lakes, were to drain into a depression at the southern end of the Eocene's limestone plateau. At the end of 1990, water began to flow through Sadat Canal in the Western Desert. With a length of 320 km from its origin to the lakes in the Toshka valley, it continues through the Sahara Desert connecting several oases, diverting a total of 10% of the Nile's water. The project considered allowing for irrigating a surface of near 5000 km<sup>2</sup>. To solve the problems derived from large losses due to evaporation, the canal was lined with layers of cement, sand, concrete and polymer. The water from Lake Nasser does not fall naturally into the canal, but must be pumped from the Mubarak Pumping Station, north of Abu Simbel.

## Constantine Cavafy and Alexandria

Many artists and scientists, from painters, sculptors and musicians, to architects and engineers, have lived and worked in that inspiring city. It is enough here to mention the four most significant for modern literature: Cavafy, Forster, Durrell and Moix.

Constantine Cavafy (1863–1933) was born and died in Alexandria—he was the youngest of seven brothers—Cavafy is considered to be the best modern Greek poet, his family's



Fig. 5. Two views of the modern Library of Alexandria. (From the booklet *Bibliotheca Alexandrina*, published by the institution itself.)

nationality. He was nine years old when, after the death of his father, a cotton trader exporter, the family moved to the UK, to Liverpool and London. He also lived in Constantinople, where his mother was born, and definitely in Alexandria from 1885 on. His father's business problems and premature death diminished the family's economic situation. A civil service position, which he kept all his life, allowed him to live on that income and have a reasonable retirement (Fig. 4).

In his lifetime he did not achieved fame as a poet, although he was known in the Greek cultural environment. He never published a book, only notebooks or *libretti* with his poems, which he himself sent to those he considered could understand them. His international recognition came about because of his friendship with Edward M. Forster, during Forster's stay in Alexandria. Lawrence Durrell also contributed to Cavafy's fame in his "Alexandria Quartet" [1]. Perfectionist to the bone, he composed poems on the decadence that often follows great historical periods, reflected in *God abandons Anthony* or *Ithaca*, both written in 1911, and *Awaiting the barbarians* (1904). His erotic poems have also regained interest, singing as they do about the sensuality of furtive love (he did not denied his homosexuality), such as *Remember, body...* (1918). In these poems, he reflects on weakness, sexual attraction often linked to Christian feelings of guilt and the fear of the passing of time. He contributed to the rebirth of modern Greek, although his poems were not published until 1948, with the 154 canon poems. The English version of these poems was published in 1951.

Cavafy was especially interested in the Greek reigns after Alexander, the subjection to Rome, Byzantium, the rise of Christianity and how pagans and Christians had lived together. He thought that, as Greeks believed, history is cyclical, and fills his evocations with feelings of nostalgia and fear of the unknown.

He underwent a tracheotomy in 1932 because of larynx cancer, and died the following year. He is buried in the Greek cemetery of Alexandria, next to his mother and brothers (Fig. 4).

## The Library

Begun along with the Museion, toward 290 BC, under the orders of Ptolemy I Soter (367–283 BC) after a proposal from Demetrius of Phalerum (350–280 BC), it was completed by Ptolemy II Philadelphus (data uncertain). He added an annex to the Serapeum and furnished with almost 44,000 volumes. Demetrius himself managed to collect some 200,000 volumes and it is estimated, although the numbers vary, that the Great Library could have contained 400,000–700,000 rolls. Stories or legends, or some combination of the two, tell that every ship landing at Alexandria was searched and, if a book was found, it was confiscated and after being copied it was registered and the copy returned to the owner. The same was done with single travelers. This fact is attributed to Ptolemy III Euergetes (ca. 282–222 BC).

The Alexandria Library attained the highest prestige as a centre of knowledge of ancient times. Scholars from all over the Mediterranean arrived to carry out investigations and plunge into studies of philosophy and the sciences (mathematics, geometry, astronomy). The memory of the Library survived its destruction and disappearance as it was a standard for knowledge.

The Musaeum, or "shrine of the Muses", was the equivalent to research center of the ancient world, and the Library, the first entity with global reach. The position of the librarian was one of the highest ranks and was named directly by the king. An important task done in the Library was translation. It

**Fig. 6.** Group representing the Institute for Catalan Studies and the Autonomous University of Barcelona that were received at the Bibliotheca Alexandrina, on 31 December 2003, by members of the Library. Among the group, Mostafa El-Abbadi (standing, fifth person from the right), a leading figure in the project, execution and functioning of the Bibliotheca. Lynn Margulis is the woman with the red shirt.



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was in Alexandria where the first translation of the Old Testament was carried out, from Hebrew to Koine Greek, what is known as the Septuagint.

The destruction of the Library has never been cleared up and sources are inconsistent. It has been said and also refuted that, during the course of one of his naval battles, in 48 BC, Caesar torched the Alexandrian fleet, whose flames extended to land, burned the Musaeum and the Library; but there is no certainty, though obviously damage would be produced. Emperor Theodosius prohibited, in 391, non-Christian religions, and Theophilus, Patriarch of Alexandria between 385 and 412, destroyed the Serapeum and the Library annex, as he considered them nests of pagan doctrine.

It has been said that the Library of Alexandria represents one of the most ambitious projects in Antiquity. Gathering, coding and organizing universal knowledge and making it available to scholars, thus allowing the meeting of cultures, meant a manifestation of openness of spirit, tolerance and respect, together with a logic that promoted discussion and the search for knowledge.

