LIVES IN THE MIDDLE AGES

John Scales Avery

March 14, 2022

INTRODUCTION[1]

How the Middle Ages are defined

The Western Roman Empire fell to the attacks of Germanic tribes in 476. The period between this event and the Renaissance is defined as the Middle Ages. Although in some ways this was a dark period for Europe, poetry, music, cathedral building and other arts were highly developed. In the field of exploration, Vikings discovered America long before Columbus.

A golden age for eastern civilizations

The definition of the Middle Ages just given is excessively Eurocentric. It is important to remember that the Middle Ages were years of great scientific and cultural progress for the Islamic world, and for China and India. In this book, we will also discuss the great achievements of these civilizations.

Human history as cultural history

We need to reform our teaching of history so that the emphasis will be placed on the gradual growth of human culture and knowledge, a growth to which all nations and ethnic groups have contributed.

This book is part of a series on cultural history. Here is a list of the other books in the series that have, until now, been completed:

- Lives in the Ancient World
- Lives in the Renaissance
- Lives in the 17th Century
- Lives in the 18th Century
- Lives in the 19th Century
- Lives in the 20th century
- Lives in Biology
- Lives of Some Great Novelists
- Lives in Mathematics
- Lives in Exploration
- Lives in Education

[1]This book makes use of my previously-published book chapters, but much of the material is new.

- Lives in Poetry
- Lives in Painting
- Lives in Engineering
- Lives in Astronomy
- Lives in Chemistry
- Lives in Medicine
- Lives in Ecology
- Lives in Physics
- Lives in Economics
- Lives in the Peace Movement

The pdf files of these books may be downloaded and circulated free of charge from the following web addresses:

https://www.johnavery.info/

http://eacpe.org/about-john-scales-avery/

https://wsimag.com/authors/716-john-scales-avery

Contents

Chapter 1

VIKING EXPLORERS

1.1 A seafaring culture

Shipbuilding was part of Scandinavian culture long before the age of Viking exploration, settlement and conquest. Denmark consists of a number of islands, and no part of Denmark is far from water. Norway is mountainous, and its coastline has numerous fjords and natural harbors. The easiest method of transportation and and communication in Norway was always by sea. Thus it was natural for Scandinavia to develop a ship-building and seafaring culture.

The Wikipedia article on *Viking ships* states that: **"The ship has been functioning as the centerpiece of Scandinavian culture for millennia, serving both pragmatic and religious purposes, and its importance was already deeply rooted in the Scandinavian culture when the Viking Age began. Scandinavia is a region with relatively high inland mountain ranges, dense forests and easy access to the sea with many natural ports. Consequently, trade routes were primarily operated via shipping, as inland travel was both more hazardous and cumbersome. Many stone engravings from the Nordic Stone Age and in particular the Nordic Bronze Age, depict ships in various situations and valuable ships were sacrificed as part of ceremonial votive offerings since at least the Nordic Iron Age, as evidenced by the Hjortspring and Nydam boats."**

Viking ships were built with overlapping wooden planks, held together by iron nails or bolts. They were long, slender and symmetrical, with a shallow draft and a true keel. Some Viking ships were designed for coastal waters and rivers, but other types, which were shorter, wider and more sturdy, could cross the open ocean.

Figure 1.1: **Viking ships.**

Figure 1.2: **A replica of a Viking ship sails in the evening on Roskilde Fjord, Denmark. It was built at the Viking Ship Museum in Roskilde using traditional Viking methods.**

Figure 1.3: **A visitor at the Viking Ship Museum in Oslo, Norway.**

Figure 1.4: **The prow of a Viking ship.**

Figure 1.5: **Viking exploration routes.**

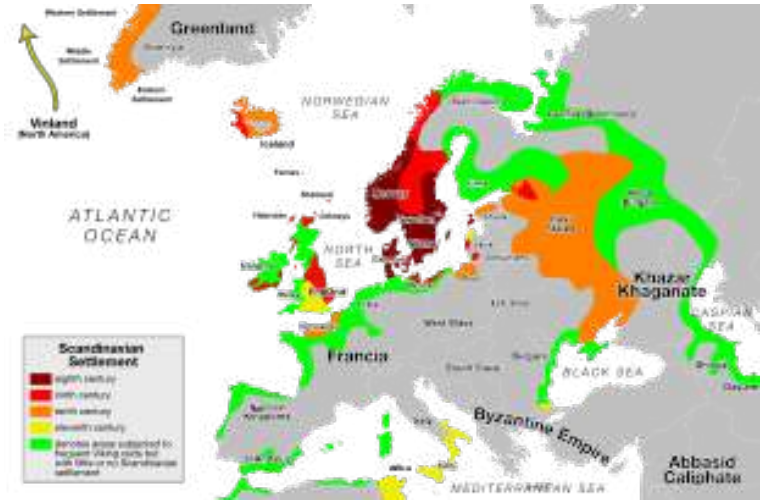

Figure 1.6: **Map showing area of Scandinavian settlement in the eighth (dark red), ninth (red), tenth (orange) centuries. Yellow denotes areas conquered by the Normans in the 11th century. Green denotes areas subjected to Viking raids.**

1.2 Icelandic Sagas

Iceland was originally populated by settlers from Scotland and Ireland. Nordic explorers and settlers arrived in the 9th century. Here are some excerpts from Wikipedia's *Timeline of Icelandic History*:

- **860: Naddodd discovers Iceland. He was heading to the Faroe Islands but drifted off course and landed near Reydarfjördur in Iceland. As he returned to his boat it started to snow and thereby he reputedly named the land Snæland (lit. Snowland).**
- **860: Gardarr Svavarsson discovers Iceland. Blown from a storm near the Orkney Islands. He circumnavigated Iceland, thus the first to establish that the landmass was an island. He stayed for one winter in Skjálfandi. He praised the new land and called it Gardarshólmi (lit. Gardar's Islet)**
- **c.870: Hrafna-Flóki Vilgerdarson becomes the first Scandinavian to deliberately sail to Iceland as news of a country in the west reached Norway. When Hrafna-Flóki climbed a mountain in Vatnsfjördur he spotted drift ice in a fjord that inspired the name of the country, Ísland (lit. Iceland).**
- **874: Ingólfr Arnarson becomes the first permanent Nordic settler of Iceland. The settlement of Iceland begins.**
- **930: The Icelandic Commonwealth is founded with the establishment of the Icelandic parliament (Althing), which had legislative and judicial power, but no executive power was present in the country.**
- **1000: The Christianization of Iceland is initiated due to pressure from the King of Norway.**

Figure 1.7: **Routes of the Vikings. (Faroe Postal Service. 15 March 1982).**

Figure 1.8: ***Ingolf settles in Iceland*, a 19th century painting by Peter Redsig.**

Saga writing and reading as a cure for immorality

In the year 1000, when many believed that the end of the world was near, Christianity came to Iceland. The Christian priests who then arrived were shocked by the immoral dancing and sex games with which Icelanders amused themselves during the long dark Icelandic winters. Therefore they introduced saga writing and reading in the hope that this would lead to a reduction of immorality.

In this way, the Christianization of Iceland lead to a unique and beautiful literature to which we owe many of the facts about Viking history and exploration. The Icelandic sagas are typically written in blank verse, with strong use of alliteration. They often are aimed at showing the strong claims of a family dynasty to a particular region of Iceland. Since the purpose of the sagas was frequently to praise the previous generations of the writer's family, one often encounters laudatory introductions to the people described, for example, "There was a man called Knud, and he was tall and handsome. He could leap over a bar set as high as he was tall, and he could lift three men... " and so on. If a woman was introduced, she was the most beautiful ever seen, as well as the most virtuous and wise. In introducing people to their narrative, the sagas also give their genealogies.

Another unique feature of Icelandic sagas is that they usually cover long multi-generational time spans. They pass quickly over decades or even centuries. Nevertheless, when they come to an incident that they find interesting, for example a fight or an important feast, the narrative slows to such a degree that we hear of every word spoken, every bird that flew overhead, every arm or leg hacked off, or, in case of a feast, every gift given.

A few of the most famous sagas

- Laxdæla saga
- Njáls saga
- Hjemskringla
- Grønlandia saga
- Eiriks saga

1.3 Aud the Deep-Minded (9th century)

The countries of Scandinavia, Denmark, Norway, Sweden, Finland and Iceland, have a seafaring tradition. Especially during the Viking era (793-1066), the men were frequently away on voyages. The women, left behind to manage families and farms by themselves, established a tradition of independence which has lasted until modern times. In Scandinavia, the high educational level and social status of women is linked with low birth rates, which are in turn the cause of the prosperity of the region.

In the 9th century AD, a local king named Harold (c.850-c.932) resolved to become king of all of Norway. He swore that he would not cut or comb his hair until he had achieved this goal. Finally after much struggle, he became the first king of the entire country. He then cut and combed his hair, after which he was known as Harold Finehair.

Figure 1.9: **Aud (or Un) the Deep-Minded (9th century) was the daughter of Ketill Flatnose. She is remembered as a great matriarch, and one of the founders of the Icelandic nation.**

Many local leaders in Norway left the country rather than submit to the rule of Harold Finehair. One of these chieftains was Ketill Flatnose, who sailed to Ireland with his daughter Aud. Aud married Olaf the White, the son of King Ingjald, who had named himself King of Dublin after conquering the city. Aud and Olaf had a son, named Thorstein the Red, who later conquered northern Scotland. Thorstein was married in the Hebrides, and had six daughters. However, he was betrayed and killed in battle.

When the news of Thorstein's death reached Aud, she realized that she and her followers were no longer safe in Scotland. Therefore she ordered the secret building of ships, on which she and her people escaped and sailed to Iceland. Aud the Deep-Minded is remembered as a great matriarch and one of the founders of the Icelandic nation.

1.4 Cnut the Great

Cnut the Great was born in c.990 and he died in 1035. He was descended from the first Danish kings: His great-grandfather was Gorm the Old, and his grandfather, Harold Bluetooth, the first king to welcome Christianity to Denmark. Cnut's father was Harold's son, Sweyn Forkbeard, who invaded England.

The 13th century *Knýtlinga saga* has given us a description of Cnut's appearance: **"Knut was exceptionally tall and strong, and the handsomest of men, all except for his nose, that was thin, high-set, and rather hooked. He had a fair complexion none-the-less, and a fine, thick head of hair. His eyes were better than those of other men, both the handsomer and the keener of their sight."**

During the summer of 1013, Cnut accompanied his father, Sweyn Forkbeard, who invaded England. For decades, the Vikings had raided England, but this invasion was on a larger scale. By the end of the the year, the English king, Æthelred the Unready, had fled to France.

When Sweyn Forkbeard died in 1014, the Vikings immediately elected Cnut King of England. However, the English nobility had other ideas, and they recalled Æthelred from

Figure 1.10: **The North Sea Empire of Cnut the Great, c. 1030.**

France. Together they waged a successful campaign against Cnut, who was forced to retreat to Denmark.

In the summer of 1015, Cnut's fleet, re-enforced by Polish allies, sailed for England. There were roughly 10,000 men in 200 longships. We have a description of the fleet from *Emma's Encomium*: **"There were there so many kinds of shields, that you could have believed that troops of all nations were present. ... Gold shone on the prows, silver also flashed on the variously shaped ships. ... For who could look upon the lions of the foe, terrible with the brightness of gold, who upon the men of metal, menacing with golden face, ... who upon the bulls on the ships threatening death, their horns shining with gold, without feeling any fear for the king of such a force? Furthermore, in this great expedition there was present no slave, no man freed from slavery, no low-born man, no man weakened by age; for all were noble, all strong with the might of mature age, all sufficiently fit for any type of fighting, all of such great fleetness, that they scorned the speed of horsemen."**

This time, the conquest of England succeeded. Cnut showed himself to be a wise ruler of his North Sea empire, uniting his subjects and advocating tolerance for ethnic and religious differences.

Figure 1.11: **A 14th-century portrait of Cnut the Great. He was a wise ruler. The semi-legendary story in which he commanded the tide to go back, if true, probably was meant to demonstrate the limitations of kingly power to his overly demanding nobles.**

Figure 1.12: **Angels crown Cnut as he and his wife, Emma of Normandy, present a large gold cross to Hyde Abbey in Winchester. (From the Liber Vitae in the British Library.)**

1.5 Russia takes its name from the Rus Vikings

The Rus Vikings, or Vangarians, were Scandinavians who migrated to Russia and settled there. The word "Rus" originally meant "men who row". Present day Russia takes its name from the Rus people, but Russia is a mixture of many ethnic groups, which have intermarried and blended over the centuries.

According to a number of sources, three Rus brothers were invited to restore order in districts near to present-day Kiev: **"The Chuds, the Slavs, the Krivichians and the Ves' then said to the people of Rus, 'Our land is great and rich, but there is no order in it. Come to rule and reign over us'. Thus they selected three brothers, with their kinsfolk, who took with them all the Russes and migrated. The oldest, Rurik, located himself in Novgorod; the second, Sineus, at Beloozero; and the third, Truvor, in Izborsk. On account of these Varangians, the district of Novgorod became known as the land of Rus."**

Here is a description of the Rus by Ahmad ibn Fadlan, a contemporary Muslim diplomat: **"I have seen the Rus as they came on their merchant journeys and encamped by the Itil. I have never seen more perfect physical specimens, tall as date palms, blond and ruddy; they wear neither tunics nor caftans, but the men wear a garment which covers one side of the body and leaves a hand free. Each man has an axe, a sword, and a knife, and keeps each by him at all times. The swords are broad and grooved, of Frankish sort. Each woman wears on either breast a box of iron, silver, copper, or gold; the value of the box indicates the wealth of the husband. Each box has a ring from which depends a knife. The women wear neck-rings of gold and silver. Their most prized ornaments are green glass beads. They string them as necklaces for their women."**

Figure 1.13: **Map showing the major Varangian trade routes: the Volga trade route (in red) and the Dnieper and Dniester routes (in purple). Other trade routes of the 8th-11th centuries shown in orange.**

Figure 1.14: ***The Invitation of the Varangians*: Rurik and his brothers arrive in Staraya Ladoga, a painting by Viktor Vasnetsov.**

Figure 1.15: **Depiction of Yaroslav the Wise from Granovitaya Palata (The Palace of Facets). Yaroslav, a descendant of Rurik, was Prince of Novagrad and Kiev. His daughter, Elisiv of Kiev, married King Harold Hardrada.**

Figure 1.16: **Golden ruble depicting Rurik, issued to mark the 1150th anniversary of the birth of the Russian state.**

1.6 Harald Hardrada, 1015-1066

Harald Hardrada (sometimes translated as Harald the Ruthless or Harald Stern Ruler) was the King of Norway from 1046 until his death at the Battle of Stamford Bridge in 1066. In addition, he unsuccessfully claimed the thrones of both Denmark and England.

At the age of 15, Harald and his half-brother Olaf (later Saint Olaf) fought against Norwegian forces loyal to King Cnut the Great at the Battle of Stiklestad. They were defeated, and forced into exile. Harald fled from Norway to the Kievian Rus, where he became a captain in the army of Grand Prince Yaraslav the Wise. He fell in love with Yaroslav's daughter Elisiv, but his marriage proposal was rejected because he had little wealth, and seemingly few prospects.

Disappointed in love, Harald left Yaroslav's service in 1034. He and about 500 of his followers and sailed down the Dnieper and across the Black Sea to Constantinople. Harald soon became the commander of the Vangarian Guards of the Byzantine Empire.

Harald and the Vangarian Guards fought against pirates in the Mediterranean and against Arab forces in Asia Minor, as far east as the Tigris and Euphrates rivers in Mesopotamia. According to the sagas, Harald and his men captured eighty Arab strongholds. Later, Harald and his men fought in Sicily and Italy.

During his time in Byzantium, Harald became extremely rich. He sent his acquired treasures back to Yaroslav the Wise for safekeeping. Harold arrived back at the Kievian Rus in 1042, and again proposed marriage to Yaroslav's daughter, Elisiv. This time the proposal was accepted.

Returning to Norway, Harald used his new wealth to finance a successful campaign for the throne of Norway. He reigned as King Harald III of Norway from 1046 until his death in 1066, with Elisiv by his side as Queen.

Meanwhile, in England, the childless King Edward the Confessor had died. On his deathbed, Edward had named the powerful Earl Harold Godwinson to be King of England. However, two men both thought that they had a better claim to the English throne than Harold Godwinson. These two men were King Harald Hardrada of Norway and Duke William of Normandy. In 1066, both men sailed to England with their armies to fight for the English throne.

Harald Hardrada and his men landed in the north of England, near to the town of Stamford. The weather was hot, and they took off their armor while foraging for food. They were surprised by Harold Godwinson's army, which had made a forced march to meet them. According to the sagas, the following exchange took place before the battle began: Harald Hardrada asked Godwinson, "How much of England will you give to me?", and Godwinson replied, "Six feet, and perhaps an extra foot, since you are taller than other men."

The Battle of Stamford Bridge then began, and after fierce fighting, Harald Hardrada was killed. Harald Godwinson and his army then made another forced march to meet William of Normandy at Hastings. Perhaps exhausted by the two forced marches, they were defeated at the Battle of Hastings, and Harold Godwinson was killed.

Figure 1.17: **Elisiv of Kiev, wife of King Harald Hardrada and Queen of Norway.**

Figure 1.18: **The Battle of Stamford Bridge, 25 September, 1066. King Harald of Norway was killed in the battle by the forces of King Harold Godwinson of England. However, less than three weeks later, Harold Godwinson was defeated killed by the army of William of Normandy at the Battle of Hastings.)**

1.7 William of Normandy

William of Normandy (1028-1087), also known as William the Conqueror or William the Bastard, was the illegitimate son of Robert I, Duke of Normandy, by his mistress Herleva. Despite his illegitimate status and his youth, he succeeded his father in 1035.

In 1050, William married Matilda of Flanders, thus obtaining a powerful ally in the neighboring country of Flanders.

William was the first cousin, once removed, of King Edward the Confessor, and he claimed that Edward had promised him the English crown, also maintaining that Harold Godwinson had sworn to support that claim. Thus when the childless King Edward died, William claimed a right to the English throne. He built a powerful fleet, and in September, 1066, he invaded England, decisively defeating and killing Harold Godwinson at the Battle of Hastings.

The Normans were Vikings, although they had been living in France so long that they had adopted the French language. When they conquered England, they brought the French language with them as the language of the aristocracy. Thus English often has two words for the same thing, the word of French origin being the finer of the two, while that of Scandinavian or Germanic origin is less fine. For example “mansion” is derived from the French word “maison”, and implies something finer than “house”, which is related to the Scandinavian word “hus” and the German word “hause”.

Figure 1.19: ***Harold Rex Interfectus Est: King Harold was killed.*** **Scene from the Bayeux Tapestry depicting the Battle of Hastings and the death of Harold.**

Figure 1.20: **Norman knights and archers at the Battle of Hastings.**

Figure 1.21: **A scene from the Bayeux Tapestry depicting Odo, Bishop of Bayeux, rallying Duke William's troops during the Battle of Hastings in 1066. Odo was the half-brother of William the Conqueror, and it was probably he who commissioned the Bayeux Tapestry.**

1.8 Erik the Red

Erik the Red (c.950-c.1003) was born in Norway. He was the son of Thorvald Asvaldsson. When Thorvald was forced to flee from Norway to avoid murder charges, Erik moved with him to Iceland. After his father's death, Erik the Red established a farm in Iceland, married, and had three sons and a daughter. However, he became involved in a dispute during which several people were killed. As a result, Erik the Red was banished from Iceland for three years. He and his followers sailed northward to Greenland, which had been discovered a century earlier, but never successfully colonized.

Concerning Erik's stay in Greenland, Wikipedia says the following: **"During his exile, around 982, Erik sailed to a somewhat mysterious and little-known land that Snæbjörn galti Hölmsteinsson had unsuccessfully attempted to settle four years before. He rounded the southern tip of the island, later known as Cape Farewell, and sailed up the western coast. Eventually, he reached a part of the coast that, for the most part, seemed ice-free and consequently had conditions - similar to those of Iceland - that promised growth and future prosperity. According to the Saga of Erik the Red, he spent his three years of exile exploring this land. The first winter he spent on the island of Eiriksey, the second winter he passed in Eiriksholmar (close to Hvarfsgnipa). In the final summer he explored as far north as Snaefell and into Hrafnsfjord.**

Erik the Red returned to Iceland after the period of his banishment had expired with stories about a wonderful country to the north, *Greenland*. He deliberately gave it this

attractive name in order to persuade Icelanders to follow him to settle there. Many did, but out of 25 ships that left to colonize Greenland, 11 were lost at sea, and only 14 arrived safely.

Erik's wife had converted to Christianity, and she commissioned the building of a small church, the remains of which can still be seen today. However, Erik himself stayed loyal to the Norse gods. This caused a rift between husband and wife.

The Norse colony in Greenland was a success, and it lasted for many centuries, finally dying out, for unknown reasons, between 1450 and 1500.

1.9 Leif Erikson

Bjarni Herjólfsson

During their voyages, the Vikings could tell their latitude by observing the sun and stars. However, they had no way of determining longitude. If they wanted to sail from Norway to Iceland, they went to a certain point on the Norwegian coast, and just sailed westward until they reached land.

According to *Grønlandia Saga*, this method was used by a man named Bjarni Herjólfsson, who attempted to reach Iceland in order to spend the winter there with his father. However, he was blown off course by a storm. Not realizing that he had missed Iceland, Bjarni continued to sail westward, finally reaching the North American continent. He returned, and finally settled in Greenland.

Leif Erikson's expedition

According to *Grónlandia Saga*, Erik the Red's son, Leif Erikson, became interested in Bjarne's discovery, and bought a ship from him. Leif tried to persuade his father to lead the expedition westward, but Erik the Red complained that he was too old. Finally persuaded, Erik mounted his horse to ride down to the ship. The horse stumbled and Erik was thrown to the ground, hurting his foot. He took this as a bad omen, and said, "I am not meant to discover more countries than that which we now inhabit." Leif Erikson was forced to lead the expedition alone.

Sailing westward, Leif Erikson and his men first reached Labrador, which they called "Markland". They then sailed southward along the coast, finally reaching Newfoundland, which they called "Vinland".

In the sagas, there is an account of a hostile encounter between Leif and his men and three North American Indians, in which the Vikings killed two , but one escaped. That night (according to the story) Erik the Red appeared to his son in a dream, and said, "Get up, Leif Erikson! Get up and take your sword in your hand! Get up and wake your men! Get up if you want to live!". Leif followed his father's advice, just as a large band of Indians attacked. Whether or not this story is true, the fact the Vikings never made peace

Figure 1.22: **A reconstruction of Norse buildings at the UNESCO listed L'Anse aux Meadows site in Newfoundland, Canada. Archaeological evidence demonstrates that iron working, carpentry, and boat repair were conducted at the site.**

with the Indians is the reason why they never colonized North America. However, they used Labrador as a source of timber, and there was some temporary settlement there.

Suggestions for further reading

1. Beamish, North Ludlow (1841). *The discovery of America by the Northmen, in the tenth century*. London: T. & W. Boone.
2. Magnus Magnusson; Hermann Pálsson (2004) [1965]. *The Vinland Sagas*. Penguin Books.
3. Reeves, Arthur M. (Middleton), tr., ed. (1895) [1890]. *The Wineland History of the Flatey Book. The Finding of Wineland the Good: The History of the Icelandic Discovery of America*. Oxford University Press.
4. Reeves, Arthur M. (Middleton); Beamish, North Ludlow; Anderson, Rasmus B. (1906). Buel, J. W. (ed.). *The Norse Discovery of America: A Compilation in Extensó of All the Sagas, Manuscripts, and Inscriptive Memorials Relating to the Finding and Settlement of the New World in the Eleventh Century*. New York: Norræna Society.
5. Örnólfur Thorsson (ed.) (2001). *The Sagas of Icelanders*. Penguin Books.
6. Sturlason, Snorre. (2004) *Heimskringla Or The Lives Of The Norse Kings*, Kessinger Publishing.
7. Sullivan, Steve & Stephen Krensky. (1991) *Who Really Discovered America?*, Hastingshouse/Daytrips Publ.
8. Oleson, T.J. *Bjarni, Hejólfsson*, Dictionary of Canadian Biography vol. 1, University of Toronto/Université Laval, 1979.

9. Kudeba, N. (2014, April 19). Chapter 5 - *Norse Explorers from Erik the Red to Leif Erikson* - Canadian Explorers.
10. Oleson, Tryggvi J., *The Norsemen in America* (Ottawa: Canadian Historical Association, 1963) (CHA Historical Booklet No. 14).
11. Oleson, Tryggvi J., *Early Voyages and Northern Approaches 1000-1632*, Volume 1 of the Canadian Centenary Series (Toronto: McClelland & Stewart, 1963; re-issue with additional material, 1968).
12. Downham, Clare *England and the Irish-Sea Zone in the Eleventh Century* in Gillingham, John (ed) (2004) Anglo-Norman Studies XXVI: Proceedings of the Battle Conference 2003. Woodbridge. Boydell Press.
13. Etchingham, Colman (2001) *North Wales, Ireland and the Isles: the Insular Viking Zone*. Peritia.
14. Howorth, Henry H. (January 1911). *Ragnall Ivarson and Jarl Otir*. The English Historical Review. 26 (101): 1-19.
15. Ó Corráin, Donnchadh (Mar 1979) *High-Kings, Vikings and Other Kings*. Irish Historical Studies 22 No. 83 pp. 283-323. Irish Historical Studies Publications.
16. Woolf, Alex *The Age of the Sea-Kings: 900-1300* in Omand, Donald (ed.) (2006) The Argyll Book. Edinburgh. Birlinn.
17. Woolf, Alex (2007) *From Pictland to Alba, 789-1070*. Edinburgh. Edinburgh University Press.
18. Woolf, Alex (ed.) (2009) *Scandinavian Scotland - Twenty Years After*. St Andrews. St Andrews University Press.
19. Blair, Peter Hunter (2003). *An Introduction to Anglo-Saxon England (3rd ed.)*. Cambridge, UK and New York City, USA: Cambridge University Press.
20. Crawford, Barbara E. (1987). *Scandinavian Scotland*. Atlantic Highlands, New Jersey: Leicester University Press.
21. DeVries, Kelly (2003). *The Norwegian Invasion of England in 1066*. Woodbridge, Suffolk: Boydell Press.
22. Graham-Campbell, James & Batey, Colleen E. (1998). *Vikings in Scotland: An Archaeological Survey*. Edinburgh: Edinburgh University Press.
23. Horspool, David (2006). *Why Alfred Burned the Cakes*. London: Profile Books.
24. Howard, Ian (2003). *Swein Forkbeard's Invasions and the Danish Conquest of England, 991-1017 (illustrated ed.)*. Boydell Press.
25. Richards, Julian D. (1991). *Viking Age England*. London: B. T. Batsford and English Heritage.
26. Keynes, Simon (1999). Lapidge, Michael; Blair, John; Keynes, Simon; Scragg, Donald (eds.). "Vikings". The Blackwell Encyclopaedia of Anglo-Saxon England. Oxford: Blackwell.
27. Panton, Kenneth J. (2011). *Historical Dictionary of the British Monarchy*. Plymouth: Scarecrow Press.
28. Pearson, William (2012). *Erik Bloodaxe: His Life and Times: A Royal Viking in His Historical and Geographical Settings*. Bloomington, IN: AuthorHouse.
29. Starkey, David (2004). *The Monarchy of England*. I. London: Chatto & Windus.

30. Downham, Clare (2007). *Viking kings of Britain and Ireland: the dynasty of Ívarr to A.D. 1014*. Dunedin Academic Press.
31. Downham, Clare (2011). *Viking Ethnicities. A Historiographic Overview*, History Compass 10.1 (2012).
32. Hadley, Dawn (2006). *The Vikings in England: Settlement, Society and Culture*. Manchester University Press.
33. Heide, Eldar (2008). *Viking, week, and Widsith. A reply to Harald Bjorvand* (PDF). Arkiv för nordisk filologi. 123. C.W.K. Gleerup.
34. Hodges, Richard (2006). *Goodbye to the Vikings: Re-Reading Early Medieval Archaeology*. Gerald Duckworth & Company Limited.
35. Svanberg, Fredrik (2003). *Decolonizing the Viking Age*. Almqvist & Wiksell International.
36. Wamers, Egon (1985). *Insularer Metallschmuck in wikingerzeitlichen Gräbern Nordeuropas. Untersuchungen zur skandinavischen Westexpansion*. Neumünster: Karl Wachholtz.
37. Wamers, Egon (1998). *Insular Finds in Viking Age Scandinavia and the State Formation of Norway*. In Clarke, H.B.; Mhaonaigh, M. NÃ; Floinn, R. Ó. (eds.). Ireland and Scandinavia in the Early Viking Age. Dublin: Four Courts Press.
38. Wawn, M.A. (2000). *The Vikings and the Victorians: Inventing the Old North in Nineteenth Century Britain*. Woodbridge: Boydell and Brewer.

Chapter 2

MARCO POLO

2.1 Family and early life

Marco Polo (1254-1324) was born in Venice, into a very successful family of merchants. At the time of his birth, his father Niccolò Polo (c.1230-c.1294) and his uncle, Maffeo Polo (c.1230-c.1309) were away from Venice on a long journey during which they spent many years in the court of the Chinese emperor, Kublai Khan. Niccolò Polo did not see his son Marco until the boy was about 15 years old.

The two Polo brothers, Niccolò and Maffeo, had established trading companies Constantinople, and in Sudak in the Crimea, which was then in the western part of the Mongol Empire. They lived in the Venetian quarter of Constantinople, where Venetians then enjoyed tax advantages and other privileges. However, in 1259 or 1260, judging the political situation in Constantinople to be precarious, they moved their business to the Crimea. This decision proved to be very fortunate, since the government in Constantinople soon changed, and Venetians in the city were then subject to terrible persecution.

The Crimea was at that time a part of the Golden Horde, the western end of of the Mongol empire. After spending some years there, the Polo brothers moved still further eastward to the city of Bukhara, where they spent three years and further increased their trading profits. While they were in Bukhara, the brothers were invited to visit the court of the great Chinese emperor, Kublai Khan.

Kublai Khan was very much interested in what the Polo brothers had to tell him about European civilization and Christianity. He wrote a letter to the pope, requesting 100 educated people and missionaries who would come and teach his people about western customs and Christianity. He also asked for oil from the lamp of the Holy Sepulchure.

When the Polo brothers returned to Venice in 1269 or 1270, they were distressed to find that there was no pope to whom they could deliver Kublai Khan's letter and request. However, in 1261, Pope Gregory X was elected, and the brothers were able to fulfil their commission. Pope Gregory sent a letter and gifts to the great Khan, but only two missionaries rather than 100. The Polo brothers took these with them when they returned to China. They also took Niccolò 's young son, Marco Polo.

Figure 2.1: **Niccolò and Maffeo Polo leaving Constantinople for the east, in 1259.**

Figure 2.2: **Niccolò and Maffeo in Bukhara, where they stayed for three years. They were invited by an envoy of Hulagu (right) to travel east to visit Kublai Khan.**

Figure 2.3: **Niccolò and Maffeo Polo remitting a letter from Kublai Khan to Pope Gregory X in 1271.**

Figure 2.4: **Rialto Bridge, Venice.**

Figure 2.5: **The Doge's Palace, Venice.**

2.2 Marco travels to China with his father and uncle

In 1271, at the age of 17, Marco Polo set off with his his father and uncle on an epic journey to the court of Kublai Khan. It would be 24 years before they returned to Venice.

In the service of Kublai Khan

Once again they were welcomed by the great Khan, who took a special interest in the young Marco Polo, who by this time was 21 years old, because of his intelligence and humility. Marco Polo also entertained the emperor with stories of the countries which he had visited. Kublai Khan was so pleased that he decided to appoint Marco as a diplomat to the various parts of his empire, for example present-day Burma, India, Indonesia, Sri Lanka, and Vietnam.

In addition to these diplomatic missions, Marco Polo also lived and travelled extensively inside China (then known as Cathay). He observed many things that were previously unknown to Europeans, for example, the use of paper money and coal.

Return to Europe

Kublai Khan several times refused to allow the Polos to return to Europe because they were useful to him. However, in 1291 he granted the Polos permission, as their last service, to accompany the Mongol princess Kököchin, to Persia, where she was to marry Arghun Khan. After performing this mission, the Polos finally returned to Venice, arriving there with many riches 24 years after they had departed on their epic journey.

Figure 2.6: **Marco Polo dressed as a Tartar.**

Figure 2.7: **Mosaic of Marco Polo displayed in the Palazzo Doria-Tursi, in Genoa, Italy.**

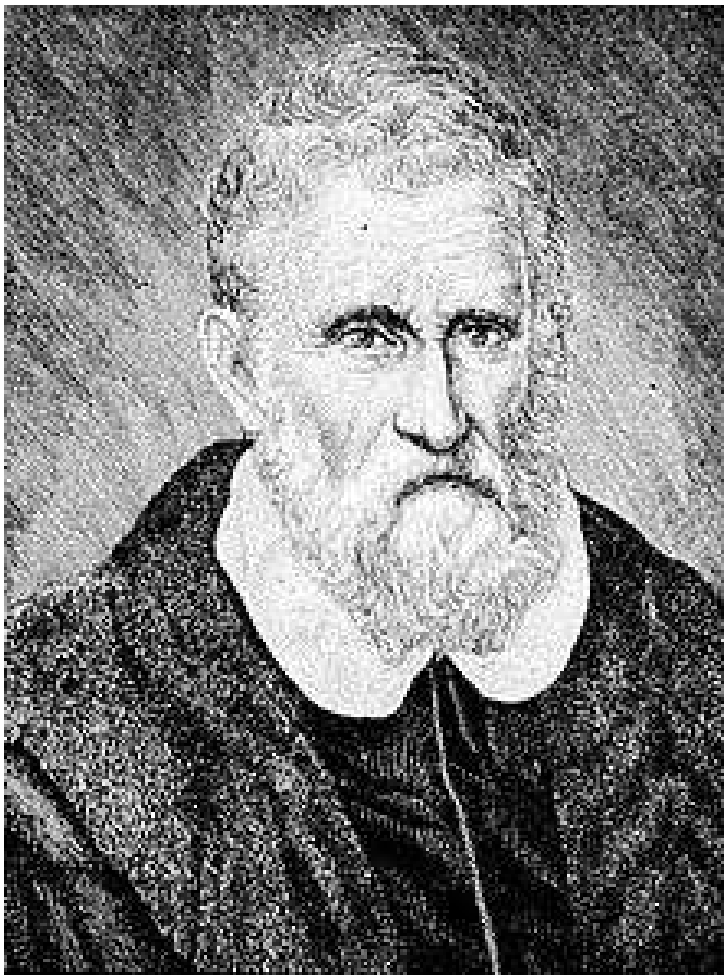

Figure 2.8: **16th century portrait of Marco Polo.**

Figure 2.9: **Portrait of Kublai Khan (1215-1294). His white robes are those of a shaman. He was the grandson and heir of Genghis Khan.**

Figure 2.10: **Portrait of young Kublai by Anige, a Nepali artist in Kublai's court.**

Figure 2.11: **The Yuan Dynasty of China, over which Kublai Khan became emperor.**

2.3 Return to Venice and capture by the Genoans

Marco's capture by the Genoans

When Marco Polo returned to Venice in 1295, the city was at war with Genoa. Marco purchased a ship and participated in the naval war. However, he was captured and imprisoned for three years.

Marco dictates his book to a cell-mate

While in prison, Marco Polo dictated a book of his recollections from his epic travels in Asia to a cell-mate, Rustichello da Pisa, who happened to be a successful author of romances. The result was the famous book whose English title is *The Travels of Marco Polo*, while the French title was *Livre des merveilles*. The book became immensely popular, and it opened the eyes of Europeans to the great wealth and knowledge of countries in Asia, thus initiating the Age of Exploration.

Xanadu (Shangdu)

In Marco Polo's book describing of his travels, he gives the following description of Kublai Khan's summer palace:

"And when you have ridden three days from the city last mentioned, between north-east and north, you come to a city called Chandu, which was built by the Khan now reigning. There is at this place a very fine marble palace, the rooms of which are all gilt and painted with figures of men and beasts and

birds, and with a variety of trees and flowers, all executed with such exquisite art that you regard them with delight and astonishment.

"Round this Palace a wall is built, inclosing a compass of 16 miles, and inside the Park there are fountains and rivers and brooks, and beautiful meadows, with all kinds of wild animals (excluding such as are of ferocious nature), which the Emperor has procured and placed there to supply food for his gerfalcons and hawks, which he keeps there in mew. Of these there are more than 200 gerfalcons alone, without reckoning the other hawks. The Khan himself goes every week to see his birds sitting in mew, and sometimes he rides through the park with a leopard behind him on his horse's croup; and then if he sees any animal that takes his fancy, he slips his leopard at it, and the game when taken is made over to feed the hawks in mew. This he does for diversion.

"Moreover at a spot in the Park where there is a charming wood he has another Palace built of cane, of which I must give you a description. It is gilt all over, and most elaborately finished inside. It is stayed on gilt and lacquered columns, on each of which is a dragon all gilt, the tail of which is attached to the column whilst the head supports the architrave, and the claws likewise are stretched out right and left to support the architrave. The roof, like the rest, is formed of canes, covered with a varnish so strong and excellent that no amount of rain will rot them. These canes are a good 3 palms in girth, and from 10 to 15 paces in length. They are cut across at each knot, and then the pieces are split so as to form from each two hollow tiles, and with these the house is roofed; only every such tile of cane has to be nailed down to prevent the wind from lifting it. In short, the whole Palace is built of these canes, which I may mention serve also for a great variety of other useful purposes. The construction of the Palace is so devised that it can be taken down and put up again with great celerity; and it can all be taken to pieces and removed whithersoever the Emperor may command. When erected, it is braced against mishaps from the wind by more than 200 cords of silk.

"The Khan abides at this Park of his, dwelling sometimes in the Marble Palace and sometimes in the Cane Palace for three months of the year, to wit, June, July and August; preferring this residence because it is by no means hot; in fact it is a very cool place..."

Coleridge's poem

In 1797, after reading a description of Shangdu, Samuel Taylor Coleridge fell asleep, and while asleep composed the poem which starts with the lines:

In Xanadu did Kublai Khan
A stately pleasure-dome decree:
Where Alph, the sacred river, ran
Through caverns measureless to man

Figure 2.12: **French *Livre des merveilles* front page. At a time before printed books, it nevertheless became a best-seller!**

Down to a sunless sea.

So twice five miles of fertile ground
With walls and towers were girdled round:
And there were gardens bright with sinuous rills,
Where blossomed many an incense-bearing tree;
And here were forests ancient as the hills,
Enfolding sunny spots of greenery...

Figure 2.13: **Handwritten notes by Christopher Columbus on the Latin edition of Marco Polo's *Le livre des merveilles*. By making Europeans conscious of the wealth and knowledge of eastern civilizations, Marco Polo's book initiated the Age of Exploration.**

2.4 History of the Silk Road

China's impact on western civilization

It was during the T'ang period that the Chinese made an invention of immense importance to the cultural evolution of mankind. This was the invention of printing. We will discuss this Chinese invention in a later chapter.

During the period when the Polo family visited China, the Mongols ruled not only China, but also southern Russia and Siberia, central Asia and Persia. They were friendly towards Europeans, and their control of the entire route across Asia opened direct contacts between China and the west. The Silk Road became a corridor for the exchange of ideas between east and west. The Chinese inventions, knowledge of which passed along the Silk Road, revolutionized European society.

The first Chinese text clearly describing the magnetic compass dates from 1088 A.D.. However, the compass is thought to have been invented in China at a very much earlier date. The original Chinese compass was a spoon carved from lodestone, which revolved on a smooth diviner's board. The historian Joseph Needham believes that sometime between the 1st and 6th centuries A.D. it was discovered in China that the directive property of the lodestone could be transferred to small iron needles. These could be placed on bits of wood and floated in water. It is thought that by the beginning of the Sung dynasty, the Chinese were also aware of the deviation of the magnetic north from the true geographical north. By 1190 A.D., knowledge of the compass had spread to the west, where it revolutionized navigation and lead to the great voyages of discovery which characterized the 15th century.

Other Chinese inventions which were transmitted to the west include metallurgical blowing engines operated by water power, the rotary fan and rotary winnowing machine, the piston bellows, the draw-loom, the wheel-barrow, efficient harnesses for draught animals, the cross bow, the kite, the technique of deep drilling, cast iron, the iron-chain suspension bridge, canal lock-gates, the stern-post rudder and gunpowder. Like paper, printing and the magnetic compass, gunpowder and its use in warfare were destined to have an enormous social and political impact.

Some personal memories of the Silk Road

In 1985, I spent two months lecturing on quantum theory at Northwestern University in Xi'an, the eastern end of the Silk Road. Every weekend, the university arranged a tour for all of the foreign lecturers. and on one of these tours, we travelled a long distance westward into the mountains, following the Silk Road. Interestingly, the farther westward we travelled, the lighter complexioned people became. Instead of having dark hair, they became more and more blond. This was because of intermarriage with ethnic Russians.

Back in Xi'an, people urged me to see the Mosque and the Muslim ethnic minority group living nearby in the old part of the city. When I went to see them, they hardly seemed different from the Han Chinese people of the city, because of intermarriage over the centuries.

Figure 2.14: **Xi'an retains its Ming Dynasty city wall. This image shows one of the gates.**

Figure 2.15: **The Big Goose Pagoda at Xi'an.**

Figure 2.16: **The Great Mosque at Xi'an is a center for the Islamic minority group. Travel along the Silk Road led to mixing between ethnic groups, and today, members of the Islamic minority are almost indistinguishable from the Han Chinese.**

Figure 2.17: **Near to Xi'an is the famous site of the 8,000 terracotta warriors.The warriors were meant to guard the emperor in the afterlife. Each statue has a different face!**

Figure 2.18: **Tupopdan Peak, 20,033 feet (6,106 meters), also known as "Passu Cathedral," just north of Gulmit village in the Hunza Valley region of Pakistan. The picturesque valley was one of several important passes along the ancient Silk Road, situated between China's western Xinjiang region and Afghanistan's Wakhan Corridor.**

Figure 2.19: **A view of the ruins of the ancient city of Jiaohe, seen at sunset on March 7, 2007 in Turpan, China. Jiaohe, built on a 98-foot-high loess plateau over 2,300 years ago, lies in the Yarnaz Valley and is protected by the natural fortification of the precipitous cliffs. The city has been a major passageway for communication between the East and West since the Han Dynasty and Tang Dynasty, and an important section of the ancient Silk Road.**

Figure 2.20: **Afghan children play in the old part of the northern town of Mazar-i-Sharif in Balkh province on March 27, 2012. Once known as the "mother of cities," the ancient city of Balkh was a popular destination along the ancient Silk Road. Balkh was destroyed by Mongol conqueror Genghis Khan during his rule, and the city's ruins remain a tourist attraction today.**

Figure 2.21: **Ancient columns stand at the Al-Mina archaeological site, Tyre, Lebanon. Tyre, on the Mediterranean Sea, served as one of several ports at the western end of the Silk Road. Traders, having reached this point, might unload their goods onto a waiting ship, or board the vessel themselves to continue westward.**

2.5 Timeline for European exploration of Asia

Here is a timeline from a Wikipedia article entitled *Chronology of European exploration of Asia*:

- **515 BC: Scylax explores the Indus and the sea route across the Indian Ocean to Egypt.**
- **330 BC: Alexander the Great conquers parts of Central Asia and parts of northwestern India**
- **300 BC: Seleucus Nicator, founder of the Seleucid Empire, forays into northwestern India but is defeated by Chandragupta Maurya, founder of the Maurya Empire, and they become allies soon after.**
- **250 - 120 BC: Greco-Bactrian states in parts of Central Asia and South Asia, including the Fergana Valley (Alexandria Eschate), Transoxiana (Alexandria on the Oxus) and Punjab (Alexandria on the Indus).**
- **180 BC - 10 AD: The Indo-Greek Kingdom was located areas now part of Afghanistan, Pakistan and north-west India.**
- **30 BC - 640 AD: With the acquisition of Ptolemaic Egypt, The Romans begin trading with India. The Empire now has a direct connection to the Spice trade Egypt had established beginning in 118 BC.**
- **100 AD - 166 AD: Romano-Chinese relations begin. Ptolemy writes of the Golden Chersonese (i.e. Malay Peninsula) and the trade port of Kattigara, now identified as Óc Eo in southern Vietnam, then part of Jiaozhou, a province of the Chinese Han Empire. The Chinese historical texts describe Roman embassies, from a land they called Daqin.**
- **2nd century: Roman traders reach Siam, Cambodia, Sumatra, and Java.**
- **161: An embassy from Roman Emperor Antoninus Pius or his successor Marcus Aurelius reaches Chinese Emperor Huan of Han at Luoyang.**
- **226: A Roman diplomat or merchant lands in northern Vietnam and visits Nanjing, China and the court of Sun Quan, ruler of Eastern Wu**
- **c.500-1000: The Radhanites were medieval Jewish merchants who dominated trade between the Christian and Islamic worlds during the early Middle Ages and travelled as far as Tang dynasty China.**
- **c.550: Byzantine traveler and author Cosmas Indicopleustes completes his work Christian Topography describing geographical features gleaned from his own travels to Eritrea, Ethiopia, India, and Sri Lanka.**
- **c.552: Two Persian monks (or perhaps emissaries disguised as monks), at the behest of Eastern Roman (Byzantine) emperor Justinian I, travel to China and smuggle silkworms back to the Eastern Roman Empire, thus enabling silk production in Europe and Asia Minor.**
- **568: The Eastern Roman (Byzantine) general Zemarchus travels to Samarkand and the court of the Western Turkic Kaganate.**

- **639-640: The Muslims subjugate Egypt, thus severing most direct Eastern-Roman (and hence European) trade with India and eastern Asia.**
- **1160-1173: The Navarrese Jewish Rabbi Benjamin of Tudela visits Syria, Palestine, Baghdad, Persia, and the Arabian Peninsula.**
- **1180-1186: Pethahiah of Regensburg goes to Baghdad.**
- **13th century: Silk Road trade reaches its height during the height of the Pax Mongolica, the relative peace in Asia during the widespread unification under the Mongol Empire.**
- **1245-1247: The Italian Franciscan Giovanni da Pian del Carpine appointed Papal Legate and accompanied by Stephen of Bohemia, and later by Benedykt Polak, reaches Karakorum present-day Mongolia. First European embassy to the Great Khan.**
- **1245-1248: The Italian Ascelin of Lombardia, Simon of St Quentin and Andrew of Longjumeau go to Armenia and Persia.**
- **1249-1251: Andrew of Longjumeau guide a French ambassador to the great Kuyuk Khan. His brother Guy and several others - John Goderiche, John of Carcassonne, Herbert "Le Sommelier", Gerbert of Sens, Robert (a clerk), a certain William, and an unnamed clerk of Poissy go with him. They reached Talas in northwestern Kyrgyzstan.**
- **c.1254: The Flemish William of Rubruck reached Mongolia through Central Asia.**
- **1264-c.1269: First travel of the Italians Niccolò and Maffeo Polo to China. In 1266, they reach Kublai Khan's seat at Dadu, now known as Beijing, China.**
- **1271-1295: Second trip of Niccolò and Maffeo Polo to China. This time with Marco, Niccolò 's son, who would write a colourful account of their experiences. The details of their account are currently debated.**
- **1275-1289 & 1289-1328: The Italian John of Montecorvino (1246-1328) was a Franciscan missionary, traveller and statesman, founder of the earliest Roman Catholic missions in India and China, and archbishop of Peking, and Patriarch of the Orient.**
- **c.1318-1329: Travels of the Franciscan friars, the Italian Odoric of Pordenone and James of Ireland via India and the Malay Peninsula to China where they stayed in Dadu (present day Beijing) for approximately three years before returning to Italy overland through Central Asia.**
- **c.1321-1330/1338(?): The French Dominican missionary Jordanus, made bishop over the whole Indian subcontinent in 1329, wrote down his travels through India and the Middle East in his book Mirabilia.**
- **1338-1353: The Italian Giovanni de' Marignolli, one of four chief envoys sent by Pope Benedict XII to Peking.**
- **1401-1402: Travel of Payo Gómez de Sotomayor, first ambassador of Henry III of Castile to the Timurid Empire.**

- **1403-1404: Travel of Ruy GonzÃ¡lez de Clavijo, second ambassador of Henry III of Castile to the Timurid Empire. He passed along the Black Sea coast of Turkey to Trabzon and then overland through Armenia, Azerbaijan, Iran and Turkmenistan to Uzbekistan. He also visited Tehran.**
- **1420-1436: Travels of the Italian explorer Niccolò de' Conti to India and Southeast Asia.**
- **1436-1439: Travels of Pedro Tafur across Middle East.**
- **1453: Constantinople falls to the Muslim Ottoman Turks, thus ending Christian rule in the Eastern Mediterranean.**
- **1470: Travels of Afanasy Nikitin, the first Russian to visit India.**
- **1471-1479: The Italian Venetian diplomats Caterino Zeno, Ambrogio Contarini and Giosafat Barbaro travel to Persia.**
- **1487-1491: Portuguese explorer and spy PÃªro da CovilhÃ£ travels to the Near East and India under the orders of the King of Portugal, to gather information necessary for successfully establishing a sea route between Portugal and India.**
- **1557-1572: The English Anthony Jenkinson travelled across the Caspian Sea to Bukhara and Persia.**
- **c.1580-1585:The Cossack Yermak Timofeyevich reaches the Siberian Tatar city of Qashliq near the right bank of Irtysh.**
- **1583-1591: The English merchant Ralph Fitch, together with John Newberry and John Eldred, a jeweller named William Leedes and a painter, James Story, travelled via the Levant and Mesopotamia to India and Portuguese Malacca (in modern Malaysia). Eldred stayed in Basra, Iraq; Story joined the Jesuits in Goa; Leedes stayed in Agra to work for Akbar and Newberry decided to begin his return journey. Fitch went by himself to Burma and Malacca (today in Malaysia). He returned to London in 1591.**

Suggestions for further reading

1. *Marco Polo, Marci Poli Veneti de Regionibus Orientalibus*, Simon Grynaeus Johannes Huttichius, Novus Orbis Regionum ac Insularum Veteribus Incognitarum, Basel, 1532, pp. 350-418.
2. Herbermann, Charles, ed. (1913). *Marco Polo* . Catholic Encyclopedia. New York: Robert Appleton Company.
3. Yule, Henry; Cordier, Henri (1923), *The Travels Of Marco Polo*, Mineola: Dover Publications.
4. Moule, Arthur Christopher; Pelliot, Paul (1938). *Marco Polo: The Description of the World*. 1. London: George Routledge & Sons Limited.
5. Niccol, Donald M. (1992), *Byzantium and Venice: a study in diplomatic and cultural relations*, Cambridge University Press,
6. Wood, Frances (1998), *Did Marco Polo Go To China?*, Westview Press.

7. *Marco Polo*, The New Encyclopædia Britannica Macropedia, 9 (15 ed.), Encyclopædia Britannica, Inc, 2002.
8. Parker, John (2004), *Marco Polo*, The World Book Encyclopedia, 15 (illustrated ed.), United States: World Book, Inc.
9. Olivier Weber, *Le grand festin de l'Orient*; Robert Laffont, 2004
10. Edwards, Mike (2005), *Marco Polo, Part 1*, Washington, D.C.: National Geographic Society
11. Falchetta, Piero (2006), *Fra Mauro's World Map*, Turnhout: Brepols.
12. McKay, John; Hill, Bennet; Buckler, John (2006), *A History of Western Society* (Eighth ed.), Houghton Mifflin Company.
13. Bergreen, Laurence (2007), *Marco Polo: From Venice to Xanadu*, Knopf Doubleday Publishing Group.
14. Power, Eileen Edna (2007), *Medieval People*, BiblioBazaar.
15. Winchester, Simon (2008), *The Man Who Loved China: Joseph Needham and the Making of a Masterpiece*, New York: HarperCollins.
16. Basil, Lubbock (2008), *The Colonial Clippers*, Read Books.
17. Brook, Timothy (2010), *The Troubled Empire: China in the Yuan and Ming Dynasties*, Harvard University Press.
18. Marco Polo (1918). Marsden, William (ed.). *The Travels of Marco Polo.* London: J.M. Dent & Sons.
19. Hart, H. Henry (1948). *Marco Polo, Venetian Adventurer.* Kessinger Publishing.
20. Dalrymple, William (1989). *In Xanadu.*
21. Daftary, Farhad (1994). *The Assassin legends: myths of the Isma'ilis (2 ed.).* I.B. Tauris.
22. Otfinoski, Steven (2003). *Marco Polo: to China and back.* New York: Benchmark Books.
23. Polo, Marco & Rustichello of Pisa (January 1, 2004). *The Travels of Marco Polo - Volume 1.* Project Gutenberg.
24. Polo, Marco & Rustichello of Pisa (May 1, 2004). *The Travels of Marco Polo - Volume 2.* Project Gutenberg.
25. Olivier Weber, *Sur les routes de la soie (On the Silk Roads) (with Reza)*, Hoëbeke, 2007
26. Yang, Dori Jones (2011). *Daughter of Xanadu.* Delacorte Press Books for Young Readers.

Chapter 3

Saint Francis of Assisi

3.1 The life of Saint Francis

Saint Francis of Assisi was born in 1181 in the Italian hilltop town of Assisi. His father, Pietro di Bernardone, was a prosperous silk merchant, and his mother Pica de Bourlemont, was a noblewoman from Provence. Saint Francis was originally called Giovanni, but his father later renamed him Francesco because of his successful business dealings in France and his admiration for all things French.