## The Bibliotheca Alexandrina: here and now

Established with the intention to be a worthy successor to the ancient Library, the Bibliotheca Alexandrina is located in a privileged place, opposite the Corniche facing the Mediterranean, in a magnificent building of eleven plants (Fig. 5). Recent archaeological studies suggest that this location is close to that of the ancient Library. It comprises also a conference center, a science museum, a planetarium, a study center and Calligra-

phy Institute and Museum. It covers an area of 85,000 m<sup>2</sup> and houses 8 million books, 100,000 ancient manuscripts and 10,000 rare books, as well as electronic, audiovisual material and databases.

The international community, through Unesco, funded the revival project of the ancient Library of Alexandria. Unesco, under the direction of Federico Mayor Zaragoza, organized a contest in 1987 in which numerous architectural centers participated. In the words of its first and current director, Ismail Serageldin, we must say that carrying out this project was making a dream come true, and this dream cannot be just the construction of a building, but also the pursuit of the ideal that inspired its creation, converting the Library into an ecumenical centre of knowledge. Today, we must add the current need for respect and acknowledgement of the contributions of the cultures that enrich the world and, again in the words of its director, "a centre for dialogue between people and civilizations".

Construction began in 1995, and in August 2001 the first book was placed in one of the shelves. The official inauguration took place on 23 April 2002, the International Day of the Book. Ismail Serageldin was appointed Director General. Besides a Ph.D. in sociology and economics, Prof. Serageldin has extensive experience in environmental issues and sustainability studies. On 3 July 2014 he gave a lecture in Barcelona, in the series "La Ciutadella, the first science park in Barcelona", co-organized by the Natural Science Museum of Barcelona and the Barcelona Zoo. "See the world, know thyself" was the title of his lecture, in which he dealt with the social and scientific challenge of museums and heritage institutions and knowledge.

In its presentation, the new Library states its purpose as "a center of excellence for the production and dissemination of

knowledge, and to be a place of dialogue and understanding between cultures and people.” As a symbol and as a reality, it is beautiful that Bibliotheca Alexandrina may be the meeting point of cultures and civilizations, past and present, most of which have as a cradle the calm waters of the Mediterranean.


In December 2003, a team consisting of fourteen people, including Ricard Guerrero on behalf of the Institute for Catalan Studies (IEC), and commissioned by Federico Mayor Zaragoza, visited the new Library of Alexandria (Fig. 6). Previously, the members of the group had contacted the responsible of the Library, who organized a private guided tour and introduced them to Mostafa El-Abbadi, a man of great knowledge that has played a significant role in the project, development and functioning of the Bibliotheca. In addition to visiting the various museum in the premises of the Library, the visitors had the opportunity to know the internal parts, facilities, offices, administration, and were given detailed explanations about the functioning of the institution, as well as historical information and data.

Especially moving was listening, directly from Mostafa El-Abbadi, the effort made for the “recovery” of the Library. It involved a huge effort to have the collaboration of experts in the history of the ancient library, the city and of the country, to discuss the appropriateness of the project, both with those who agreed, and with those who for various reasons did not agree. The magnitude of such an initiative and its purpose had to be tackled internationally and Unesco would be the appropriate institution.

One of the members of the group in this trip was Lynn Margulis, the renowned North-American biologist who, besides her extraordinary knowledge and contribution to science, has been an example of an open mind and encouragement to attract young people and adults into the adventure of knowledge and its dissemination. It was her first and only visit to Egypt and she was asked to sign some of her books that she donated to the Library. Lynn Margulis passed away in full intellectual youth, 73-years old, on 22 November 2011.

Ricard Guerrero, on behalf of the IEC, donated several books and documents. Science, inserted in culture, is a bridge that approaches and joins distances, and makes it

through the contribution of so many people, past and present, who have bequeathed to the society a precious good treasure, the fruit of their knowledge and wisdom.

On this Mediterranean shore where the Nile abandon its water, Alexandria wakes every morning to the chant of the muezzin calling to prayer. The far-distant traces of so many who shaped its history and made up our culture remains intact, perhaps increased by the gaze and the poetry of those who centuries later captured the essence of a city that had sheltered the wisdom of all times. And while it was wise, it was rich in the most outstanding talents. Never again should intransigence It would be fervently desirable that never again intransigence bury, under water and sand, the overwhelming memory of stones, papyrus and parchments, and everlasting ideas. 

**Acknowledgements.** Author thanks the collaboration of Sandra Young, Mercè Berlanga, Ricard Guerrero, and Mercè Piqueras, from the journal *International Microbiology*, in the preparation and final form of this article.

**Competing interests.** None declared.

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**About the images on the first page of the articles in this issue.** Articles of this thematic issue of CONTRIBUTIONS TO SCIENCE, devoted to the activities of the Barcelona Knowledge Hub of the Academia Europaea (AE-BKH), show in their first page a reproduction of a *trencadís*, a type of mosaic used in Catalan Modernism, made from broken pieces of ceramics, like tiles and dinnerware. Those nine “broken tiles,” designed by the architect from Reus Antoni Gaudí, show multiple angles and views, reflecting the ever-changing reality around us. The AE-BKH believes that those images, created more than a century ago, represent appropriately the multiple aspects of the present academic world, both in science and humanities, which constitute one of the main objectives of the activities of the Barcelona hub. See also the article “Antoni Gaudí (1852–1926): The Manuscript of Reus,” by R. Gomis and K. Katte, on pages 145-149 of this issue. This issue can be downloaded in ISSUU format and individual articles can be found at the journals’ repository of the Institute for Catalan Studies [[www.cat-science.cat](http://www.cat-science.cat); <http://revistes.iec.cat/contributions>].