After leading the ordinary (somewhat dissolute) life of a wealthy young man of that period, Saint Francis underwent a religious conversion, following which he renounced his inheritance and embraced a life of poverty. Although not ordained as a priest, he began teaching what he believed to be the true Christian message. He soon acquired a small group of followers, and he traveled with them to Rome to ask Pope Innocent III for permission to found a new religious order. During his life, Saint Francis founded three religious orders.

Saint Francis continued to preach, and is even said to have preached to birds and animals, whom he regarded as his sisters and brothers. His attitude towards nature can be seen in his "Canticle of the Sun":

3.2 *Canticle of the Sun*

Most High, all powerful, good Lord,
Yours are the praises, the glory, the honor,
and all blessing.

To You alone, Most High, do they belong,
and no man is worthy to mention Your name.

Be praised, my Lord, through all your creatures,
especially through my lord Brother Sun,
who brings the day; and you give light through him.

And he is beautiful and radiant in all his splendor!
Of you, Most High, he bears the likeness.

Praise be You, my Lord, through Sister Moon
and the stars, in heaven you formed them
clear and precious and beautiful.

Praised be You, my Lord, through Brother Wind,
and through the air, cloudy and serene,
and every kind of weather through which
You give sustenance to Your creatures.

Praised be You, my Lord, through Sister Water,
which is very useful and humble and precious and chaste.

Praised be You, my Lord, through Brother Fire,
through whom you light the night and he is beautiful
and playful and robust and strong.

Praised be You, my Lord, through Sister Mother Earth,
who sustains us and governs us and who produces
varied fruits with colored flowers and herbs.

Praised be You, my Lord,
through those who give pardon for Your love,
and bear infirmity and tribulation.

Blessed are those who endure in peace
for by You, Most High, they shall be crowned.

Praised be You, my Lord,
through our Sister Bodily Death,
from whom no living man can escape.

Woe to those who die in mortal sin.
Blessed are those whom death will
find in Your most holy will,
for the second death shall do them no harm.

Praise and bless my Lord,
and give Him thanks
and serve Him with great humility.

3.3 Canonization

Pope Gregory IX canonized Francis on 16 July 1228. Along with Saint Catherine of Sienna, he was designated Patron Saint of Italy. He later became associated with patronage of animals and the natural environment, and it became customary for Catholic and Anglican churches to hold ceremonies blessing animals on his feast day of 4 October.

3.4 *A prayer of Saint Francis*

Blessed is he who loves and does not therefore desire to be loved;
Blessed is he who fears and does not therefore desire to be feared;
Blessed is he who serves and does not therefore desire to be served;
Blessed is he who behaves well toward others and does not desire that others behave well toward him;

Wikipedia states that **"On 29 November 1979, Pope John Paul II declared Francis the patron saint of ecology. On 28 March 1982, John Paul II said that Francis' love and care for creation was a challenge for contemporary Catholics and a reminder not to behave like dissident predators where nature is concerned, but to assume responsibility for it, taking all care so that everything stays healthy and integrated, so as to offer a welcoming and friendly environment even to those who succeed us. The same Pope wrote on the occasion of the World Day of Peace, 1 January 1990, that Francis "invited all of creation - animals, plants, natural forces, even Brother Sun and Sister Moon - to give honour and praise to the Lord. The poor man of Assisi gives us striking witness that when we are at peace with God we are better able to devote ourselves to building up that peace with all creation which is inseparable from peace among all peoples.**

"It is a popular practice on his feastday, 4 October, for people to bring their pets and other animals to church for a blessing."

Pope Francis I, an outstanding environmentalist, chose Francis as his name when he became Pope.

Figure 3.1: ***Saint Francis preaching to the birds*** **in a painting by Giotto.**

Figure 3.2: **Philip Fruytiers, *St. Francis of Assisi*, oil on canvas, 259.5 x 169.3 cm, Royal Museum of Fine Arts Antwerp).**

Figure 3.3: ***Saint Francis of Assisi in Ecstasy*, by Jusepe de Ribera.**

Figure 3.4: ***Saint Francis in Meditation*, by Francisco de Zurbarán.**

Figure 3.5: ***St. Francis and scenes from his life*, 13th century.**

Figure 3.6: **A garden statue of Francis of Assisi with birds.**

Suggestions for further reading

1. Acocella, Joan (14 January 2013). *Rich Man, Poor Man: The Radical Visions of St. Francis*. The New Yorker. Vol. 88, no. 43. pp. 72-77.
2. Brady, Kathleen (2021). *Francis and Clare: the Struggles of the Saints of Assisi*. Lodwin Press, New York.
3. *The Little Flowers [Fioretti] of Saint Francis* (Translated by Raphael Brown), Doubleday, 1998.
4. Valerie Martin, *Salvation: Scenes from the Life of St. Francis*, New York: Alfred A. Knopf, 2001.
5. Giovanni Morello and Laurence B. Kanter, eds., *The Treasury of Saint Francis of Assisi*, Electa, Milan, 1999. Catalog of exhibition at the Metropolitan Museum of Art, March 16-June 27, 1999.
6. Paul Moses, *The Saint and the Sultan: The Crusades, Islam, and Francis of Assisi's Mission of Peace*, New York: Doubleday, 2009.
7. Donald Spoto, *Reluctant Saint: The Life of Francis of Assisi*, New York: Viking Compass, 2002.
8. Brady, Ignatius Charles; Cunningham, Lawrence (29 September 2020). *St. Francis of Assisi*. Encyclopædia Britannica. Encyclopædia Britannica.
9. Brooke, Rosalind B. (2006). *The Image of St Francis: Responses to Sainthood in the Thirteenth Century*. Cambridge: University Press.
10. Chesterton, Gilbert Keith (1924). *St. Francis of Assisi (14th ed.)*. Garden City, New York: Image Books.
11. Englebert, Omer (1951). *The Lives of the Saints*. New York: Barnes & Noble.
12. Karrer, Otto, ed., *St. Francis, The Little Flowers, Legends, and Lauds*, trans. N. Wydenbruck, (London: Sheed and Ward, 1979).
13. Tolan, John V. (2009). *Saint Francis and the Sultan: The Curious History of a Christian-Muslim Encounter*. Oxford: University Press.

Chapter 4

THE INVENTION OF PRINTING

4.1 China

It was during the T'ang period that the Chinese made an invention of immense importance to the cultural evolution of mankind. This was the invention of printing. Together with writing, printing is one of the key inventions which form the basis of human cultural evolution.

Printing was invented in China in the 8th or 9th century A.D., probably by Buddhist monks who were interested in producing many copies of the sacred texts which they had translated from Sanskrit. The act of reproducing prayers was also considered to be meritorious by the Buddhists.

The Chinese had for a long time followed the custom of brushing engraved official seals with ink and using them to stamp documents. The type of ink which they used was7 made from lamp-black, water and binder. In fact, it was what we now call "India ink". However, in spite of its name, India ink is a Chinese invention, which later spread to India, and from there to Europe.

We mentioned that paper of the type which we now use was invented in China in the first century A.D.. Thus, the Buddhist monks of China had all the elements which they needed to make printing practical: They had good ink, cheap, smooth paper, and the tradition of stamping documents with ink-covered engraved seals. The first block prints which they produced date from the 8th century A.D.. They were made by carving a block of wood the size of a printed page so that raised characters remained, brushing ink onto the block, and pressing this onto a sheet of paper.

The oldest known printed book, the "Diamond Sutra", is dated 868 A.D.., and it consists of only six printed pages. In was discovered in 1907 by an English scholar who obtained permission from Buddhist monks in Chinese Turkestan to open some walled-up monastery rooms, which were said to have been sealed for 900 years. The rooms were found to contain a library of about 15,000 manuscripts, among which was the Diamond Sutra.

Block printing spread quickly throughout China, and also reached Japan, where wood-

block printing ultimately reached great heights in the work of such artists as Hiroshige and Hokusai. The Chinese made some early experiments with movable type, but movable type never became popular in China, because the Chinese written language contains 10,000 characters. However, printing with movable type was highly successful in Korea as early as the 15th century A.D..

The unsuitability of the Chinese written language for the use of movable type was the greatest tragedy of the Chinese civilization. Writing had been developed at a very early stage in Chinese history, but the system remained a pictographic system, with a different character for each word. A phonetic system of writing was never developed.

The failure to develop a phonetic system of writing had its roots in the Chinese imperial system of government. The Chinese empire formed a vast area in which many different languages were spoken. It was necessary to have a universal language of some kind in order to govern such an empire. The Chinese written language solved this problem admirably.

Suppose that the emperor sent identical letters to two officials in different districts. Reading the letters aloud, the officials might use entirely different words, although the characters in the letters were the same. Thus the Chinese written language was a sort of "Esperanto" which allowed communication between various language groups, and its usefulness as such prevented its replacement by a phonetic system.

The invention of block printing during the T'ang dynasty had an enormously stimulating effect on literature, and the T'ang period is regarded as the golden age of Chinese lyric poetry. A collection of T'ang poetry, compiled in the 18th century, contains 48,900 poems by more than 2,000 poets.

Figure 4.1: **The Diamond Sutra, 868 A.D., is the first known printed book.**

4.2 Islamic civilization and printing

Muslims in Egypt and probably elsewhere were using printing to mass-produce texts as early as the 10th century. Dozens of examples of their output are preserved in museums and libraries, but have, until recently, been overlooked and neglected by scholars. This phenomenon is yet another example of the 1000-year missing history of science and technology.

It is, however, true that Muslims did not use printing to produce books, nor extended texts in any form, until the 18th century. This challenge was taken up by Europeans from the 15th century onwards, and it would not have been possible there, without the availability of another gift from the Muslims, paper, which had earlier reached Europe from the Muslim world, via Spain and Italy.

Figure 4.2: **A handwritten Islamic manuscript: Qazwini, 'Ajaib al-makhluqat, MS probably from Mosul, ca.1305. British Library.**

4.3 Gutenberg

Johannes Gensfleisch zur Laden zum Gutenberg (c.1400-1468) was born in the German city of Mainz. He was the youngest son of an upper-class merchant, Friele Gensfleisch zur Laden, whose long-established family traced its roots back to the 13th century.

Johannes Gutenberg was educated as a goldsmith and blacksmith, and may also have attended the University of Erfurt. In 1440, while he was living in Strassburg. he is said to have perfected and unveiled his system of printing with movable type.

By 1448, he was back in Mainz, where he took a loan from his brother-on-law to meet the expenses of setting up a printing press.In 1450, the press was in operation, and Gutenberg took a further loan, 800 guilders, from the moneylender Johann Fust. Peter Schöffer, who became Fust's son-in-law also joined the enterprise, and is believed to have designed the type faces.

Among the many technical innovations introduced by Gutenberg are the invention of a process for mass-producing movable type; the use of oil-based ink for printing books; adjustable molds; mechanical movable type; and the use of a wooden printing press similar to the agricultural screw presses of the period. The alloy which he used was a mixture of lead, tin, and antimony that melted at a relatively low temperature for faster and more economical casting, cast well, and created a durable type. The combination of all these elements made the mass production of books both practical and economically feasible.

Gutenberg's greatest artistic achievement was his printed Bible, but this project also cost so much that it left him with debts of more than 20,000 guilders. A court order gave Fust control of the Bible printing project, and half of the printed Bibles.

Although he had suffered bankruptcy, the aging Gutenberg's greatness was acknowledged in 1465. He was given the tithe "Hofmann" (Gentleman of the Court) and awarded a yearly stipend, as well as 2,180 liters of grain and 2,000 liters of wine tax-free. He died in 1468, having enjoyed this official recognition for only three years.

Printing quickly affected both religion and science in Europe. By 1517, when Martin Luther posted his Ninety-Five Theses on the door of All Saint's Church in Wittenburg, many cities has printing presses. The theses were quickly reprinted and translated, and they spread throughout Europe. This initiated a pamphlet war, in which both sides used printing to spread their views. The impact of Luther's German translation of the Bible was greatly increased by the fact that inexpensive printed copies were widely available.

Science was Similarly revolutionized. Nicolaus Copernicus (1473-1543) had a far greater impact on the history of science than his near contemporary Leonardo da Vinci (1452-1519) because of printing. Leonardo's thousands of pages of notes and his innovations in virtually all the fields of human knowledge have only recently become available in printed form. By contrast, the publication Copernicus' great book, *De revolutionibus orbium coelestium* (On the Revolutions of the Celestial Spheres) initiated a sequence of discoveries by Tycho Brahe, Galileo, Johannes Kepler and Isaac Newton, discoveries upon which the modern world is built.

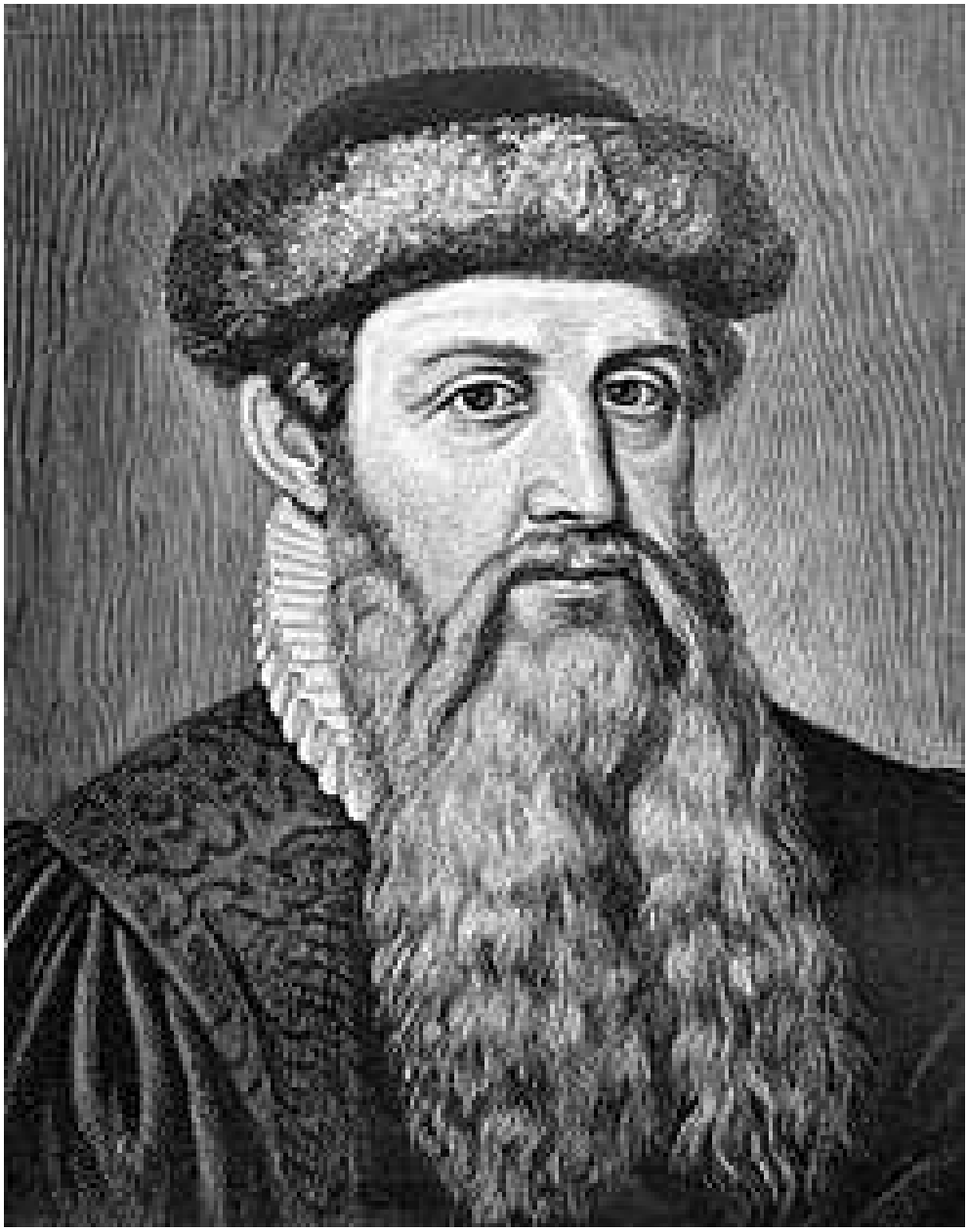

Figure 4.3: **Gutenberg is credited with introducing printing with movable type into Europe, with many improvements of technique. His inventions were a turning point in European history, and ushered in the modern era, the Reformation, the Age of Reason and the Industrial Revolution.**

Figure 4.4: **Gutenberg's printing press**

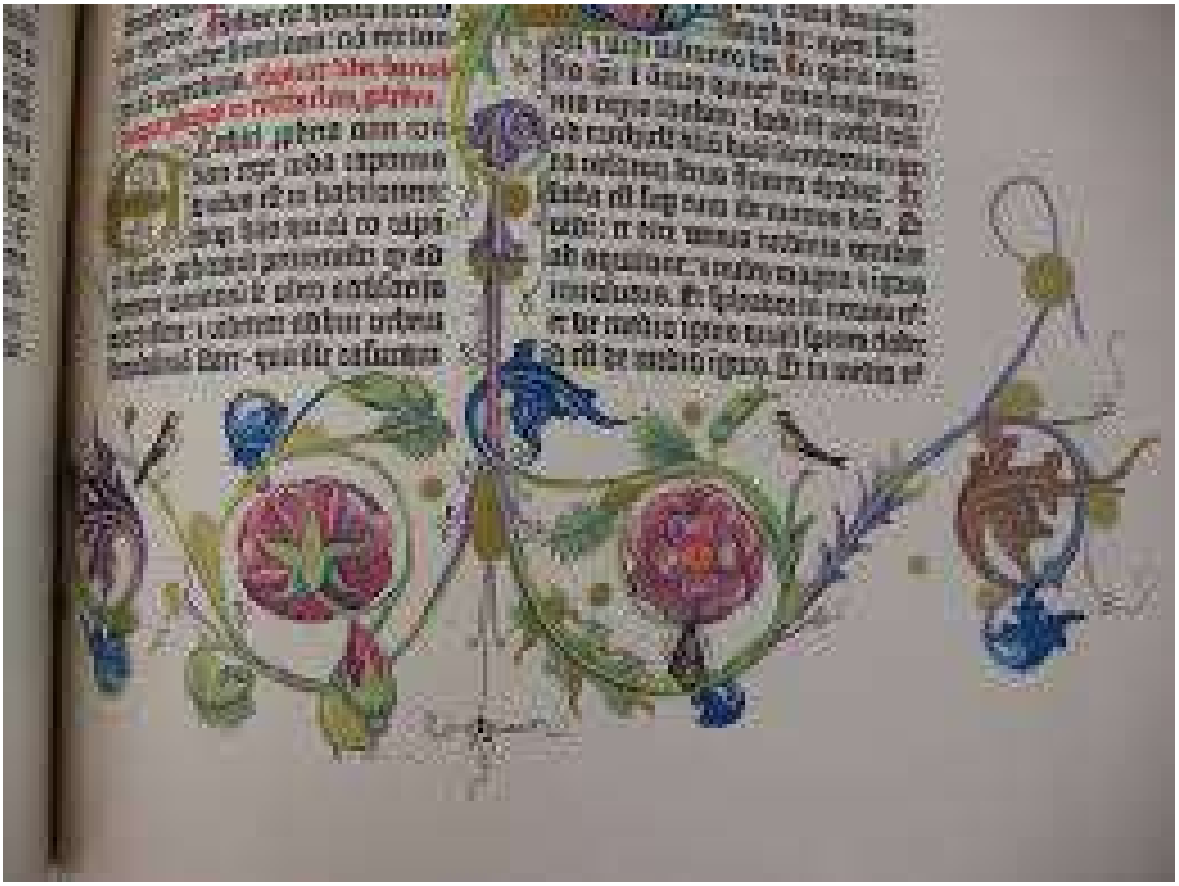

Figure 4.5: **Gutenberg's bible**

Suggestions for further reading

1. Phillip Bricker and R.I.G. Hughs, *Philosophical Perspectives on Newtonian Science*, M.I.T. Press, Cambridge, Mass., (1990).
2. Zev Bechler, *Newton's Physics and the Conceptual Structure of the Scientific Revolution*, Kluwer, Dordrecht, (1991).
3. Zev Bechler, *Contemporary Newtonian Research*, Reidel, Dordrecht, (1982).
4. I. Bernard Cohen, *The Newtonian Revolution*, Cambridge University Press, (1980).
5. B.J.T. Dobbs, *The Janus Face of Genius; The Role of Alchemy in Newton's Thought*, Cambridge University Press, (1991).
6. Paul B. Scheurer and G. Debrock, *Newton's Scientific and Philosophical Legacy*, Kluwer, Dordrecht, (1988).
7. A. Rupert Hall, *Isaac Newton, Adventurer in Thought*, Blackwell, Oxford, (1992).
8. Frank Durham and Robert D. Purrington, *Some Truer Method; Reflections on the Heritage of Newton*, Columbia University Press, New York, (1990).
9. John Fauvel, *Let Newton Be*, Oxford University Press, (1989).
10. René Taton and Curtis Wilson, *Planetary Astronomy from the Renaissance to the Rise of Astrophysics*, Cambridge University Press, (1989).
11. Brian Vickers, *English Science, Bacon to Newton*, Cambridge University Press, (1989).
12. John G. Burke, *The Uses of Science in the Age of Newton*, University of California Press, (1983).
13. A.I. Sabra, *Theories of Light from Descartes to Newton*, Cambridge University Press, (1991).
14. E.N. da Costa Andrade, *Isaac Newton*, Folcroft Library Editions, (1979).
15. Gideon Freudenthal, *Atom and Individual in the Age of Newton*, Reidel, Dordrecht, (1986).
16. Henry Guerlac, *Newton on the Continent*, Cornell University Press, (1981).
17. A.R. Hall, *Philosophers at War; the Quarrel Between Newton and Leibnitz*, Cambridge University Press, (1980).
18. Gale E. Christianson, *In the Presence of the Creator; Isaac Newton and his Times*, Free Press, New York, (1984).
19. Lesley Murdin, *Under Newton's Shadow; Astronomical Practices in the Seventeenth Century*, Hilger, Bristol, (1985).
20. H.D. Anthony, *Sir Isaac Newton*, Collier, New York (1961).
21. Sir Oliver Lodge, *Pioneers of Science*, Dover, New York (1960).

Chapter 5

MATHEMATICIANS AL-KHWARIZMI AND OMAR KHAYAM

Wikipedia says of him:

"Muhammad ibn Musa al-Khwarizmi (c.780-c.850), Arabized as al-Khwarizmi and formerly Latinized as Algorithmi, was a Persian polymath who produced vastly influential works in mathematics, astronomy, and geography. Around 820 CE he was appointed as the astronomer and head of the library of the House of Wisdom in Baghdad.

"Al-Khwarizmi's popularizing treatise on algebra (The Compendious Book on Calculation by Completion and Balancing, c. 813-833 CE) presented the first systematic solution of linear and quadratic equations. One of his principal achievements in algebra was his demonstration of how to solve quadratic equations by completing the square, for which he provided geometric justifications. Because he was the first to treat algebra as an independent discipline and introduced the methods of 'reduction' and 'balancing' (the transposition of subtracted terms to the other side of an equation, that is, the cancellation of like terms on opposite sides of the equation), he has been described as the father or founder of algebra. The term algebra itself comes from the title of his book (the word al-jabr meaning 'completion' or 'rejoining'). His name gave rise to the terms algorism and algorithm, as well as Spanish and Portuguese terms algoritmo, and Spanish guarismo and Portuguese algarismo meaning 'digit'.

"In the 12th century, Latin translations of his textbook on arithmetic (*Algorithmo de Numero Indorum*) which codified the various Indian numerals, introduced the decimal positional number system to the Western world. The *Compendious Book on Calculation by Completion and Balancing*, translated into Latin by Robert of Chester in 1145, was used until the sixteenth century as the principal mathematical text-book of European universities.

"In addition to his best-known works, he revised Ptolemy's *Geography*, list-

ing the longitudes and latitudes of various cities and localities. He further produced a set of astronomical tables and wrote about calendaric works, as well as the astrolabe and the sundial. He also made important contributions to trigonometry, producing accurate sine and cosine tables...”

Figure 5.1: **Statue of al-Khwarizmi in front of the Faculty of Mathematics of Amirkabir University of Technology in Tehran. Iran.**

Figure 5.2: **A stamp issued September 6, 1983 in the Soviet Union, commemorating al-Khwarizmi's (approximate) 1200th birthday.**

Figure 5.3: **Statue of Al-Khwarizmi in Uzbekistan.**

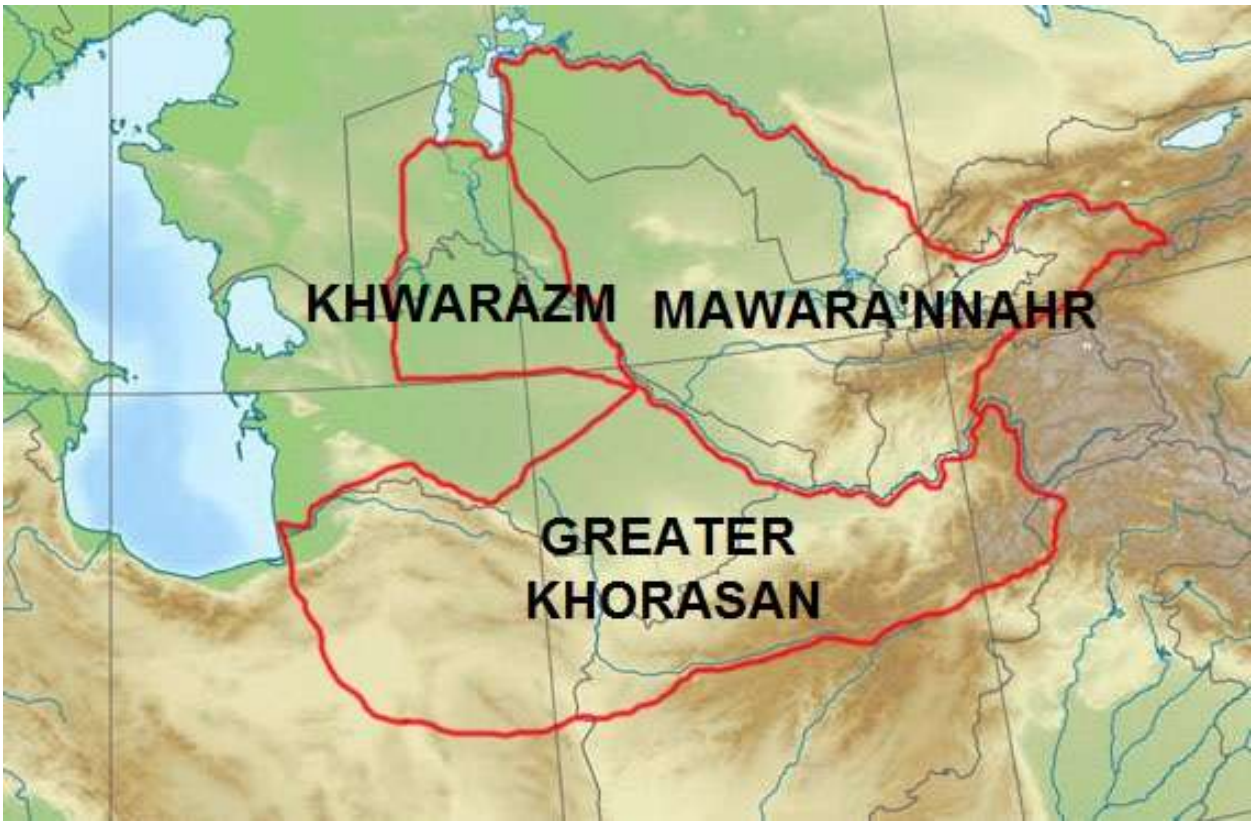

Figure 5.4: **This map shows Khwarazm, the place of Al-Khwarizmi's birth. It lies to the east of the Caspian Sea.**

Figure 5.5: **Scholars at the library of the House of Wisdom in Baghdad. Illustration by Yahyá al-Wasiti, 1237.**

5.1 Al-Khwarizmi's life

Muhammad ibn Musa al-Khwarizmi (c.780-c.850) was born in the Persian province of Khwarazm, shown on the map in Figure 4.4. During his lifetime, Muslim conquests made Baghdad the most important intellectual center, and scholars from as far away as China were attracted to the Arab capitol. Al-Khwarizmi also traveled to Baghdad, where he worked at the "House of Wisdom", which had been established by Caliph al-Ma'mun. Here he was able to study both Greek and Sanskrit manuscripts on science and mathematics, and to carry out his highly influential original work.

5.2 The father of algebra

Al-Khwarizmi has been called "the father of algebra". J. J. O'Connor and E. F. Robertson wrote in the MacTutor History of Mathematics archive:

"Perhaps one of the most significant advances made by Arabic mathematics began at this time with the work of al-Khwarizmi, namely the beginnings of algebra. It is important to understand just how significant this new idea was. It was a revolutionary move away from the Greek concept of mathematics which was essentially geometry. Algebra was a unifying theory which allowed rational numbers, irrational numbers, geometrical magnitudes, etc., to all be treated as 'algebraic objects'. It gave mathematics a whole new development path so much broader in concept to that which had existed before, and provided a vehicle for future development of the subject. Another important aspect of the introduction of algebraic ideas was that it allowed mathematics to be applied to itself in a way which had not happened before."

In modern terms, one of the methods introduced by al-Khwarizmi corresponds to moving terms in an equation freely to the right or left of the equal sign in an equation, with a change of sign. He also introduced a systematic method for solving quadratic equations. However, modern notation had not been invented at the time, and al-Khwarizmi described all of the operations for solving a problem in words, even using words rather than symbols for numbers. He introduced the decimal positional number system to the west. When we speak of "Arabic numerals", it is because of his work. However, positional number systems had long been in use, both in Mesopotamia and in India.

Wikipedia states that:

"Al-Khwarizmi's work on arithmetic was responsible for introducing the Arabic numerals, based on the Hindu-Arabic numeral system developed in Indian mathematics, to the Western world. The term 'algorithm' is derived from the algorism, the technique of performing arithmetic with Hindu-Arabic numerals developed by al-Khwarizmi. Both 'algorithm' and 'algorism' are derived from the Latinized forms of al-Khwarizmi's name, Algoritmi and Algorismi, respectively."

In 1145. Al-Khwarizmi's book *Compendious Book on Calculation by Completion and Balancing,* was translated into Latin by Robert of Chester, and for many centuries it was the principle book on mathematics used at European universities.

5.3 Contributions to astronomy

Al-Khwarizmi's book on astronomy, *Zij al-Sindhind*, consisted of approximately 37 chapters on calendars and calculations. and 116 tables. The tables give the values of trigonometric functions and calculated locations of the sun, moon and the five planets that were known at the time. The fact that al-Khwarizmi performed original calculations of these positions marked a turning point in Islamic astronomy. The original manuscript has been lost, but copies of a Latin translation, thought to be by Adalard of Bath, exist in four European libraries, in Chartres, Paris, Madrid and Oxford.

5.4 Omar's family and education

Omar Khayyam (1048-1131) was born in the city of Nishapur, which is located in the northern part of Persia, or present-day Iran. His father was a wealthy physician, who paid a tutor to give his son Omar an excellent education. The tutor, Bahmanyar bin Marzban, was a Zoroastrian, and had been a student of the great physician, scientist, and philosopher Avicenna. Thus Omar Khayyam received an unusually good education in science, philosophy and mathematics.

In 1066, Omar's father died, and his tutor also died soon afterwards. Two years later, in 1068, Omar joined a caravan for a three-month journey to Samarkand, then a great center of learning in Uzbekistan. He arrived there at the age of 20, and introduced himself to the governor of the city, Abe Tapir, an old friend of his father. Tahir soon recognized Omar's extraordinary mathematical ability and have him a job in his office. Soon afterwards, Omar was promoted to a job in the king's treasury.

Two years later, in 1070, Omar Khayyam published one of his greatest mathematical works, *Treatise on Demonstration of Problems of Algebra and Balancing.* This book contains a discussion of cubic equations, and it shows that they may have more than one root. Like other Islamic mathematicians, Omar did not consider negative roots. The book established Omar's reputation as a mathematician, and his fame spread throughout Persia,

5.5 Invited to Isfahan

In 1073, the young but already famous Omar received an invitation to come to Persia's capitol city, Isfahan. The invitation came from the two most powerful men of the Seljuk Empire, Malik Shah, Sultan of the empire, and Nizam al-Mulk, his vizier. Omar's job was to produce a calendar that would be valid over a long period, without the need for

adjustment. He was given an enormous salary, and the means to hire many assistants. With these ample means, he recruited many talented scientists and founded an astronomical observatory.

Omar measured the length of the tropical year with extraordinary accuracy. His value, 365.2422 days. is extremely close to the currently-accepted value.

5.6 Linking algebra and geometry

The Pythagoreans had abandoned algebra when they discovered irrational numbers, such as $\sqrt{2}$, since their religion was based on the idea rationality both in mathematics and in the social sphere. Ancient Greek mathematics concentrated on geometry.

The union of geometry and algebra was pioneered in the western world by Pierre de Fermat and René Descartes. However, both Fermat and Descartes were preceded in the Islamic world by Omar Khayyam, whose mathematical work united algebra and geometry.

5.7 Omar Khayyam anticipates non-Euclidean geometry

Throughout history, many authors have doubted that Euclid's fifth postulate concerning parallel lines was necessary. Many, including Khayyam, have tried to prove the fifth postulate from the first four. Omar's attempt is particularly interesting because in it we can see the first glimmerings on non-Euclidean geometry, later developed in Europe by Gauss and Riemann. One of Omar's diagrams is shown in Figure 5.6.

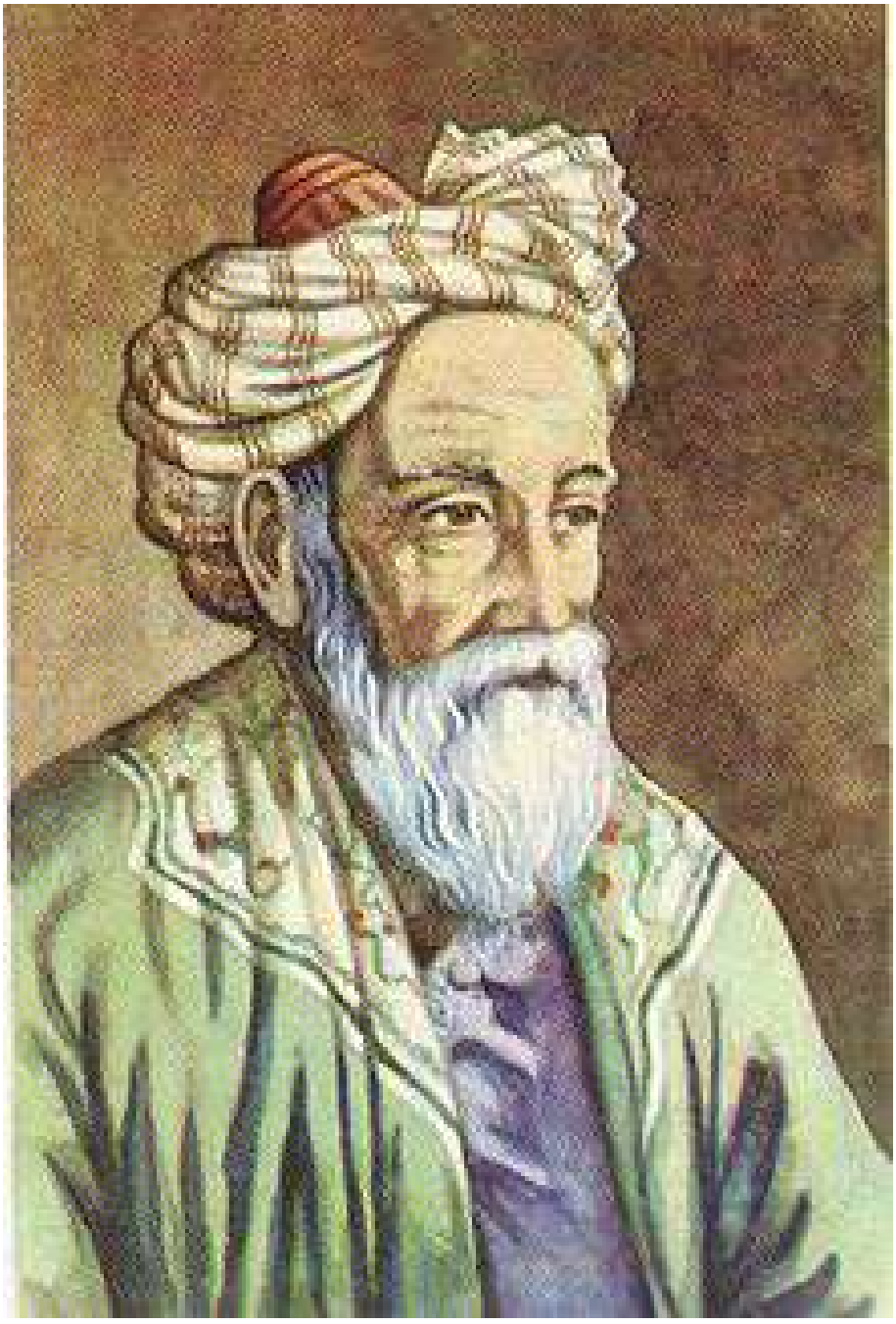

Figure 5.6: **Omar Khayyam was a Persian mathematician, astronomer and poet. His work in mathematics was notable for his solutions to cubic equations, his understanding of the binomial theorem, and his discussions of the axioms of Euclid. As an astronomer, he directed the building of an observatory to reform the Persian calendar. Omar Khayyam's long poem, *Rubaiyat*, is known to western readers through Edward Fitzgerald's brilliant translation.**

Figure 5.7: **Omar Khayyam.**

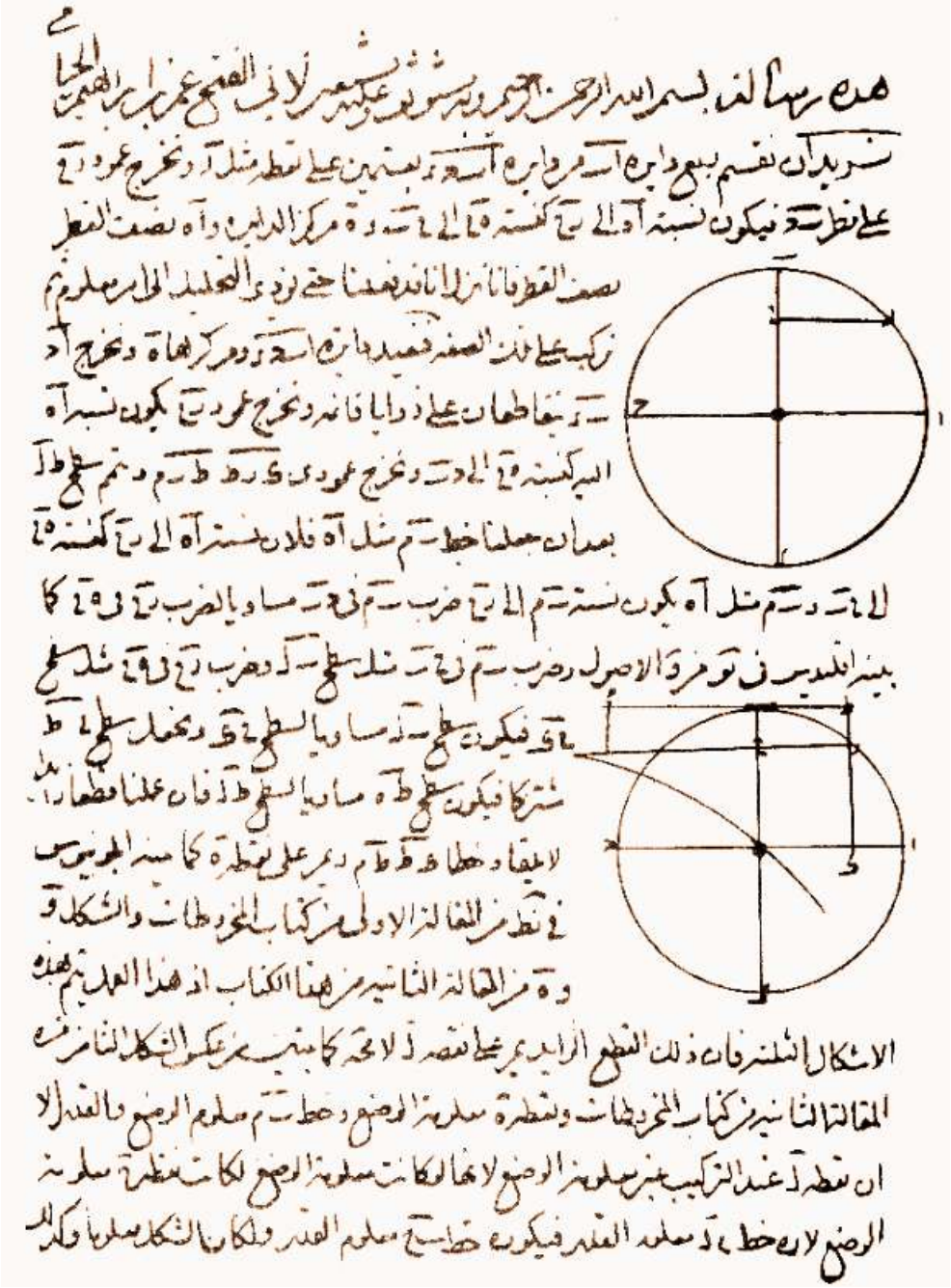

Figure 5.8: **"Cubic equation and intersection of conic sections" the first page of a two-chaptered manuscript kept in Tehran University.**

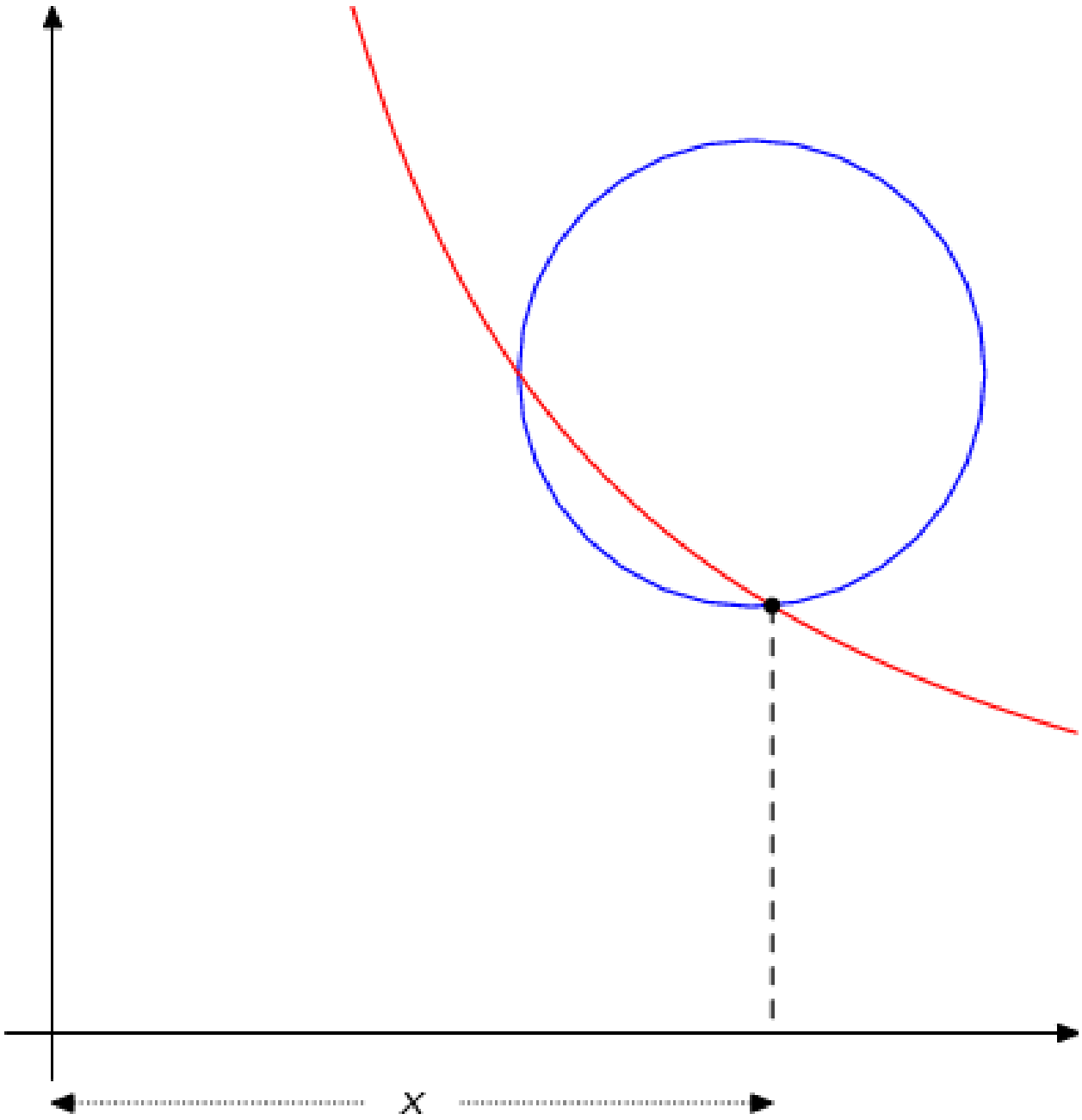

Figure 5.9: **Omar Khayyam's construction of a solution to the cubic equation $x^3+2x = 2x^2+2$. The intersection point produced by the circle and the hyperbola determine the desired segment.**

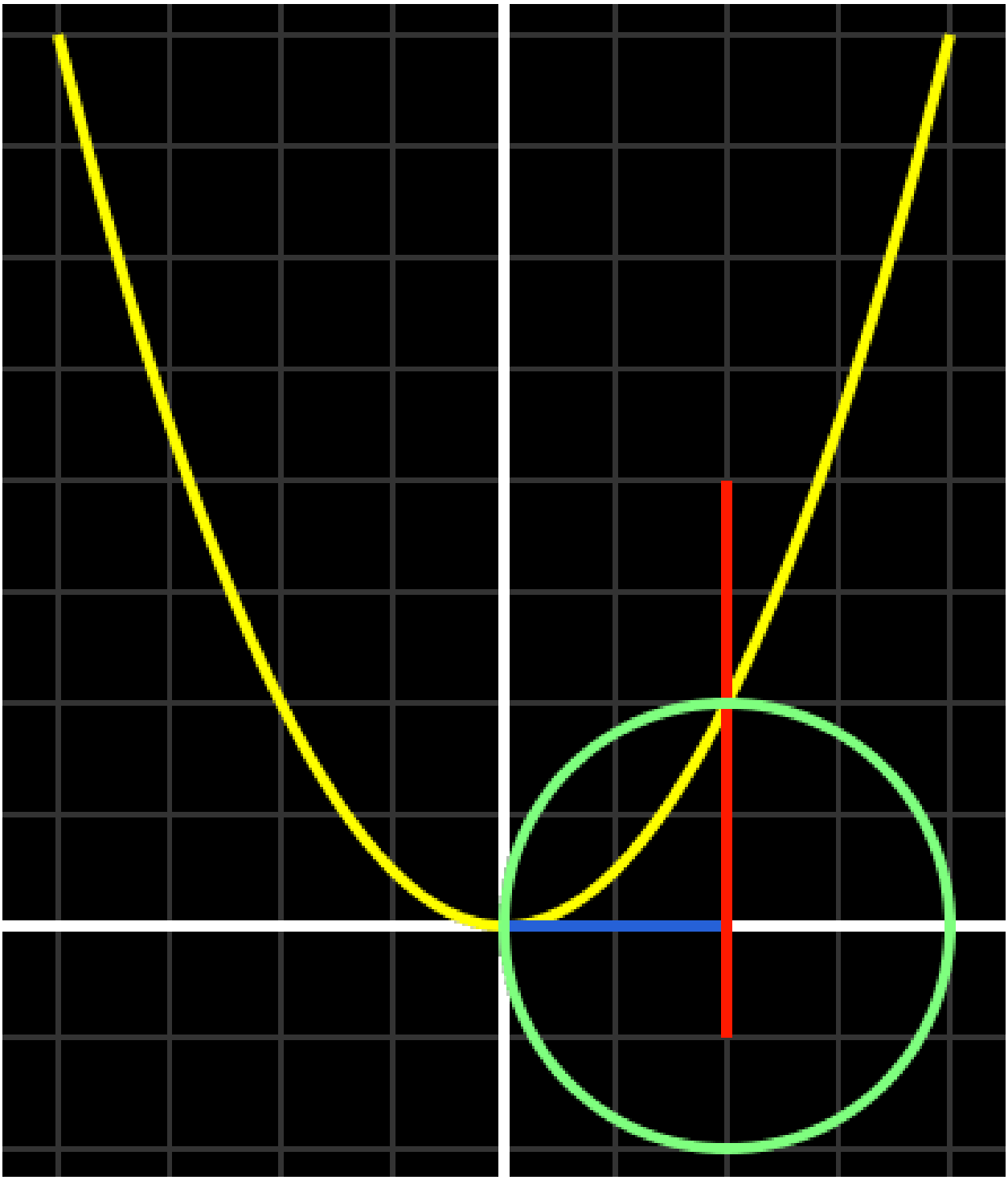

Figure 5.10: **In the language of modern mathematics, Khayyam's solution to the equation $x^3 + a^2x = b$ features a parabola of equation $x^2 = ay$, a circle with diameter b/a^2, and a vertical line through the intersection point. The solution is given by the distance on the x-axis between the origin and the (red) vertical line. Image by Pieter Kuiper.**

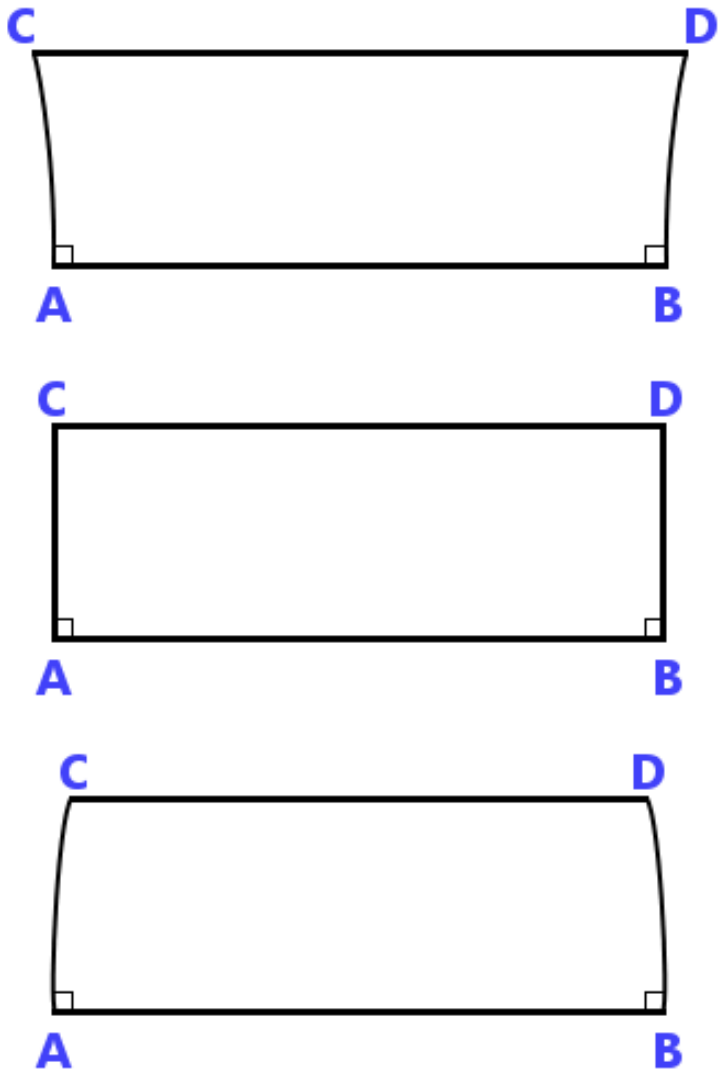

Figure 5.11: **In Omar Khayyam's discussion of Euclid's postulate concerning parallel lines, we see the first glimmering of non-Euclidean geometry. The figure shows one of Khayyam's diagrams. Lines which are locally parallel at one point meet at another point when they are drawn on curved surfaces.**

Figure 5.12: **Statue of Omar Khayyam in Bucharest.**

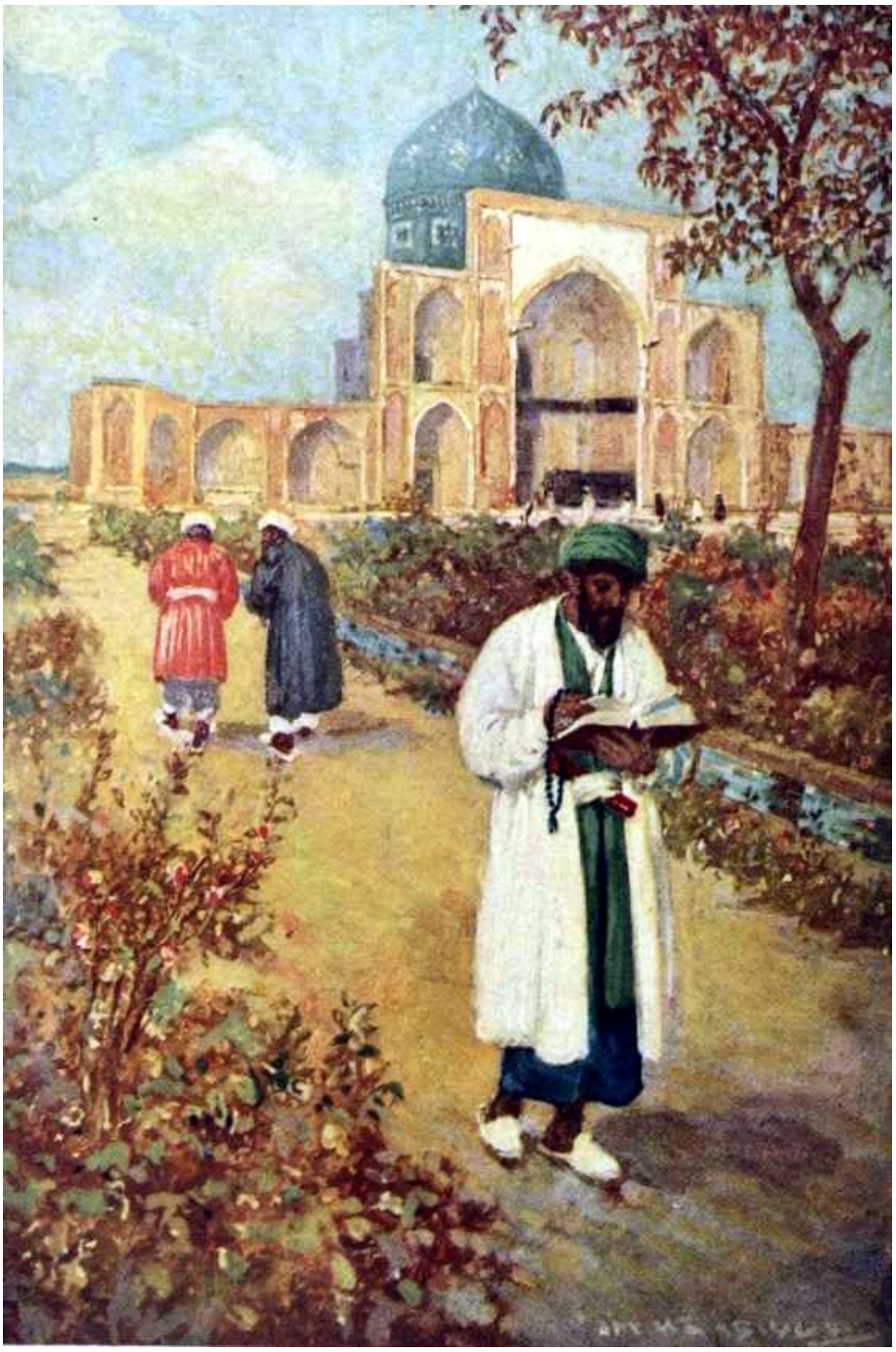

Figure 5.13: **"At the Tomb of Omar Khayyam" by Jay Hambidge (1911).**

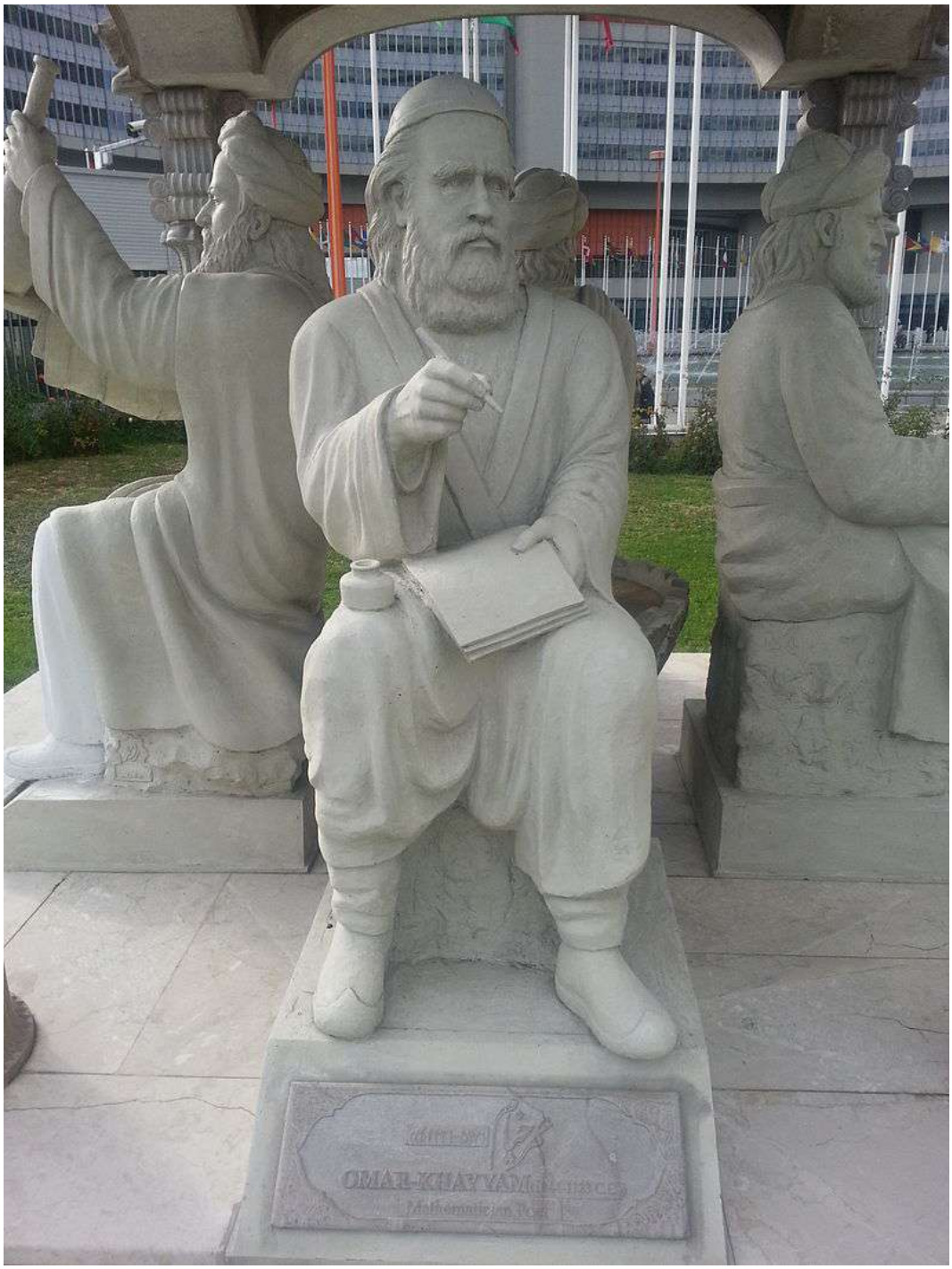

Figure 5.14: **The statue of Khayyam in United Nations Office in Vienna as a part of Persian Scholars Pavilion donated by Iran.**

Suggestions for further reading

1. Toomer, Gerald (1990). *Al-Khwarizmi, Abu Ja'far Muhammad ibn Musa.* In Gillispie, Charles Coulston (ed.). Dictionary of Scientific Biography. 7. New York: Charles Scribner's Sons.
2. Arndt, A. B. (1983). *Al-Khwarizmi* (PDF). 76 (9). National Council of Teachers of Mathematics: 668-670.
3. Berggren, J. Lennart (1986). *Episodes in the Mathematics of Medieval Islam.* New York: Springer Science+Business Media.
4. Boyer, Carl B. (1991). *The Arabic Hegemony.* A History of Mathematics (Second ed.). John Wiley &- Sons, Inc.
5. Daffa, Ali Abdullah al- (1977). *The Muslim contribution to mathematics.* London: Croom Helm.
6. Dallal, Ahmad (1999). *Science, Medicine and Technology.* In Esposito, John (ed.). The Oxford History of Islam. Oxford University Press, New York.
7. Kennedy, E.S. (1956). *A Survey of Islamic Astronomical Tables; Transactions of the American Philosophical Society.* 46 (2). Philadelphia: American Philosophical Society.
8. Brentjes, Sonja (2007). *Khwarizmi: Muhammad ibn Musa al-Khwarizmi* in Thomas Hockey et al.(eds.). The Biographical Encyclopedia of Astronomers, Springer Reference. New York: Springer, 2007, pp. 631-633. (PDF version)
9. Dunlop, Douglas Morton (1943). *Muhammad b. Musa al-Khwarizmi.* The Journal of the Royal Asiatic Society of Great Britain and Ireland (2): 248-250.
10. Hogendijk, Jan P., *Muhammad ibn Musa (Al-)Khwarizmi (c. 780-850 CE) - bibliography of his works, manuscripts, editions and translations.*
11. O'Connor, John J.; Robertson, Edmund F., *Abu Ja'far Muhammad ibn Musa Al-Khwarizmi*, MacTutor History of Mathematics archive, University of St Andrews.
12. Fuat Sezgin. Geschichte des arabischen Schrifttums. 1974, E.J. Brill, Leiden, the Netherlands.
13. Sezgin, F., ed., *Islamic Mathematics and Astronomy*, Frankfurt: Institut für Geschichte der arabisch-islamischen Wissenschaften, 1997-99.
14. King, David A. (1999a). *Islamic Astronomy.* In Walker, Christopher (ed.). Astronomy before the telescope. British Museum Press. pp. 143-174.
15. King, David A. (2002). *A Vetustissimus Arabic Text on the Quadrans Vetus.* Journal for the History of Astronomy. 33 (112): 237-255.
16. Struik, Dirk Jan (1987). *A Concise History of Mathematics* (4th ed.). Dover Publications.
17. O'Connor, John J.; Robertson, Edmund F., *Abraham bar Hiyya Ha-Nasi*, MacTutor History of Mathematics archive, University of St Andrews.
18. O'Connor, John J.; Robertson, Edmund F., *Arabic mathematics: forgotten brilliance?*, MacTutor History of Mathematics archive, University of St Andrews.

19. Roshdi Rashed, *The development of Arabic mathematics: between arithmetic and algebra*, London, 1994.
20. Vogel, Kurt (1968).*Mohammed ibn Musa Alchwarizmi's Algorismus; das früheste Lehrbuch zum Rechnen mit indischen Ziffern. Nach der einzigen (lateinischen) Handschrift* (Cambridge Un. Lib. Ms. Ii. 6.5) in Faksimile mit Transkription und Kommentar herausgegeben von Kurt Vogel. Aalen, O. Zeller.
21. Goldstein, B.R. (1968). *Commentary on the Astronomical Tables of Al-Khwarizmi: By Ibn Al-Muthanna*. Yale University Press.
22. Hogendijk, Jan P. (1991). *Al-Khwarizmi's Table of the "Sine of the Hours" and the Underlying Sine Table*. Historia Scientiarum. 42: 1-12.
23. King, David A. (1983). *Al-Khwarizmi and New Trends in Mathematical Astronomy in the Ninth Century*. New York University: Hagop Kevorkian Center for Near Eastern Studies: Occasional Papers on the Near East 2.
24. Neugebauer, Otto (1962). *The Astronomical Tables of al-Khwarizmi*.
25. Rosenfeld, Boris A. (1993). Menso Folkerts; J.P. Hogendijk (eds.). *Geometric trigonometry* in treatises of al-Khwarizmi, al-Mahani and Ibn al-Haytham. Vestiga Mathematica: Studies in Medieval and Early Modern Mathematics in Honour of H.L.L. Busard. Amsterdam: Rodopi.
26. Suter, Heinrich. [Ed.]: *Die astronomischen Tafeln des Muhammed ibn Musa al-Khwarizmi in der Bearbeitung des Maslama ibn Ahmed al-Madjriti und der latein. Übersetzung des Athelhard von Bath auf Grund der Vorarbeiten von A. Bjørnbo und R. Besthorn in Kopenhagen. Hrsg. und komm. Kopenhagen 1914*. 288 pp. Repr. 1997 (Islamic Mathematics and Astronomy. 7).
27. Van Dalen, B. *Al-Khwarizmi's Astronomical Tables Revisited: Analysis of the Equation of Time*.
28. Gandz, Solomon (November 1926). *The Origin of the Term "Algebra"*. The American Mathematical Monthly. 33 (9): 437-440.
29. Gandz, Solomon (1936). *The Sources of al-Khowarizmi's Algebra*. Osiris. 1 (1): 263-277.
30. Gandz, Solomon (1938). *The Algebra of Inheritance: A Rehabilitation of Al-Khuwarizmi*. Osiris. 5 (5): 319-391.
31. Hughes, Barnabas (1986). *Gerard of Cremona's Translation of al-Khwarizmi's al-Jabr: A Critical Edition*. Mediaeval Studies. 48: 211-263.
32. Barnabas Hughes. *Robert of Chester's Latin translation of al-Khwarizmi's al-Jabr: A new critical edition*. In Latin. F. Steiner Verlag Wiesbaden (1989).
33. Karpinski, L.C. (1915). *Robert of Chester's Latin Translation of the Algebra of Al-Khowarizmi: With an Introduction, Critical Notes and an English Version*. The Macmillan Company.
34. Rosen, Fredrick (1831). *The Algebra of Mohammed Ben Musa*. Kessinger Publishing.
35. Ruska, Julius (1917). *Zur ältesten arabischen Algebra und Rechenkunst*. Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Philosophisch-historische Klasse. Sitzungsberichte der Heidelberger Akademie der Wissenschaften. Philologisch-historische Klasse. Jahr. 1917,2. Abh: 1-125.

36. Gandz, Solomon (1936). *The Sources of al-Khowarizmi's Algebra*. Osiris. 1 (1): 263-277.
37. Daunicht, Hubert (1968-1970). *Der Osten nach der Erdkarte al-á¸¥uwarizmis : Beiträge zur historischen Geographie und Geschichte Asiens* (in German). Bonner orientalistische Studien. N.S.; Bd. 19.
38. Mzik, Hans von (1915). *Ptolemaeus und die Karten der arabischen Geographen*. Mitteil. D. K. K. Geogr. Ges. In Wien. 58: 152.
39. Nallino, C.A. (1896), *Al-Huwarizmi e il suo rifacimento della Geografia di Tolemo*, Atti della R. Accad. Dei Lincei, Arno 291, Serie V, Memorie, Classe di Sc. Mor., Vol. II, Rome
40. Ruska, Julius (1918). *Neue Bausteine zur Geschichte der arabischen Geographie*. Geographische Zeitschrift. 24: 77-81.
41. Spitta, W. (1879). *HuwarizmI's Auszug aus der Geographie des Ptolomaeus*. Zeitschrift Deutschen Morgenl. Gesell. 33.
42. Burnett, Charles (2017), *Arabic Numerals*, in Thomas F. Glick (ed.), *Routledge Revivals: Medieval Science, Technology and Medicine* (2006): An Encyclopedia, Taylor &- Francis,
43. Folkerts, Menso (1997). *Die älteste lateinische Schrift über das indische Rechnen nach al-Hwarizmi* (in German and Latin). München: Bayerische Akademie der Wissenschaften.
44. Edward FitzGerald (translator) *The Rubaiyat of Omar Khayyam* Howard Willford Bell, 1901
45. Victor J. Katz *A History of Mathematics: An Introduction* HarperCollins College Publishers, New York, 1993
46. Roshdi Rashed (Editor) *Encyclopedia of the History of Arabic science* Routledge, 1996
47. *History of Astronomy - Middle East* ephemeris.com, 2003
48. Hazhir Teimourian *Omar Khayyam: Poet, Rebel, Astronomer* The History Press, 2008
49. Mehdi Aminrazavi *The Wine of Wisdom: The Life, Poetry and Philosophy of Omar Khayyam*, Oneworld Publications, 2013

Chapter 6

PAINTERS IN CHINA AND RUSSIA

6.1 Some examples of traditional Chinese painting

Traditional Chinese painting is an extremely old tradition, one of the oldest in the world. Oils are not used. Instead the paintings are made on silk or paper, using a brush dipped in ink. Wikipedia lists two main techniques:

- **Gongbi, meaning "meticulous", uses highly detailed brushstrokes that delimit details very precisely. It is often highly coloured and usually depicts figural or narrative subjects. It is often practised by artists working for the royal court or in independent workshops.**
- **Ink and wash painting... ("water and ink") also loosely termed watercolour or brush painting, and also known as "literati painting", as it was one of the "Four Arts" of the Chinese Scholar-official class. In theory this was an art practiced by gentlemen, a distinction that begins to be made in writings on art from the Song dynasty, though in fact the careers of leading exponents could benefit considerably.[2] This style is also referred to as "xieyi" or freehand style.**

Landscape painting was regarded as the highest form of Chinese painting, and generally still is. The time from the Five Dynasties period to the Northern Song period (907-1127) is known as the "Great age of Chinese landscape". In the north, artists such as Jing Hao, Li Cheng, Fan Kuan, and Guo Xi painted pictures of towering mountains, using strong black lines, ink wash, and sharp, dotted brushstrokes to suggest rough stone. In the south, Dong Yuan, Juran, and other artists painted the rolling hills and rivers of their native countryside in peaceful scenes done with softer, rubbed brushwork. These two kinds of scenes and techniques became the classical styles of Chinese landscape painting.

Figure 6.1: ***Quietly Listening to Wind in the Pines*, by Ma Lin (1180-1256), National Palace Museum, Taibei, Taiwan.**

Figure 6.2: ***Loquats and Mountain Bird*, painting, album leaf, colors on silk, Chinese Southern Song Dynasty (1127-1279), Collection of the National Palace Museum, Beijing.**

Figure 6.3: ***Buddhist Temple in the Mountains*, 11th century, ink on silk, Nelson-Atkins Museum of Art, Kansas City, Missouri.**

6.2 Calligraphy as an art-form

Calligraphy, literally "beautiful writing," has been appreciated as an art form in many different cultures throughout the world, but the stature of calligraphy in Chinese culture is unmatched.

Xi'an's Forest of Stelae

Xi'an is a city in northwest China, at the eastern end of the Silk Road. It was once the capital of China, and at that time, together with Rome, it was one of the world's two largest cities. Near to Xi'an, is the recently-discovered Terraotta Army.

Among the many interesting things to see in Xi'an is the Museum of the Stele Forest, which houses about 3,000 high stone slabs or stelae, engraved with the calligraphy of "famous scholars and emperors". The stelae often stand on the backs of large carved stone turtles. What had presumably happened was that the famous scholars and emperors were invited to write several characters with a brush on the smooth surface of a stele. Workmen then came and carved the image of the character into the stone, so that it formed an indentation below the smooth stone surface.

When I was lecturing at Northwestern University in Xi'an for several months in 1986, I visited the Forest of Stelae, and saw many people making inked copies of the engraved calligraphy, on specially moistened paper. Black ink was rolled onto the surface of the stone, and then the paper was applied smoothly so that the parts in contact with the stone were blackened, while the parts above the indentations in the stone remained white.

6.3 Saint Andrei Rublev

Student of Theophantes the Greek

Theophantes the Greek (c.1340-c.1410) brought the traditions of Byzantine art to Russia. He was a famous painter of frescos and icons in his own right, but he is also remembered as the teacher and mentor of an even greater Russian artist, Saint Andrei Rublev (c.1360-c.1428).

Little is known about Andrei Rublev's early life. It is not even known where he was born, but it is thought that he lived in the Trinity Lavra of St. Sergius monastery, about 70 km to the north-east of Moscow. After studying with Theophantes the Greek, Rublev helped to decorate many churches, including, between 1425 and 1427, the Trinity Cathedral in his own monastery.

Canonization

In 1988, the Russian Orthodox Church canonized Andrei Rublev. His feast day is celebrated on the 29th of January each year, and/or on the 4th of July. In the United States the Episcopal Church remembers Andrei Rublev on the 29th of January.

A film based on Andrei Rublev's life

In 1969 the Soviet Union produced a film entitled *Andrei Rublev*, based on the life of the great Russian painter. Although only loosely based on Rublev's life, the film gives an accurate portrayal of life in 15th century Russia. In particular, it shows Christianity as an integral part of Russia's historical identity. Although plagued by censorship and cuts, the film, when restored to its original version, has been rated by critics as one of the greatest films of all time.

Figure 6.4: ***Annunciation*, c. 1405, by Andrei Rublev, Tretyakov Gallery, Moscow.**

Figure 6.5: ***Nativity of Jesus*, c. 1405, by Andrei Rublev, Cathedral of the Annunciation, Moscow.**

Figure 6.6: ***Holy Trinity Hospitality of Abraham*, c. 1411, by Andrei Rublev, Tretyakov Gallery, Moscow.**

6.4 Russian icons

Wikipedia states that:

The use and making of icons entered Kievan Rus' following its conversion to Orthodox Christianity in AD 988. As a general rule, these icons strictly followed models and formulas hallowed by Byzantine art, led from the capital in Constantinople. As time passed, the Russians widened the vocabulary of types and styles far beyond anything found elsewhere in the Orthodox world.

The personal, innovative and creative traditions of Western European religious art were largely lacking in Russia before the 17th century, when Russian icon painting became strongly influenced by religious paintings and engravings from both Protestant and Catholic Europe. In the mid-17th-century changes in liturgy and practice instituted by Patriarch Nikon resulted in a split in the Russian Orthodox Church. The traditionalists, the persecuted "Old Ritualists" or "Old Believers", continued the traditional stylization of icons, while the State Church modified its practice. From that time icons began to be painted not only in the traditional stylized and non-realistic mode, but also in a mixture of Russian stylization and Western European realism, and in a Western European manner very much like that of Catholic religious art of the time. These types of icons, while found in Russian Orthodox churches, are also sometimes found in various sui juris rites of the Catholic Church.

Russian icons are typically paintings on wood, often small, though some in churches and monasteries may be much larger. Some Russian icons were made of copper. Many religious homes in Russia have icons hanging on the wall in the krasny ugol, the "red" or "beautiful" corner.

There is a rich history and elaborate religious symbolism associated with icons. In Russian churches, the nave is typically separated from the sanctuary by an iconostasis, or icon-screen, a wall of icons with double doors in the centre.

Russians sometimes speak of an icon as having been "written", because in the Russian language (like Greek, but unlike English) the same word (pisat', in Russian) means both to paint and to write. Icons are considered to be the Gospel in paint, and therefore careful attention is paid to ensure that the Gospel is faithfully and accurately conveyed...

Many Russian icons were destroyed, or sold abroad, by agents of the Soviet government; some were hidden to avoid destruction, or were smuggled out of the country. Since the fall of communism, numbers of icon painting studios have again opened and are painting in a variety of styles for the local and international market. Many older, hidden icons have also been retrieved from hiding, or brought back from overseas.

The demand for Russian icons by collectors in the west is very great today, but Russian law forbids the export of icons over 100 years in age.

Figure 6.7: ***Christ Pantocrator*, with enamelled riza, and jewelled halo (venets) and collar (tsata), Bob Jones University Museum and Gallery.**

Suggestions for further reading

1. Rawson, Jessica (ed). *The British Museum Book of Chinese Art*, 2007 (2nd edn), British Museum Press.
2. Sickman, Laurence, in: Sickman L & Soper A, *The Art and Architecture of China*, Pelican History of Art, 3rd ed 1971, Penguin (now Yale History of Art).
3. Fong, Wen (1973). *Sung and Yuan paintings.* New York: The Metropolitan Museum of Art.
4. Liu , Shi-yee (2007). *Straddling East and West: Lin Yutang, a modern literatus: the Lin Yutang family collection of Chinese painting and calligraphy.* New York: The Metropolitan Museum of Art.
5. *Andrei Rublev*, a 1966 film by Andrei Tarkovsky loosely based on the painter's life.
6. Mikhail V. Alpatov, Andrey Rublev, Moscow: Iskusstvo, 1972.
7. Gabriel Bunge, *The Rublev Trinity*, transl. Andrew Louth, St. Vladimir's Seminary Press, Crestwood, New York, 2007.
8. Sergius Golubtsov, Voplosh'enie bogoslovskih idey v tvorchestve prepodobnogo Andreya Rubleva [The realization of theological ideas in creative works of Andrey Rublev]. Bogoslovskie trudy 22, 20-40, 1981.
9. *Troitca Andreya Rubleva [The Trinity of Andrey Rublev]*, Gerold I. Vzdornov (ed.), Moscow: Iskusstvo 1989.
10. Viktor N. Lazarev, *The Russian Icon: From Its Origins to the Sixteenth Century*, Gerold I. Vzdornov (ed.). Collegeville, MN: Liturgical Press, 1997.
11. Priscilla Hunt, *Andrei Rublev's Old Testament Trinity Icon in Cultural Context, The Trinity-Sergius Lavr in Russian History and Culture: Readings in Russian Religious Culture*, vol. 3, ed. Deacon Vladimir Tsurikov, (Jordanville, NY: Holy Trinity Seminary Press, 2006), 99-122.
12. Konrad Onasch, *Das Problem des Lichtes in der Ikonomalerei Andrej Rublevs. Zur 600-Jahrfeier des grossen russischen Malers*, vol. 28. Berlin: Berliner byzantinische Arbeiten, 1962.
13. Konrad Onasch, *Das Gedankenmodell des byzantisch-slawischen Kirchenbaus. In Tausend Jahre Christentum in Russland*, Karl Christian Felmy et al. (eds.), 539-543. Goöttingen: Vandenhoeck und Ruprecht, 1988.
14. Georgij Yu. Somov, *Semiotic systemity of visual artworks: Case study of The Holy Trinity by Rublev*, Semiotica 166 (1/4), 1-79, 2007.

Chapter 7

CHINESE AND ISLAMIC POETS

7.1 The T'ang dynasty, a golden age for China

The T'ang period (618 A.D. - 906 A.D.) was a brilliant one for China. Just as Europe was sinking further and further into a mire of superstition, ignorance and bloodshed, China entered a period of peace, creativity and culture. During this period, China included Turkestan, northern Indochina and Korea. The T'ang emperors re-established and strengthened the system of civil-service examinations which had been initiated during the Han dynasty.

7.2 Tu Fu, 712-770

Alone, Looking for Blossoms Along the River

The sorrow of riverside blossoms inexplicable,
And nowhere to complain – I've gone half crazy.
I look up our southern neighbor. But my friend in wine
Gone ten days drinking. I find only an empty bed.

A thick frenzy of blossoms shrouding the riverside,
I stroll, listing dangerously, in full fear of spring.
Poems, wine – even this profusely driven, I endure.
Arrangements for this old, white-haired man can wait.

A deep river, two or three houses in bamboo quiet,
And such goings on: red blossoms glaring with white!
Among spring's vociferous glories, I too have my place:
With a lovely wine, bidding life's affairs bon voyage.

Looking east to Shao, its smoke filled with blossoms,

I admire that stately Po-hua wineshop even more.
To empty golden wine cups, calling such beautiful
Dancing girls to embroidered mats – who could bear it?

East of the river, before Abbot Huang's grave,
Spring is a frail splendor among gentle breezes.
In this crush of peach blossoms opening ownerless,
Shall I treasure light reds, or treasure them dark?

At Madame Huang's house, blossoms fill the paths:
Thousands, tens of thousands haul the branches down.
And butterflies linger playfully – an unbroken
Dance floating to songs orioles sing at their ease.

I don't so love blossoms I want to die. I'm afraid,
Once they are gone, of old age still more impetuous.
And they scatter gladly, by the branchful. Let's talk
Things over, little buds —open delicately, sparingly.

Ballad of the Old Cypress

In front of the temple of Chu-ko Liang there is an old cypress. Its branches are like green bronze; its roots like rocks; around its great girth of forty spans its rimy bark withstands the washing of the rain. Its jet-colored top rises two thousand feet to greet the sky. Prince and statesman have long since paid their debt to time; but the tree continues to be cherished among men. When the clouds come, continuous vapors link it with the mists of the long Wu Gorge; and when the moon appears, the cypress tree shares the chill of the Snowy Mountains' whiteness.
I remember a year or so ago, where the road wound east round my Brocade River pavilion, the First Ruler and Chu-ko Liang shared the same shrine. There, too, were towering cypresses, on the ancient plain outside the city. The paint-work of the temple's dark interior gleamed dully through derelict doors and windows. But this cypress here, though it holds its ground well, clinging with wide-encompassing, snake-like hold, yet, because of its lonely height rising into the gloom of the sky, meets much of the wind's fierce blast. Nothing but the power of Divine Providence could have kept it standing for so long; its straightness must be the work of the Creator himself! If a great hall had collapsed and beams for it were needed, ten thousand oxen might turn their heads inquiringly to look at such a mountain of a load. But it is already marvel enough to astonish the world, without any need to undergo a craftsman's embellishing. It has never refused the axe: there is simply no one who could carry it away if it were felled. Its bitter heart has not escaped the ants; but

Figure 7.1: **Tu Fu (also called Du Fu) was a major poet of the T'ang Dynasty, and his work had a great influence on both Chinese and Japanese literature. Nearly 1,500 of his poems have been preserved. Because of the range of topics in his poems, he has been introduced to western readers as "the Chinese Virgil, Horace, Ovid, Shakespeare, Milton, Burns, Wordsworth, Béranger, Hugo or Baudelaire". The son of a civil servant, Tu Fu wished to follow his father's career, but was unable to do so because of the unsettled times in which he lived.**

there are always phoenixes roosting in its scented leaves. Men of ambition, and you who dwell unseen, do not cry out in despair! From of old the really great have never been found useful.

Day's End

Oxen and sheep were brought back down
Long ago, and bramble gates closed. Over
Mountains and rivers, far from my old garden,
A windswept moon rises into clear night.

Springs trickle down dark cliffs, and autumn
Dew fills ridgeline grasses. My hair seems
Whiter in lamplight. The flame flickers
Good fortune over and over – and for what?

7.3 Li Po, 701-762

Alone And Drinking Under The Moon

Amongst the flowers I
am alone with my pot of wine
drinking by myself; then lifting
my cup I asked the moon
to drink with me, its reflection
and mine in the wine cup, just
the three of us; then I sigh
for the moon cannot drink,
and my shadow goes emptily along
with me never saying a word;
with no other friends here, I can
but use these two for company;
in the time of happiness, I
too must be happy with all
around me; I sit and sing
and it is as if the moon
accompanies me; then if I
dance, it is my shadow that
dances along with me; while
still not drunk, I am glad
to make the moon and my shadow

Figure 7.2: **Like his friend Tu Fu, Li Po was a great poet of the T'ang Dynasty, which is often called the Golden Age of Chinese Poetry. At the start of this golden age, China enjoyed peace and prosperity under an emperor who actively encouraged the arts. This peaceful period was ended by rebellion and disorder. However, over a thousand of Li Po's poems have survived. They celebrate the joys of nature, friendship, solitude, and the joys of drinking wine.**

into friends, but then when
I have drunk too much, we
all part; yet these are
friends I can always count on
these who have no emotion
whatsoever; I hope that one day
we three will meet again,
deep in the Milky Way.

Taking Leave of a Friend

Blue mountains lie beyond the north wall;
Round the city's eastern side flows the white water.
Here we part, friend, once forever.
You go ten thousand miles, drifting away
Like an unrooted water-grass.
Oh, the floating clouds and the thoughts of a wanderer!
Oh, the sunset and the longing of an old friend!
We ride away from each other, waving our hands,
While our horses neigh softly, softly . . . .

7.4 Li Ching Chao, 1081-c.1141

A Friend Sends Her Perfumed Carriage

A friend sends her perfumed carriage
And high-bred horses to fetch me.
I decline the invitation of
My old poetry and wine companion.

I remember the happy days in the lost capital.
We took our ease in the woman's quarters.
The Feast of Lanterns was elaborately celebrated -
Folded pendants, emerald hairpins, brocaded girdles,
New sashes - we competed
To see who was most smartly dressed.
Now I am withering away,
Wind-blown hair, frost temples.
I prefer to stay beyond the curtains,
And listen to talk and laughter
I can no longer share.

A Song of Departure

Warm rain and soft breeze by turns
Have just broken
And driven away the chill.
Moist as the pussy willows,
Light as the plum blossoms,
Already I feel the heart of Spring vibrating.
But now who will share with me
The joys of wine and poetry?
Tears streak my rouge.
My hairpins are too heavy.
I put on my new quilted robe
Sewn with gold thread
And throw myself against a pile of pillows,
Crushing my phoenix hairpins.
Alone, all I can embrace is my endless sorrow.
I know a good dream will never come.
So I stay up till past midnight
Trimming the lamp flower's smoking wick.

Autumn Love

Search. Search. Seek. Seek.
Cold. Cold. Clear. Clear.
Sorrow. Sorrow. Pain. Pain.
Hot flashes. Sudden chills.
Stabbing pains. Slow agonies.
I can find no peace.
I drink two cups, then three bowls,
Of clear wine until I can't
Stand up against a gust of wind.
Wild geese fly over head.
They wrench my heart.
They were our friends in the old days.
Gold chrysanthemums litter
The ground, pile up, faded, dead.
This season I could not bear
To pick them. All alone,
Motionless at my window,
I watch the gathering shadows.
Fine rain sifts through the wu-t'ung trees,
And drips, drop by drop, through the dusk.
What can I ever do now?
How can I drive off this word -
Hopelessness?

Figure 7.3: **Li Ching Chao (1081-c.1141) was born into a family of scholar-officials in the Song Dynasty. Her husband was also a scholar-official, and during their happy marriage, they shared an interest in collecting art and calligraphy. Many of her famous poems are love poems addressed to her husband. She is considered to be one of the greatest Chinese poets.**

7.5 Ferdowsi, c.940-1020

Alas for Youth
translated by R.A, Nicholson

Much have I labored, much read o'er
Of Arabic and Persian Lore
Collecting tales unknown and known;
Now two and sixty years have flown.
Regret and deeper woe of sin.
'Tis all that youth have ended in,
And I with mournful thoughts rehearse
Bu Táhir Khusrawáni's verse:
"I mind me of my youth and sigh,
Alas for youth, for youth gone by!"

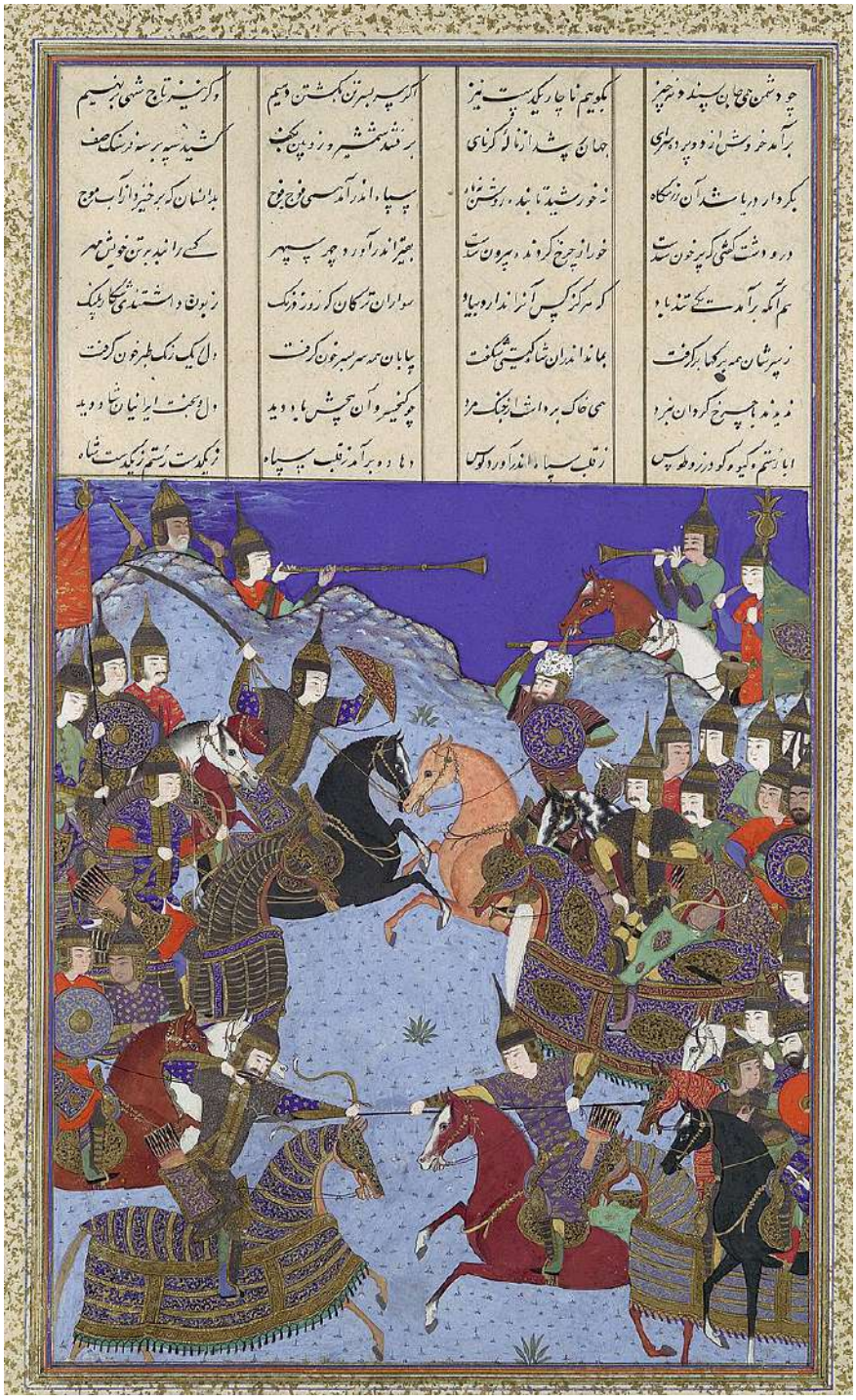

Figure 7.4: **An illustration to the long poem *Shahnemah* ("The Book of Kings") by Ferdowsi. It is one of the longest poem ever created by a single author, and is regarded as the national epic of greater Persia. Through his authorship of this epic, Ferdowsi became one of the most influential poets in history.**

7.6 Omar Khayyam, 1048-1131

The Rubáiyát
translated by Edward Fitzgerald. Only the first few verses are shown here

Awake! for Morning in the Bowl of Night
Has flung the Stone that puts the Stars to Flight:
And Lo! the Hunter of the East has caught
The Sultan's Turret in a Noose of Light.

Dreaming when Dawn's Left Hand was in the Sky
I heard a voice within the Tavern cry,
"Awake, my Little ones, and fill the Cup
Before Life's Liquor in its Cup be dry."

And, as the Cock crew, those who stood before
The Tavern shouted – "Open then the Door!
You know how little while we have to stay,
And, once departed, may return no more."

Now the New Year reviving old Desires,
The thoughtful Soul to Solitude retires,
Where the White Hand of Moses on the Bough
Puts out, and Jesus from the Ground suspires.

Iram indeed is gone with all its Rose,
And Jamshyd's Sev'n-ring'd Cup where no one Knows;
But still the Vine her ancient ruby yields,
And still a Garden by the Water blows.

And David's Lips are lock't; but in divine
High piping Pehlevi, with "Wine! Wine! Wine!
Red Wine!" – the Nightingale cries to the Rose
That yellow Cheek of hers to incarnadine.

Come, fill the Cup, and in the Fire of Spring
The Winter Garment of Repentance fling:
The Bird of Time has but a little way
To fly – and Lo! the Bird is on the Wing.

Whether at Naishapur or Babylon,
Whether the Cup with sweet or bitter run,
The Wine of Life keeps oozing drop by drop,

The Leaves of Life keg falling one by one.

Morning a thousand Roses brings, you say;
Yes, but where leaves the Rose of Yesterday?
And this first Summer month that brings the Rose
Shall take Jamshyd and Kaikobad away.

But come with old Khayyam, and leave the Lot
Of Kaikobad and Kaikhosru forgot:
Let Rustum lay about him as he will,
Or Hatim Tai cry Supper – heed them not.

With me along the strip of Herbage strown
That just divides the desert from the sown,
Where name of Slave and Sultan is forgot –
And Peace is Mahmud on his Golden Throne!

A Book of Verses underneath the Bough,
A Jug of Wine, a Loaf of Bread, – and Thou
Beside me singing in the Wilderness –
Oh, Wilderness were Paradise enow!

Some for the Glories of This World; and some
Sigh for the Prophet's Paradise to come;
Ah, take the Cash, and let the Promise go,
Nor heed the rumble of a distant Drum!

Were it not Folly, Spider-like to spin
The Thread of present Life away to win –
What? for ourselves, who know not if we shall
Breathe out the very Breath we now breathe in!

Look to the Rose that blows about us – "Lo,
Laughing," she says, "into the World I blow:
At once the silken Tassel of my Purse
Tear, and its Treasure on the Garden throw."

The Worldly Hope men set their Hearts upon
Turns Ashes – or it prospers; and anon,
Like Snow upon the Desert's dusty Face
Lighting a little Hour or two – is gone.

And those who husbanded the Golden Grain,

And those who flung it to the Winds like Rain,
Alike to no such aureate Earth are turn'd
As, buried once, Men want dug up again.

Think, in this batter'd Caravanserai
Whose Doorways are alternate Night and Day,
How Sultan after Sultan with his Pomp
Abode his Hour or two and went his way.

They say the Lion and the Lizard keep
The Courts where Jamshyd gloried and drank deep:
And Bahram, that great Hunter – the Wild Ass
Stamps o'er his Head, but cannot break his Sleep.

I sometimes think that never blows so red
The Rose as where some buried Caesar bled;
That every Hyacinth the Garden wears
Dropt in its Lap from some once lovely Head.

And this delightful Herb whose tender Green
Fledges the River's Lip on which we lean –
Ah, lean upon it lightly! for who knows
From what once lovely Lip it springs unseen!

Ah, my Beloved, fill the Cup that clears
To-day of past Regrets and future Fears –
To-morrow? – Why, To-morrow I may be
Myself with Yesterday's Sev'n Thousand Years.

Lo! some we loved, the loveliest and best
That Time and Fate of all their Vintage prest,
Have drunk their Cup a Round or two before,
And one by one crept silently to Rest.

And we, that now make merry in the Room
They left, and Summer dresses in new Bloom,
Ourselves must we beneath the Couch of Earth
Descend, ourselves to make a Couch – for whom?

Ah, make the most of what we may yet spend,
Before we too into the Dust descend;
Dust into Dust, and under Dust, to lie;
Sans Wine, sans Song, sans Singer, and – sans End!

Alike for those who for To-day prepare,
And those that after some To-morrow stare,
A Muezzin from the Tower of Darkness cries
"Fools! Your Reward is neither Here nor There!"

Why, all the Saints and Sages who discuss'd
Of the Two Worlds so learnedly, are thrust
Like foolish Prophets forth; their Works to Scorn
Are scatter'd, and their Mouths are stopt with Dust.

Oh, come with old Khayyam, and leave the Wise
To talk; one thing is certain, that Life flies;
One thing is certain, and the Rest is Lies;
The Flower that once has blown forever dies.

Myself when young did eagerly frequent
Doctor and Saint, and heard great Argument
About it and about; but evermore
Came out by the same Door as in I went.

With them the Seed of Wisdom did I sow,
And with my own hand labour'd it to grow:
And this was all the Harvest that I reap'd –
"I came like Water and like Wind I go."

Into this Universe, and Why not knowing,
Nor Whence, like Water willy-nilly flowing:
And out of it, as Wind along the Waste,
I know not Whither, willy-nilly blowing.

Up from Earth's Centre through the Seventh Gate
I rose, and on the Throne of Saturn sate,
And many Knots unravel'd by the Road;
But not the Master-Knot of Human Fate.

There was the Door to which I found no Key:
There was the Veil through which I could not see:
Some little talk awhile of Me and Thee
There was – and then no more of Thee and Me.

7.7 Rumi, 1207-1273

Longing is the core of mystery.
Longing itself brings the cure.
The only rule is, Suffer the pain.
Your desire must be disciplined,
and what you want to happen
in time, sacrificed
Rumi - The Essential Rumi - Coleman Barks

The Morning Wind Spreads
The morning wind spreads its fresh smell.
We must get up and take that in,
that wind that lets us live.
Breathe before it's gone
Rumi - 'The Essential Rumi' - Coleman Barks

Only Breath

Not Christian or Jew or Muslim, not Hindu
Buddhist, Sufi, or Zen. Not any religion
or cultural system. I am not from the East
or the West, not out of the ocean or up
from the ground, not natural or ethereal, not
composed of elements at all. I do not exist,
am not an entity in this world or in the next,
did not descend from Adam and Eve or any
origin story. My place is placeless, a trace
of the traceless. Neither body or soul.
I belong to the beloved, have seen the two
worlds as one and that one call to and know,
first, last, outer, inner, only that
breath breathing human being.

Enough words?

But that shadow has been serving you!
What hurts you, blesses you.
Darkness is your candle.
Your boundaries are your quest.
You must have shadow and light source both.
Listen, and lay your head under the tree of awe.

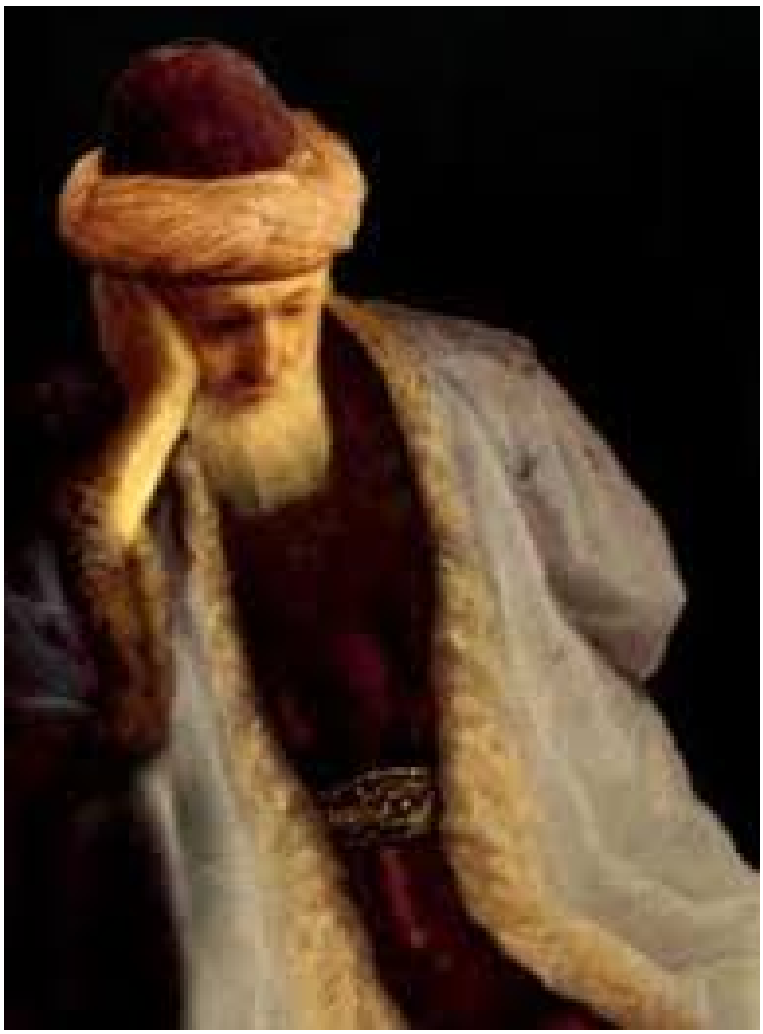

Figure 7.5: **Jalaluddin Rumi, saint and mystic, inspiration for the Mevlevi Order of the whirling dervishes, is highly revered for his great poem *Mathnawi* which is a grand tribute to the depth of spiritual life. Rumi's poems have been translated many languages and he is read by Iranians, Tajiks, Turks, Greeks, Pashtuns, other Central Asian Muslims, and the Muslims of the Indian subcontinent. He is also a popular and widely-read poet in the United States. His name, "Rumi", means "Roman", and it refers to the fact that he was born in Anatolia, a region that was once part of the eastern Roman Empire.**

Two kinds of intelligence

There are two kinds of intelligence: one acquired,
As a child in school memorizes facts and concepts
With such intelligence you rise in the world.
There is another kind of tablet, one
Already completed and preserved inside you.
This other intelligence does not turn yellow or stagnate.
It's fluid, and it doesn't move from outside to inside
Through the conduits of plumbing-learning.
This second knowing is a fountainhead
From within you, moving out.

7.8 Saadi Shirazi, 1210-1292

How could I ever thank my Friend?
No thanks could ever begin to be worthy.
Every hair of my body is a gift from Him;
How could I thank Him for each hair?
Praise that lavish Lord forever
Who from nothing conjures all living beings!
Who could ever describe His goodness?
His infinite glory lays all praise waste.
Look, He has graced you a robe of splendor
From childhood's first cries to old age!
He made you pure in His own image; stay pure.
It is horrible to die blackened by sin.
Never let dust settle on your mirror's shining;
Let it once grow dull and it will never polish.
When you work in the world to earn your living
Do not, for one moment, rely on your own strength.
Self-worshiper, don't you understand anything yet?
It is God alone that gives your arms their power.
If, by your striving, you achieve something good,
Don't claim the credit all for yourself;
It is fate that decides who wins and who loses
And all success streams only from the grace of God.
In this world you never stand by your own strength;

Figure 7.6: **Saadi in a rose garden, from a Mughal manuscript of his work. Saadi of Shiraz (1215-1292) was a great poet of Persia, author of the *Gulistan* ("Rose-Garden") and the *Bostan* ("Orchard"). He also wrote many odes and lyrics. His pen name was simply Sadi. Saadi is famous for the depths of his social and moral thoughts.**

It is the Invisible that sustains you every moment

7.9 Hafiz, 1315-1390

The Green Sea of Heaven
translated by Elizabeth T. Gray Jr

I speak frankly and that makes me happy:
I am the slave of love, I am free of both worlds.

I am a bird from heaven's garden. How do I describe that separation,
my fall into this snare of accidents?
I was an angel and highest paradise was my place.
Adam brought me to this monastery in the city of ruin.

The hours' caress, the pool and shade trees of paradise
were forgotten in the breeze from your alleyway.

There is nothing on the tablet of my heart but my love's tall alif.
What can I do? My master taught me no other letter.

No astrologer knew the constellations of my fate.
O lord, when I was born of mother earth which stars were rising?

Ever since I became a slave at the door of love's tavern
sorrows come to me each moment with congratulations.

The pupil of my eye drains the blood from my heart.
I deserve it. Why did I give my heart to the darling of others?

Wipe the tears from Hafiz's face with soft curls
or else this endless torrent will uproot me.

Figure 7.7: **Entrance to the tomb of Hafiz. Hafiz of Shiraz was the greatest lyric poet of Persia. He took the poetic form of the *ghazal* to unparalleled heights of subtlety and beauty. People in the Persian-speaking world often learn his poems by heart, and use them as proverbs.**

7.10 Jami, 1414-1492

Whether your destiny is glory or disgrace,
Purify yourself of hatred and love of self.
Polish your mirror; and that sublime Beauty
From the regions of mystery
Will flame out in your heart
As it did for the saints and prophets.
Then, with your heart on fire with that Splendor,
The secret of the Beloved will no longer be hidden.
Jami, translation by Andrew Harvey and Eryk Hanut - 'Perfume of the Desert'

Who is man?
The reflection of the Eternal Light.
What is the world?
A wave on the Everlasting Sea.
How could the reflection be cut off from the Light?
How could the wave be separate from the Sea?
Know that this reflection and this wave are that very Light and Sea.

Figure 7.8: **Jami (Nur al-Din 'Abd al-Rahman ibn Ahmad al-Jami) is commonly called the last great classical poet of Persia. Saint and mystic, he composed numerous lyrics and idylls, as well as many works in prose. His *Salaman and Absal* is an allegory of profane and sacred love. Some of his other works include *Haft Awrang*, *Tuhfat al-Ahrar* and *Fatihat al-Shabab*. Jami was a prolific Sufi scholar, theologian and writer.**

Figure 7.9: **Youth seeking his father's advice about love, an illustration for one of Jami's poems.**

Suggestions for further reading

1. Graves, Robert (1969). *ON POETRY: Collected Talks and Essays.* Garden City, New York: Doubleday.
2. Hinton, David (2008). *Classical Chinese Poetry: An Anthology.* New York: Farrar, Straus, and Giroux.
3. Mao, Xian (2013). *New Translation of Most Popular 60 Classical Chinese Poems.* eBook: Kindle Direct Publishing.
4. Stephen Owen. *The Poetry of the Early T'ang.* New Haven: Yale University Press, 1977. ISBN 0-300-02103-8. Revised edition, Quirin Press, 2012.
5. Stephen Owen. *The Great Age of Chinese Poetry: The High T'ang.* New Haven Conn.: Yale University Press, 1981.
6. Stephen Owen. *The Late Tang: Chinese Poetry of the Mid-Ninth Century (827-860).* Cambridge, Mass.: Harvard University Press, Harvard East Asian Monographs, 2006.
7. Browne, E. G. (1998). *A Literary History of Persia.* Psychology Press.
8. Chopra, R. M. (2014). *Great Poets of Classical Persian.* Kolkata: Sparrow.
9. Mackey, Sandra; Harrop, W. Scott (2008). *The Iranians: Persia, Islam and the soul of a nation.* University of Michigan.
10. Rypka, Jan (1968). *History of Iranian Literature.*
11. Sharma, Sunil; Waghmar, Burzine K., eds. (2016). *Firdawsii Millennium Indicum: Proceedings of the Shahnama Millenary Seminar*, the KR Cama Oriental Institute, Mumbai, 8-9 January, 2011. KR Cama Oriental Institute. pp. 7-18.
12. Wiesehöfer, Josef (2001). *Ancient Persia: From 550 BC to 650 AD.* I.B.Tauris.

Chapter 8

EDUCATION IN THE MIDDLE AGES

8.1 The Nestorians and Islam

After the burning of the great library at Alexandria and the destruction of Hellenistic civilization, most of the books of the classical Greek and Hellenistic philosophers were lost. However, a few of these books survived and were translated from Greek, first into Syriac, then into Arabic and finally from Arabic into Latin. By this roundabout route, fragments from the wreck of the classical Greek and Hellenistic civilizations drifted back into the consciousness of the west.

We mentioned that the Roman empire was ended in the 5th century A.D. by attacks of barbaric Germanic tribes from northern Europe. However, by that time, the Roman empire had split into two halves. The eastern half, with its capital at Byzantium (Constantinople), survived until 1453, when the last emperor was killed vainly defending the walls of his city against the Turks.

The Byzantine empire included many Syriac-speaking subjects; and in fact, beginning in the 3rd century A.D., Syriac replaced Greek as the major language of western Asia. In the 5th century A.D., there was a split in the Christian church of Byzantium;and the Nestorian church, separated from the official Byzantine church. The Nestorians were bitterly persecuted by the Byzantines, and therefore they migrated, first to Mesopotamia, and later to south-west Persia. (Some Nestorians migrated as far as China.)

During the early part of the middle ages, the Nestorian capital at Gondisapur was a great center of intellectual activity. The works of Plato, Aristotle, Hippocrates, Euclid, Archimedes, Ptolemy, Hero and Galen were translated into Syriac by Nestorian scholars, who had brought these books with them from Byzantium.

Among the most distinguished of the Nestorian translators were the members of a family called Bukht-Yishu (meaning "Jesus hath delivered"), which produced seven generations of outstanding scholars. Members of this family were fluent not only in Greek and Syriac, but also in Arabic and Persian.

In the 7th century A.D., the Islamic religion suddenly emerged as a conquering and proselytizing force. Inspired by the teachings of Mohammad (570 A.D. - 632 A.D.), the Arabs and their converts rapidly conquered western Asia, northern Africa, and Spain. During the initial stages of the conquest, the Islamic religion inspired a fanaticism in its followers which was often hostile to learning. However, this initial fanaticism quickly changed to an appreciation of the ancient cultures of the conquered territories; and during the middle ages, the Islamic world reached a very high level of culture and civilization.

Thus, while the century from 750 to 850 was primarily a period of translation from Greek to Syriac, the century from 850 to 950 was a period of translation from Syriac to Arabic. It was during this latter century that Yuhanna Ibn Masawiah (a member of the Bukht-Yishu family, and medical advisor to Caliph Harun al-Rashid) produced many important translations into Arabic.

The skill of the physicians of the Bukht-Yishu family convinced the Caliphs of the value of Greek learning; and in this way the family played an extremely important role in the preservation of the western cultural heritage. Caliph al-Mamun, the son of Harun al-Rashid, established at Baghdad a library and a school for translation, and soon Baghdad replaced Gondisapur as a center of learning.

An Islamic philosopher who had great influence on western thought was Averröes, who lived in Spain from 1126 to 1198. His writings took the form of thoughtful commentaries on the works of Aristotle. He shocked both his Moslem and his Christian readers by maintaining that the world was not created at a definite instant, but that it instead evolved over a long period of time, and is still evolving.

Like Aristotle, Averröes seems to have been groping towards the ideas of evolution which were later developed in geology by Steno, Hutton and Lyell and in biology by Darwin and Wallace. Much of the scholastic philosophy which developed at the University of Paris during the 13th century was aimed at refuting the doctrines of Averröes; but nevertheless, his ideas survived and helped to shape the modern picture of the world.

Figure 8.1: **Avicenna (c.980-1037) was a Persian astronomer, philosopher, and physician. He was one of the most influential thinkers of the Islamic Golden Age. Of the 450 works he is believed to have written, around 240 have survived, including 150 on philosophy and 40 on medicine. Avicenna's famous book. "The Canon of Medicine", was a standard medical text in many mideival European universities, and was still in use as late as 1650. The statue of Avicenna shown here is in the United Nations Office in Vienna.**

Figure 8.2: **Ulugh Beg (1394-1449), whose statue is shown here, was the ruler of the Samarkand region of present-day Uzbekistan. He was also a notable astronomer and mathematician. Ulugh Beg made important contributions to spherical geometry and trigonometry. For example, he made tables of trigonometric functions which are accurate to five significant figures. He spoke five languages, including Arabic, Persian, Turkic, Mongolian, and a little Chinese.**

8.2 East-West exchanges in Toledo

In the 12th century, parts of Spain, including the city of Toledo, were reconquered by the Christians. Toledo had been an Islamic cultural center, and many Muslim scholars, together with their manuscripts, remained in the city when it passed into the hands of the Christians. Thus Toledo became a center for the exchange of ideas between east and west; and it was in this city that many of the books of the classical Greek and Hellenistic philosophers were translated from Arabic into Latin.

Toledo had been an Islamic cultural center, and many Moslem scholars, together with their manuscripts, remained in the city when it passed into the hands of the Christians. Thus Toledo became a center for the exchange of ideas between east and west; and it was in this city that many of the books of the classical Greek and Hellenistic philosophers were translated from Arabic into Latin. By this roundabout route the culture that was lost because of the burning of the Great Library at Alexandria reentered the consciousness of Europe and contributed to the Renaissance.

In the 12th century, the translation was confined to books of science and philosophy. Classical Greek literature was forbidden by both the Christian and Moslem religions; and the beautiful poems and dramas of Homer, Sophocles and Euripides were not translated into Latin until the time of the Renaissance Humanists.

It is interesting and inspiring to visit Toledo. A tourist there can see ample evidence of

Figure 8.3: **Mosaics at the Alhambra**

Figure 8.4: **Mosaics at the Alhambra**

a period of tolerance and enlightenment, when members of the three Abrahamic religions, Christianity, Judaism and Islam , lived side by side in harmony and mutual respect, exchanging important ideas which were to destined to become the foundations of our modern civilization. One can also see a cathedral, a mosque and a synagogue, in each of which craftsmen from all three faiths worked cooperatively to produce a beautiful monument to human solidarity.

Figure 8.5: **The interior of the great mosque at Isfahan**

Figure 8.6: **A view of Toledo**

8.3 Mathematics in ancient India

In Indian mathematics, algebra and trigonometry were especially highly developed. For example, the astronomer Brahmagupta (598 A.D. - 660 A.D.) applied algebraic methods to astronomical problems. The notation for zero and the decimal system were invented in India, probably during the 8th or 9th century A.D.. These mathematical techniques were later transmitted to Europe by the Arabs.

8.4 Manufacturing

Many Indian techniques of manufacture were also transmitted to the west by the Arabs. Textile manufacture in particular was highly developed in India, and the Arabs, who were the middlemen in the trade with the west, learned to duplicate some of the most famous kinds of cloth. One kind of textile which they copied was called "quttan" by the Arabs, a word which in English has become "cotton". Other Indian textiles included cashmere (Kashmir), chintz and calico (from Calcutta, which was once called Calicut). Muslin derives its name from Mosul, an Arab city where it was manufactured, while damask was made in Damascus.

Indian mining and metallurgy were also highly developed. The Europeans of the middle ages prized fine laminated steel from Damascus; but it was not in Damascus that the technique of making steel originated. The Arabs learned steelmaking from the Persians, and Persia learned it from India.

8.5 Buddhist period (500 BC - 1200 AD)

The rigidities of the Vedic rituals and sacrifices and the dominance of Brahmans over the lower caste became responsible for the disenchantment of the masses with the system. Gautama Buddha, the great religious leader as well as social reformer, preached non-violence and social equality. As a result, the social discrimination in the field of education that was prevalent in the Vedic period was challenged in this period.

European universities grew out of the earlier traditions of monastic scholarship. Below is a list of some of the oldest universities in Europe,

Figure 8.7: **A teacher and his students.**

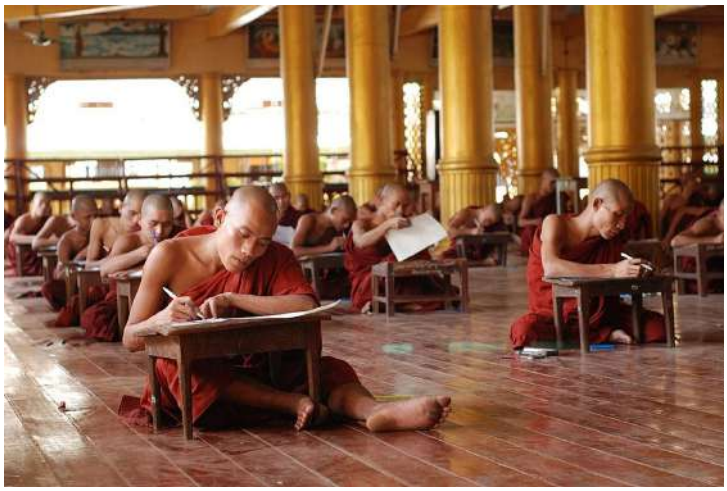

Figure 8.8: **Monks taking an exam.**

Figure 8.9: **Students praying before lunch.**

Figure 8.10: **Teaching painting.**

Figure 8.11: **Learning the Vedas.**

8.6 University of Bologna, Italy, 1088

The University of Bologna is the oldest continuously operating university in the world. At its start in 1088, it was a collection of foreign students and professors. The foreign students of a particular nation could be punished collectively for the debts or misdemeanors of any student of that nation, and the students joined together to protest against this collective punishment. The students also joined together to hire or fire the professors.

Later in the evolution of the University of Bologna, collective punishment of the students was abolished, and the salaries of the professors were paid by the city. The influence of the university increased because the city of Bologna derived many revenues from the presence of the students.

Famous alumnae of the University of Bologna include Albrecht Dürer, Dante Alighieri, Erasmus of Rotterdam, Guglielmo Marconi, Luigi Galvani, Nicolaus Copernicus, Petrarch, Thomas Becket (Archbishop of Canterbury), Romano Prodi and Umberto Eco.

Other early Italian universities

- University of Padua, 1222
- University of Naples Federico II, 1224
- University of Sienna, 1254
- University of Macerata, 1290
- Sapienza University of Rome, 1303
- University of Perugia, 1308

Figure 8.12: **The University of Bologna.**

- University of Florence, 1321
- University of Pisa, 1343
- University of Pavia, 1361
- University of Ferrara, 1391
- University of Turin, 1404
- University of Catania, 1434
- University of Genoa, 1481

8.7 University of Paris, 1150

History of the university

According to Wikipedia,

Emerging around 1150 as a corporation associated with the cathedral school of Notre Dame de Paris, it was considered the second oldest university in Europe.[1] Officially chartered in 1200 by King Philip II of France and recognized in 1215 by Pope Innocent III, it was later often nicknamed after its theological College of Sorbonne, in turn founded by Robert de Sorbon and chartered by French King Saint Louis around 1257.

Figure 8.13: **The University of Paris was originally associated with Notre-Dame Cathedral.**

Famous alumni and faculty members

Among the famous people associated with the University of Paris are Thomas Aquinas, John Calvin, Denis Diderot, Voltaire, Honré de Balzac, Jean-Jaques Ampère, Henri Poincaré, Pierre and Marie Curie, Louis de Broglie, Fréderik and Irène Joliot-Curie, André Lwoff, Francois Jacob, Jaques Monod, Albert Schweitzer, Henri Bergson, Jean-Paul Sartre and T.S. Eliot.

8.8 Oxford University, England, 1096-1167

The University of Oxford is the oldest university in the English-speaking world, and the second-oldest in the entire world. It is also one of the most prestigious institutions of higher learning. More than 70 Nobel laureates and more than 50 global leaders (kings, prime ministers or presidents) have been associated with the University of Oxford.

The university is composed of 39 colleges and 6 permanent private halls. The colleges offer both living quarters and tutorials (by fellows of the colleges) to their members. The tutorials are supplemented by lectures and laboratory work in the buildings of the university, conducted by professors hired by the university as a whole.

According to Wikipedia,

Twenty-eight British prime ministers have attended Oxford, including William

Gladstone, H. H. Asquith, Clement Attlee, Harold Macmillan, Edward Heath, Harold Wilson, Margaret Thatcher, Tony Blair, David Cameron, Theresa May and Boris Johnson.

Scientists who performed research in Oxford include chemist Dorothy Hodgkin who received her Nobel Prize for "determinations by X-ray techniques of the structures of important biochemical substances", Howard Florey who shared the 1945 Nobel prize "for the discovery of penicillin and its curative effect in various infectious diseases", and John B. Goodenough, who shared the Nobel Prize in Chemistry in 2019 "for the development of lithium-ion batteries". Both Richard Dawkins and Frederick Soddy studied at the university and returned for research purposes. Robert Hooke, Edwin Hubble, and Stephen Hawking all studied in Oxford.

Writers associated with Oxford include Vera Brittain, A.S. Byatt, Lewis Carroll, Penelope Fitzgerald, John Fowles, Theodor Geisel, Robert Graves, Graham Greene, Joseph Heller, Christopher Hitchens, Aldous Huxley, Samuel Johnson, C. S. Lewis, Thomas Middleton, Iris Murdoch, V.S. Naipaul, Philip Pullman, Dorothy L. Sayers, Vikram Seth, J. R. R. Tolkien, Evelyn Waugh, Oscar Wilde, the poets Percy Bysshe Shelley, John Donne, A. E. Housman, Gerard Manley Hopkins, W. H. Auden, T. S. Eliot, Wendy Perriam and Philip Larkin, and seven poets laureate: Thomas Warton, Henry James Pye, Robert Southey, Robert Bridges, Cecil Day-Lewis, Sir John Betjeman, and Andrew Motion.

Composers Hubert Parry, George Butterworth, John Taverner, William Walton, James Whitbourn and Andrew Lloyd Webber have all been involved with the university.

Actors Hugh Grant, Kate Beckinsale, Rosamund Pike, Felicity Jones, Gemma Chan, Dudley Moore, Michael Palin, Terry Jones, Anna Popplewell and Rowan Atkinson were students at the university, as were filmmakers Ken Loach and Richard Curtis.

Oxford's philosophical tradition started in the medieval era, with Robert Grosseteste and William of Ockham, commonly known for Occam's razor, among those teaching at the university. Thomas Hobbes, Jeremy Bentham and the empiricist John Locke received degrees from Oxford. Though the latter's main works were written after leaving Oxford, Locke was heavily influenced by his twelve years at the university.

Figure 8.14: **A view of Oxford.**

Figure 8.15: **Oxford: one of the University buildings.**

8.9 University of Cambridge, England, 1209

The University of Cambridge was founded when a group of scholars fled from a dangerous dispute with the townspeople of Oxford and settled in the town of Cambridge. By the time that it was safe to go back to Oxford, the University of Cambridge had been established and many students and professors remained.

Today, the University of Cambridge is one of the leading universities in the world, especially in the fields of physics, astronomy, biology, medicine, mathematics and computer science. It has many common features with Oxford, and the two universities are sometimes referred to together as "Oxbridge". The University of Cambridge consists of 31 semi-independent colleges and 100 academic departments. Students receive tutorials from the fellows of their colleges, but also attend lectures and laboratory exercises given by the university's professors.

According to the Wikipedia article on the University of Cambridge:

Cambridge's libraries, of which there are over 100, hold a total of around 16 million books, around nine million of which are in Cambridge University Library, a legal deposit library. The university is home to, but independent of, the Cambridge Union - the world's oldest debating society. The university is closely linked to the development of the high-tech business cluster known as 'Silicon Fen'. It is the central member of Cambridge University Health Partners, an academic health science centre based around the Cambridge Biomedical Campus.

The university has educated many notable alumni, including eminent mathematicians, scientists, politicians, lawyers, philosophers, writers, actors, monarchs and other heads of state. As of October 2019, 120 Nobel Laureates, 11 Fields Medalists, 7 Turing Award winners and 14 British Prime Ministers have been affiliated with Cambridge as students, alumni, faculty or research staff. University alumni have won 194 Olympic medals.

The university's publishing arm, the Cambridge University Press, is the oldest printer and publisher in the world, and it is the second largest university press in the world.

Among the most famous of Cambridge natural philosophers is Sir Isaac Newton, who conducted many of his experiments in the grounds of Trinity College. Others are Sir Francis Bacon, who was responsible for the development of the scientific method and the mathematicians John Dee and Brook Taylor. Pure mathematicians include G. H. Hardy, John Edensor Littlewood and Augustus De Morgan; Sir Michael Atiyah, a specialist in geometry; William Oughtred, inventor of the logarithmic scale; John Wallis, first to state the law of acceleration; Srinivasa Ramanujan, the self-taught genius who made substantial contributions to mathematical analysis, number theory, infinite series and continued fractions; and James Clerk Maxwell, who brought about the "second great unification of physics" (the first being accredited to Newton) with his

classical theory of electromagnetic radiation. In 1890, mathematician Philippa Fawcett was the person with the highest score in the Cambridge Mathematical Tripos exams, but as a woman was unable to take the title of 'Senior Wrangler'.

In biology, Charles Darwin, famous for developing the theory of natural selection, was an alumnus of Christ's College, although his education was intended to allow him to become a clergyman. Biologists Francis Crick and James Watson worked out a model for the three-dimensional structure of DNA while working at the Cavendish Laboratory; Cambridge graduates Maurice Wilkins and especially Rosalind Franklin produced key X-ray crystallography data, which was shared with Watson by Wilkins. Wilkins went on to help verify the proposed structure and win the Nobel Prize with Watson and Crick. More recently, Sir Ian Wilmut was part of the team responsible for the first cloning of a mammal (Dolly the Sheep in 1996), naturalist and broadcaster David Attenborough, ethologist Jane Goodall, expert on chimpanzees was a PhD student, anthropologist Dame Alison Richard, former vice-chancellor of the university, and Frederick Sanger, a biochemist known for developing Sanger sequencing and receiving two Nobel prizes.

The university can be considered the birthplace of the computer, mathematician Charles Babbage designed the world's first computing system as early as the mid-1800s. Alan Turing went on to devise what is essentially the basis for modern computing and Maurice Wilkes later created the first programmable computer. The webcam was also invented at Cambridge University.

In physics, Ernest Rutherford who is regarded as the father of nuclear physics, spent much of his life at the university where he worked closely with E. J. Williams and Niels Bohr, a major contributor to the understanding of the atom, J. J. Thomson, discoverer of the electron, Sir James Chadwick, discoverer of the neutron, and Sir John Cockcroft and Ernest Walton, responsible for first splitting the atom. J. Robert Oppenheimer, leader of the Manhattan Project that developed the atomic bomb, also studied under Rutherford and Thomson. Joan Curran devised the 'chaff' technique during the Second World War to disrupt radar on enemy planes.

Astronomers Sir John Herschel, Sir Arthur Eddington, Paul Dirac, the discoverer of antimatter and one of the pioneers of quantum mechanics; Stephen Hawking, theoretical physicist and the university's long-serving Lucasian Professor of Mathematics until 2009; and Lord Martin Rees, the current Astronomer Royal and former Master of Trinity College.

Other significant scientists include Henry Cavendish, the discoverer of hydrogen; Frank Whittle, co-inventor of the jet engine; William Thomson (Lord Kelvin), who formulated the original Laws of Thermodynamics; William Fox Talbot, who invented the camera, Alfred North Whitehead, Einstein's major opponent; Sir Jagadish Chandra Bose, one of the fathers of radio science; Lord Rayleigh, who made extensive contributions to both theoretical and experimental physics in the 20th century; and Georges Lemaitre, who first proposed

a Big Bang theory.

Distinguished Cambridge academics include economists such as John Maynard Keynes, Thomas Malthus, Alfred Marshall, Milton Friedman, Joan Robinson, Piero Sraffa, Ha-Joon Chang and Amartya Sen, a former Master of Trinity College. Philosophers Sir Francis Bacon, Bertrand Russell, Ludwig Wittgenstein, Leo Strauss, George Santayana, G. E. M. Anscombe, Sir Karl Popper, Sir Bernard Williams, Sir Allama Muhammad Iqbal and G. E. Moore were all Cambridge scholars, as were historians such as Thomas Babington Macaulay, Frederic William Maitland, Lord Acton, Joseph Needham, E. H. Carr, Hugh Trevor-Roper, Rhoda Dorsey, E. P. Thompson, Eric Hobsbawm, Quentin Skinner, Niall Ferguson and Arthur M. Schlesinger, Jr., and famous lawyers such as Glanville Williams, Sir James Fitzjames Stephen, and Sir Edward Coke.

Cambridge poets include Edmund Spenser, author of The Faerie Queene, the Metaphysical poets John Donne, George Herbert and Andrew Marvell, John Milton, renowned for his late epic Paradise Lost, the Restoration poet and playwright John Dryden, the pre-romantic Thomas Gray, best known his Elegy Written in a Country Churchyard, William Wordsworth and Samuel Taylor Coleridge, whose joint work Lyrical Ballads is often seen to mark the beginning of the Romantic movement, later Romantics such as Lord Byron and the postromantic Alfred, Lord Tennyson, classical scholar and lyric poet A. E. Housman, war poets Siegfried Sassoon and Rupert Brooke, modernist T. E. Hulme, confessional poets Ted Hughes, Sylvia Plath and John Berryman, and, more recently, Cecil Day-Lewis, Joseph Brodsky, Kathleen Raine and Geoffrey Hill. At least nine of the Poets Laureate graduated from Cambridge.

Actors and directors such as Sir Ian McKellen, Eleanor Bron, Miriam Margolyes, Sir Derek Jacobi, Sir Michael Redgrave, James Mason, Emma Thompson, Stephen Fry, Hugh Laurie, John Cleese, Freddie Highmore, Eric Idle, Graham Chapman, Graeme Garden, Tim Brooke-Taylor, Bill Oddie, Simon Russell Beale, Tilda Swinton, Thandie Newton, Georgie Henley, Rachel Weisz, Sacha Baron Cohen, Tom Hiddleston, Sara Mohr-Pietsch, Eddie Redmayne, Dan Stevens, Jamie Bamber, Lily Cole, David Mitchell, Robert Webb, Mel Giedroyc and Sue Perkins all studied at the university, as did directors such as Mike Newell, Sam Mendes, Stephen Frears, Paul Greengrass, Chris Weitz and John Madden.

Other early universities in the United Kingdom

- University of St. Andrews, 1413
- University of Glasgow, 1451
- University of Aberdeen, 1495

Figure 8.16: **The Bridge of Sighs at St John's College.**

Figure 8.17: **King's College, Cambridge.**

8.10 University of Coimbra, Portugal, 1290

Foundation by King Denis I

The university was originally called *Studium Generale*, and it was originally located in Lisbon. However, in 1537 it was moved to Coimbra and installed in the Alacova Palace, which was purchased from the Portuguese Royal Family.

Portugal's greatest poet

One of the most famous graduates of the University of Coimbra was Luís de Camoes (c.1524-1580), who is considered to be Portugal's greatest poet. His mastery of verse has been compared to that of Shakespeare, Homer and Dante. Portuguese is sometimes called "The language of Camoes".

Student resistance to Salazar's dictatorship

According to Wikipedia,

The years of dictatorship were gruesome. Apart from the students that got 7 years in prison for toasting to freedom which led directly to the foundation of Amnesty International in 1961, in 1968 students would spend the whole night greasing streets and sidewalks with soap so the mounted police would have a hard time chasing them down to break a demonstration. It is said that a student dared a policeman to get his shoes and feet wet chasing after a cigarette lighter, thrown in the duck pond, while he had the license for it in his pocket. In those days one needed a permit to own a cigarette lighter, as imposed by Salazar to protect the matches industry.

Research Institutes at the University of Coimbra

- Association for the Development of Industrial Aerodynamics
- AIBILI (Association for Innovation and Biomedical Research on Light and Image)
- Institute of Biomedical Research in Light and Image
- Centro de Histofisiologia, Patologia Experimental e Biologia do Desenvolvimento
- Center of Cardiothoracic Surgery
- Center for Pharmaceutical Studies
- Mechanical Engineering Center
- Centre for Functional Ecology
- Center for Informatics and Systems
- Institute of Science and Engineering Materials and Surfaces
- Institute for Sustainability and Innovation in Structural Engineering
- Institute for Systems and Computers Engineering at Coimbra

- Institute of Systems and Robotics
- X-Ray Diffraction Center for Materials Research (CEMDRX)
- Centre for Computational Physics
- Center of Theoretical Physics
- Electronics and Instrumentation Center
- Instrumentation Center
- Laboratory for Instrumentation and Particle Physics - Coimbra
- Centre for Mathematics
- Molecular Chemistry-Physics
- Institute of Marine Research - Coimbra Interdisciplinary Center
- Institute of Environment and Life
- Geosciences Centre
- Centre for Social Studies
- Research Centre for Anthropology and Health
- Centre for Neuroscience and Cell Biology
- Institute of Urban and Regional Studies
- Linguagem, Interpretacao e Filosofia
- Centre for the History of Society and Culture
- Estudos ClÃ¡ssicos e HumanÃsticos
- Instituto de Estudos JornalÃsticos

Figure 8.18: **The University's Joanine Library.**

Figure 8.19: **Some of the University buildings.**

8.11 University of Valadolid, Spain, 1293

According to Wikipedia,

The youth symphonic orchestra: the Joven Orquesta de la Universidad de Valladolid (Youth Orchestra of the University of Valladolid, JOUVa) is run by students of the university, and headquartered in the Residencia Universitaria Alfonso VIII of Valladolid. Since its founding in 1998 Francisco Lara Tejero has been the artistic musical director.

The choir, the Coro de la Universidad de Valladolid[4] (Choir of the University of Valladolid), is directed by Marcos CastÃ¡n and the Early Music Group *El Parnasso*.

The theatre group is *Gente de Teatro de la Uva*, founded in 1984 with the name of People's Theatre of the Faculty of Medicine, that from 1998 became the official theater group of the university. Its director is Carlos Burguillo.

Through the Area of Extension and Culture, the university presents cultural programs throughout the year, with special emphasis on the UniversiJazz Festival and Santa Cruz.

Valladolid University supports cultural initiatives such as those developed by the *Hermandad Universitaria del Santo Cristo de la Luz*, which includes Christmas and Auto Passion. It assists in the concerts that are organized through each Vice President for University Association and with public and private partnerships.

The university library has 14 library services : they are located in Palencia, Soria and Segovia provinces, the rest are situated in Valladolid, each of them have a director. All the services are managed by a Chief Librarian and coordinated by Central Services. The book collection is available through the Almena Catalogue and UVaDoc repository.

The collection has 970,000 books, some of which are important ; for example its ancient book collection has 45,000 titles including manuscripts and incunabulum of 10th century. Periodicals: 16,000 titles, E-journals: 21,000 titles, E-books: 900, Data bases: 66. , Theses and Masters projects: 33,000. Library Services : Website, reading room, interlibrary and intercampus loan, loan (book collection), computers, e-books, bibliographic information, user education online through Moodle, subject guides, and tutorials.

Other early Spanish universities

- Complutense University of Madrid, 1293
- University of Barcelona, 1450
- University of Santiago de Compostela, 1495
- University of Valencia, 1499

Figure 8.20: **Some University buildings at Valadolid**

Figure 8.21: **Valadolid.**

8.12 Charles University, Prague, 1348

Foundation by the Holy Roman Emperor Charles IV

According to Wikipedia,

Charles University, known also as Charles University in Prague... is the oldest and largest university in the Czech Republic. Founded in 1348, it was the first university in Central Europe. It is one of the oldest universities in Europe in continuous operation. Today, the university consists of 17 faculties located in Prague, Hradec Králové and Pilsen. Its academic publishing house is Karolinum Press. The university also operates several museums and two botanical gardens.

Its seal shows its protector Emperor Charles IV, with his coats of arms as King of the Romans and King of Bohemia, kneeling in front of Saint Wenceslas, the patron saint of Bohemia. It is surrounded by the inscription, *Sigillum Universitatis Scolarium Studii Pragensis* (English: Seal of the Prague academia).

Saint Wenceslas, who lived from 911 to 935 was the "Good King Wenceslas" who is familiar to us from the Christmas carol.

Charles University was the scene of important steps towards Newton's theories of motion and gravitation. The great Danish astronomer Tycho Brahe moved to Prague after quarrelling with his royal patron in Denmark. His work was continued by Johannes Kepler, whom Tycho Brahe invited to join him in Prague. Kepler's three laws of planetary motion became the basis for Newton's universal theory of gravitation.

Jan Hus and religious reform

Jan Hus was a member of the theological faculty of Charles University. His support for John Wycliffe's teaching, and his criticism of the Catholic Church anticipated the Reformation which was later to cause bitter divisions and warfare in Europe. Charles University adopted Hussite principles, was banned by the Pope, but nevertheless continued teaching.

Albert Einstein's work at the Charles University in Prague

Albert Einstein's stay in Prague as a professor at Charles University was extraordinarily successful. During this period wrote 11 scientific works, 5 of them on radiation mathematics and on quantum theory of the solids. In March 1916 in the Leipzig *Annalen der Physik* the work *The Foundation of the General Theory of Relativity* was published and in December of the same year Einstein published his famous book *On the Special and General Theory of Relativity*. This book was later translated also into the Czech language.

Einstein wrote a special preface to this edition "I'm pleased that this little book in which the main thoughts of the theory of relativity are portrayed is now published in the national language of the country in which I found the necessary composure to give the basic thought of the general theory of relativity (1908) step by step a more definite shape so it

Figure 8.22: **Charles University, Prague**

Figure 8.23: **Some Charles University buildings.**

could be realized. In the quiet rooms of the Theoretical Physical Institute of the Prague German University in the Vinicna ulice I discovered in 1911 that the equivalence principle demands a refraction of the rays of light at the sun of a sum that can be observed without knowing that more than a hundred years before a similar conclusion out of the Newton mechanic in connection with Newton's emission theory of the light was drawn. Also the still not really confirmed consequence of the red shift of the spectral lines I discovered in Prague."

8.13 Jagalonian University, Poland, 1364

According to Wikipedia,

Founded in 1364 by Casimir III the Great, the Jagiellonian University is the oldest university in Poland, the second oldest university in Central Europe, and one of the oldest surviving universities in the world. Notable alumni include

astronomer Nicolaus Copernicus, poet Jan Kochanowski, Polish King John III Sobieski, constitutional reformer Hugo Kollataj, chemist Karol Olszewski, anthropologist Bronislaw Malinowski, writer Stanislaw Lem, and President of Poland Andrzej Duda. Students at the University who did not earn diplomas included Nobel laureates Ivo Andrić and Wislawa Szymborska. Pope John Paul II enrolled in the Jagiellonian University of Krakow in 1938 to study Polish Studies at the JU Faculty of Philosophy, but shortly after enrollment, his studies were interrupted by Sonderaktion Krakau.

The campus of the Jagiellonian University is centrally located within the city of Krakow. The university consists of fifteen faculties, including the humanities, law, the natural and social sciences, and medicine. The university employs roughly 4,000 academics, and has more than 40,000 students who study in some 80 disciplines.[4] More than half of the student body are women. The language of instruction is usually Polish, although several degrees are offered in either German or English. The university library is one of Poland's largest, and houses several medieval manuscripts, including Copernicus' *De Revolutionibus*.

Copernicus

Among the most famous graduates of the Jagalonian University was Nicolas Copernicus (1473-1543). He was orphaned at the age of ten, but fortunately for science he was adopted by his uncle, Lucas Watzelrode, the Prince-Bishop of Ermland (a small semi-independent state which is now part of Poland). Through his uncle's influence, Copernicus was made a Canon of the Cathedral of Frauenberg in Ermland at the age of twenty-three. He had already spent four years at the University of Krakow, but his first act as Canon was to apply for leave of absence to study in Italy.

At that time, Italy was very much the center of European intellectual activity. Copernicus stayed there for ten years, drawing a comfortable salary from his cathedral, and wandering from one Italian University to another. He studied medicine and church law at Padua and Bologna, and was made a Doctor of Law at the University of Ferrara. Thus, thanks to the influence of his uncle, Copernicus had an education which few men of his time could match. He spent altogether fourteen years as a student at various universities, and he experienced the bracing intellectual atmosphere of Italy at the height of the Renaissance.

In 1506, Bishop Lucas recalled Copernicus to Ermland, where the young Canon spent the next six years as his uncle's personal physician and administrative assistant. After his uncle's death, Copernicus finally took up his duties as Canon at the cathedral-fortress of Frauenberg on the Baltic coast of Ermland; and he remained there for the rest of his life, administering the estates of the cathedral, acting as a physician to the people of Ermland, and working in secret on his sun-centered cosmology.

Even as a student in Krakow, Copernicus had thought about the problem of removing the defects in the Ptolomeic system. In Italy, where the books of the ancient philosophers had just become available in the original Greek, Copernicus was able to search among

Figure 8.24: **Nicolas Copernicus (1473-1543).**

their writings for alternative proposals. In Ptolemy's system, not all the "wheels within wheels" turn with a uniform velocity, although it is possible to find a point of observation called the *"punctum equans"* from which the motion seems to be uniform. Concerning this, Copernicus wrote:

"A system of this sort seems neither sufficiently absolute, nor sufficiently pleasing to the mind... Having become aware of these defects, I often considered whether there could be found a more reasonable arrangement of circles, in which everything would move uniformly about its proper center, as the rule of absolute motion requires.."

While trying to remove what he regarded as a defect in the Ptolemeic system by rearranging the wheels, Copernicus rediscovered the sun-centered cosmology of Aristarchus. However, he took a crucial step which went beyond Aristarchus: What Copernicus did during the thirty-one years which he spent in his isolated outpost on the Baltic was to develop the heliocentric model into a complete system, from which he calculated tables of planetary positions.

The accuracy of Copernicus' tables was a great improvement on those calculated from the Ptolemeic system, and the motions of the planets followed in a much more natural way. The inner planets, Mercury and Venus, stayed close to the sun because of the smallness of their orbits, while the occasional apparently retrograde motion of the outer planets could be explained in a very natural way by the fact that the more rapidly-moving earth sometimes overtook and passed one of the outer planets. Furthermore, the speed of the planets diminished in a perfectly regular way according to their distances from the sun.

According the the Copernican cosmology, the earth moves around the sun in an orbit whose radius is ninety-three million miles. As the earth moves in its enormous orbit, it is sometimes closer to a particular star, and sometimes farther away. Therefore the observed positions of the stars relative to each other ought to change as the earth moves around its orbit. This effect, called "stellar parallax", could not be observed with the instruments which were available in the 16th century.

Figure 8.25: **Jagalonian University, Krakow, Poland.**

The explanation which Copernicus gave for the absence of stellar parallax was that "Compared to the distance of the fixed stars, the earth's distance from the sun is negligibly small!" If this is true for the nearest stars, then what about the distance to the farthest stars?

Vast and frightening chasms of infinity seemed to open under the feet of those who understood the implications of the Copernican cosmology. Humans were no longer rulers of a small, tidy universe especially created for themselves. They were suddenly "lost in the stars", drifting on a tiny speck of earth through unimaginably vast depths of space. Hence the cry of Blaise Pascal: *"Le silence eternal de ce éspaces infinis m'effraie!"*, "The eternal silence of these infinite spaces terrifies me!"

Figure 8.26: **Some Jagalonian University buildings.**

8.14 University of Vienna, Austria, 1365

Foundation by Duke Rudolph IV

According to Wikipedia,

The University of Vienna is a public university located in Vienna, Austria. It was founded by Duke Rudolph IV in 1365 and is the oldest university in the German-speaking world. With its long and rich history, the University of Vienna has developed into one of the largest universities in Europe, and also one of the most renowned, especially in the Humanities. It is associated with 20 Nobel prize winners and has been the academic home to many scholars of historical as well as of academic importance.

Sigmund Freud

Freud was one of the most famous alumni of the University of Vienna. He received his medical degree from the university in 1881, and he became a professor there in 1902. Forced to leave Austria to escape from the Nazis, he spent his last years in England.

Nobel laureates

- Robert Bárány Physiology or Medicine 1914
- Richard Adolf Zsigmondy Chemistry 1925
- Julius Wagner-Jauregg Physiology or Medicine 1927
- Hans Fischer Chemistry 1930
- Karl Landsteiner Physiology or Medicine 1930
- Erwin Schrödinger Physics 1933.

Figure 8.27: **The University of Vienna, Austria.**

- Otto Loewi Physiology or Medicine 1936.
- Victor Francis Hess Physics 1936
- Richard Kuhn Chemistry 1938
- Max Perutz Chemistry 1962
- Karl von Frisch Physiology or Medicine 1973.
- Konrad Lorenz Physiology or Medicine 1973.
- Friedrich Hayek Economics 1974
- Elias Canetti Literature 1981
- Elfriede Jelinek Literature 2004

Figure 8.28: **The Faculty of Psychology at the University of Vienna.**

8.15 Ruprecht Karl University of Heidelberg, Germany, 1386

Schism and the foundation of the university

In the Great Schism of 1378, two popes were elected after the death of Pope Gregory XI. One of these popes has his residence in Avignon, France, while the other resided in Rome. Germany's leaders supported the pope in Rome, which meant that German scholars studying at the University of Paris lost their stipends. The German Elector of Palatine, Rupert I, recognized this as an opportunity, and initiated talks with Rome that led to a Papal Bull authorizing the foundation of the University of Heidelberg in 1386.

Nobel prizewinners associated with Heidelberg

Alumni

- Theodor W. Hänsch, Physics, 2005
- Wolfgang Ketterle, Physics, 2001
- Max Born, Physics, 1954
- James Franck, Physics, 1925
- Heike Onnes, Physics, 1913
- Albert Michelson, Physics, 1907
- Philipp Lenard, Physics, 1905
- Stefan Hell, Chemistry, 2014
- Fritz Haber, Chemistry, 1918
- Adolf von Baeyer, Chemistry, 1905
- Hans Spemann, Physiology or Medicine, 1935
- Otto Warburg, Physiology or Medicine, 1931

- Otto Meyerhoff, Physiology or Medicine, 1922
- Carl Spitteler, Literature, 1919
- Charles Gobat, Peace, 1902

Long-term staff

- Hans D, Jensen, Physics, 1963
- Walther Bothe, Physics, 1954
- Philipp Lenard, Physics, 1905
- Georg Wittig, Chemistry, 1979
- Karl Ziegler, Chemistry, 1963
- Richard Kuhn, Chemistry, 1938
- Carl Bosch, Chemistry, 1931
- Friedrich Bergius, Chemistry, 1931
- Bert Sakmann, Physiology or Medicine, 1991
- Albrecht Kossel, Physiology or Medicine, 1910

Other early German universities

- University of Leipzig, 1409
- University of Rostock, 1419
- University of Greifswald, 1456
- Albert Ludwigs University of Freiburg, 1457
- Ludwig Maximilian University of Munich, 1472
- Eberhard Karls University of Tübingen, 1477

Figure 8.29: **The University of Heidelberg.**

Figure 8.30: **Heidelberg, Germany.**

8.16 University of Basel, Switzerland, 1460

Some famous graduates

Famous graduates of the University of Basel include Erasmus of Rotterdam, Paracelcus, Jacob Burckhardt, Friedrich Nietzsche, Tadeusz Reichstein, Karl Jaspers, Carl Gustav Jung, Karl Barth, and Jeanne Hersch.

Figure 8.31: **Students from the University of Basel, Switzerland.**

Figure 8.32: **The University of Basel.**

8.17 University of Uppsala, Sweden, 1477

Figure 8.33: **University of Uppsala, the Gustavanium.**

Figure 8.34: **University of Uppsala, the Linnaeus Botanical Garden.**

8.18 University of Copenhagen, Denmark, 1479

Nobel laureates associated with the University of Copenhagen

Alumni

- Subrahmanyan Chandrasekhar, Physics, 1983
- Steven Weinberg, Physics, 1979
- Aage Bohr, Physics, 1975
- Niels Bohr, Physics, 1922
- Jens Skou, Chemistry, 1997
- Niels Jerne, Physiology or Medicine, 1984
- Henrik Dam, Physiology or Medicine, 1943
- Johannes Fibiger, Physiology or Medicine, 1926
- August Krogh, Physiology or Medicine, 1920
- Niels Finsen, Physiology or Medicine, 1903
- Johannes V. Jensen, Literature, 1944
- Karl Adolph Gjellerup, Literature, 1917

Long-term academic staff

- Aage Bohr, Physics, 1975
- Werner Heisenberg, Physics, 1932
- Niels Bohr, Physics, 1922
- George de Hevesy, Chemistry, 1943
- Henrik Dam, Physiology or Medicine, 1943
- Johannes Fibiger, Physiology or Medicine, 1926
- August Krogh, Physiology or Medicine, 1920
- Bertil Ohlin, Economics, 1977

Short-term academic staff

- Andre Geim, Physics, 2010
- David Gross, Physics, 2004
- Sheldon Glashow, Physics, 1979
- Neville Mott, Physics, 1977
- Ben Mottelson, Physics, 1975
- John Schrieffer, Physics, 1972
- Hans Bethe, Physics, 1967
- Lev Landau, Physics, 1962
- Donald Glaser, Physics, 1960
- Felex Bloch, Physics, 1952
- Wolfgang Pauli, Physics, 1945
- Isador Rabi. Physics, 1944

Figure 8.35: **University of Copenhagen buildings at Frue Plads.**

- Paul Dirac, Physics, 1933
- Werner Heisenberg, Physics, 1932
- James Franck, Physics, 1925
- Walter Kohn, Chemistry, 1998
- Paul Berg, Chemistry, Chemistry, 1980
- Geoffrey Wilkinson, Chemistry, 1973
- Linus Pauling, Chemistry, 1954
- Harold Urey, Chemistry, 1934
- Edward B. Lewis, Physiology or Medicine, 1995
- Max Delbrück, Physiology or Medicine, 1969
- James Watson. Physiology or Medicine, 1962
- Wiliam Nordhaus, Economics, 2018
- Laurence Klein, Economics, 1980

Suggestions for further reading

1. Cobban, Alan B. *English University Life in the Middle Ages*, Columbus: Ohio State University Press, 1999.
2. Ferruolo, Stephen: *The Origins of the University: The Schools of Paris and their Critics*, 1100-1215 Stanford: Stanford University Press, 1998.
3. Haskins, Charles Homer: *The Rise of Universities*. Ithaca, New York: Cornell University Press, 1972.

4. Rashdall, Hastings; revd. by Powicke, F. M., and Emden, A. B.: *The Universities of Europe in the Middle Ages, 3 vols.* Oxford: Clarendon Press, [1895] 1987,
5. Lee, John S., and Steer, Christian (eds.), *Commemoration in Medieval Cambridge History of the University of Cambridge*, Boydell, 2018.
6. de Ridder-Symoens, Hilde (ed.): *A History of the University in Europe. Vol. I: Universities in the Middle Ages*, Cambridge University Press, 1992,
7. Rait, Robert S.: *Life in the Medieval University*, Cambridge University Press, [1912] 1931,
8. Pedersen, Olaf, *The First Universities: Studium Generale and the Origins of University Education in Europe*, Cambridge University Press, 1997.
9. Seybolt, Robert Francis (trans.): *The Manuale Scholarium: An Original Account of Life in the Mediaeval University*, Cambridge: Harvard University Press, 1921
10. Thorndike, Lynn (trans. and ed.): *University Records and Life in the Middle Ages*, New York: Columbia University Press, 1975,
11. Verger, Jacques (1999). *"Universität". Lexikon des Mittelalters. Vol. 8.* Stuttgart: J.B. Metzler.

Chapter 9

THREE MEDIEVAL COMPOSERS

9.1 William IX, Duke of Aquitaine (1086-1127)

William IX, Duke of Aquitaine, was the ruler of a province of France. He was also a troubadour, that is to say a composer of poems and songs dealing with courtly love. He is one of the first troubadours whose musical and poetic works have survived. (Eleven of his songs have survived.)

William IX was a notorious womanizer, and he seemed to enjoy shocking his contemporaries with these exploits.

Interestingly, William's granddaughter, Eleanor of Aquitaine, was one of the most wealthy and influential European women of her time. She became Queen of France and later, Queen of England.

9.2 Hildegard of Bingen (1098-1179)

Hildegard von Bingen (1098-1179) was a German scientist, philosopher, theologian, and composer. Her works include three large volumes of visionary theology, over 70 chants and hymns that continue to be performed today, 400 letters to popes, emperors, abbots and abbesses throughout Europe, two volumes devoted to medicine and cures, the first known invented language, and pioneering works on natural history. One of her musical compositions, *Ordo Vertutum*, is a liturgical drama believed to be the oldest example of a morality play. She has for centuries been recognized as a saint by branches of the Roman Catholic Church, and in 2012, Pope Benedict XVI named her a Doctor of the Church. She is also known as Saint Hildegard and Sibyl of the Rhine.

Figure 9.1: **Hildegard von Bingen and her nuns.**

9.3 Guillaume de Machaut (c.1300-1377)

Composer and poet

Guillaume de Machaut is regarded as the most important French composer and poet of the late Middle Ages, and many musicologists regard him as the greatest European composer of the 14th century.

He was born in about 1300 in the Ardennes region of France, near to Reims and to the town of Machault, from which his name undoubtedly derives.

Sectrtary to King John I of Bohemia

Between 1323 and 1346, Guillaume de Machaut was employed as the secretary of John I, king of Bohemia. Machaut often accompanied King John on his trips around Europe, many of them military. In 1330, Machaut was named Canon of Verdun.

In 1346, King John I was killed in the Battle of Créchy, but by that time Machaut was famous as a composer, and he readily found employment in the service of other noble and royal patrons.

Machaut's surviving musical compositions

These include

- 42 Ballades
- 1 Complainte, *Tels rit au main from Le Reméde de Fortune*
- 1 Chanson royale, *Joie, plaisence from Le Remède de Fortune*
- 19 Lais
- 1 Mass
- 24 Motets
- 22 Rondeaux
- 33 Virelais

Many modern recordings of these works are available.

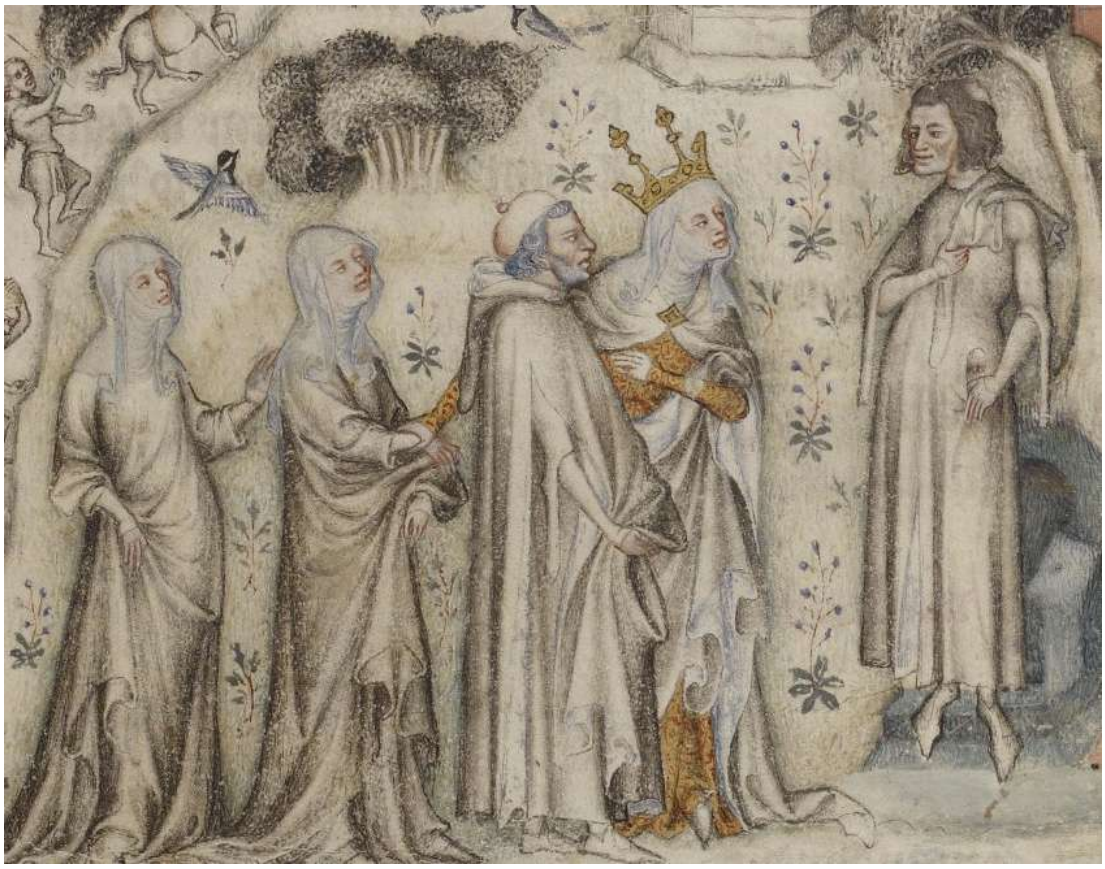

Figure 9.2: **Machaut (right) receiving Nature and three of her children. From an illuminated Parisian manuscript of the 1350s.**

Suggestions for further reading

1. Harvey, Ruth E. *The wives of the 'first troubadour', Duke William IX of Aquitaine* (Journal of Medieval History), 1993
2. Meade, Marion. *Eleanor of Aquitaine*, 1991
3. Merwin, W.S. *Sir Gawain and the Green Knight*, 2002. pp xv-xvi. New York: Alfred A. Knopf. ISBN 0-375-41476-2.
4. Owen, D.D.R. *Eleanor of Aquitaine: Queen and Legend*
5. Parsons, John Carmi. *Eleanor of Aquitaine: Lord and Lady.*
6. Verdon, J. *La chroique de Saint Maixent*, 1979.
7. Waddell, Helen. *The Wandering Scholars: the Life and Art of the Lyric Poets of the Latin Middle Ages*, 1955
8. Burnett, Charles and Peter Dronke, eds. *Hildegard of Bingen: The Context of Her Thought and Art.* The Warburg Colloquia. London: The University of London, 1998.
9. Cherewatuk, Karen and Ulrike Wiethaus, eds. *Dear Sister: Medieval Women and the Epistolary Genre. Middle Ages Series.* Philadelphia: University of Pennsylvania Press, 1993.
10. Davidson, Audrey Ekdahl. *The Ordo Virtutum of Hildegard of Bingen: Critical Studies.* Kalamazoo, MI: Medieval Institute Publications, 1992. ISBN 978-1-879288-17-1
11. Dronke, Peter. *Women Writers of the Middle Ages: A Critical Study of Texts from Perpetua to Marguerite Porete.* 1984. Cambridge: Cambridge University Press, 2001.
12. Flanagan, Sabina. *Hildegard of Bingen: A Visionary Life.* London: Routledge, 1998. ISBN 978-0-7607-1361-7
13. King-Lenzmeier, Anne H. *Hildegard of Bingen: An Integrated Vision.* Collegeville, MN: Liturgical Press, 2001.
14. Newman, Barbara, ed. Voice of the Living Light: *Hildegard of Bingen and Her World.* Berkeley: University of California, 1998.
15. Newman, Barbara. *Sister of Wisdom: St. Hildegard's Theology of the Feminine.* Berkeley: University of California Press, 1987.
16. Pernoud, RÃ©gine. *Hildegard of Bingen: Inspired Conscience of the Twelfth Century.* Translated by Paul Duggan. NY: Marlowe & Co., 1998.
17. Schipperges, Heinrich *The World of Hildegard of Bingen: Her Life, Times, and Visions. Trans.* John Cumming. Collegeville, MN: The Liturgical Press, 1999.
18. Wilson, Katharina. *Mediev al Women Writers.* Athens, GA: University of Georgia Press, 1984.
19. Hanly, Michael (2008). *France: Jean Froissart and Guillaume de Machaut". In Brown, Peter (ed.). A Companion to Chaucer.* Hoboken, New Jersey: Wiley-Blackwell.

Chapter 10

MEDIEVAL CATHEDRAL BUILDERS

10.1 Why and how were the great cathedrals built?

Between the 11th and 13th centuries, the population and prosperity of northern Europe greatly increased, particularly in towns or cities on trading routes. The leaders of these cities and towns wished to show visible evidence of their prosperity and prestige. Also populations had grown so much that the old Romanesque cathedrals were not large enough. However, building new cathedrals, often in the Gothic style, was an expensive and lengthy undertaking, often requiring half a century, or even a full century for completion. Money was solicited from wealthy donors in exchange for the privilege of being buried under the floor of the new cathedral. Donors were even promised absolution from sins in exchange for contributions.

The key figure in the construction of a cathedral was the Master Builder or Master Mason, who was in charge of both the architectural design of the cathedral, and also the daily work on its construction.

Stones were quarried at places which were often far away from the new cathedral's construction site. For example, highly desirable stones from quarries in Normandy were used to build cathedrals in England. Large amounts of timber were also required. Pine was used for scaffolding, and hardwoods, such as oak, were used for supporting roofs.

10.2 Notre-Dame de Paris

The Cathedral of Notre-Dame de Paris, which stands on an island in the middle of the Seine, is considered to be one of the finest examples of Gothic architecture. It is known for its pioneering use of rib vault and flying buttrasses, and for it enormous stained glass rose windows. The construction of Notre-Dame began in 1163. and it was completed by 1260.

Figure 10.1: **The Cathedral of Notre Dame in the 15th century, illuminated by the Master of Anthony of Burgundy.**

Figure 10.2: **View of Cathedrale Notre-Dame de Paris from the river.**

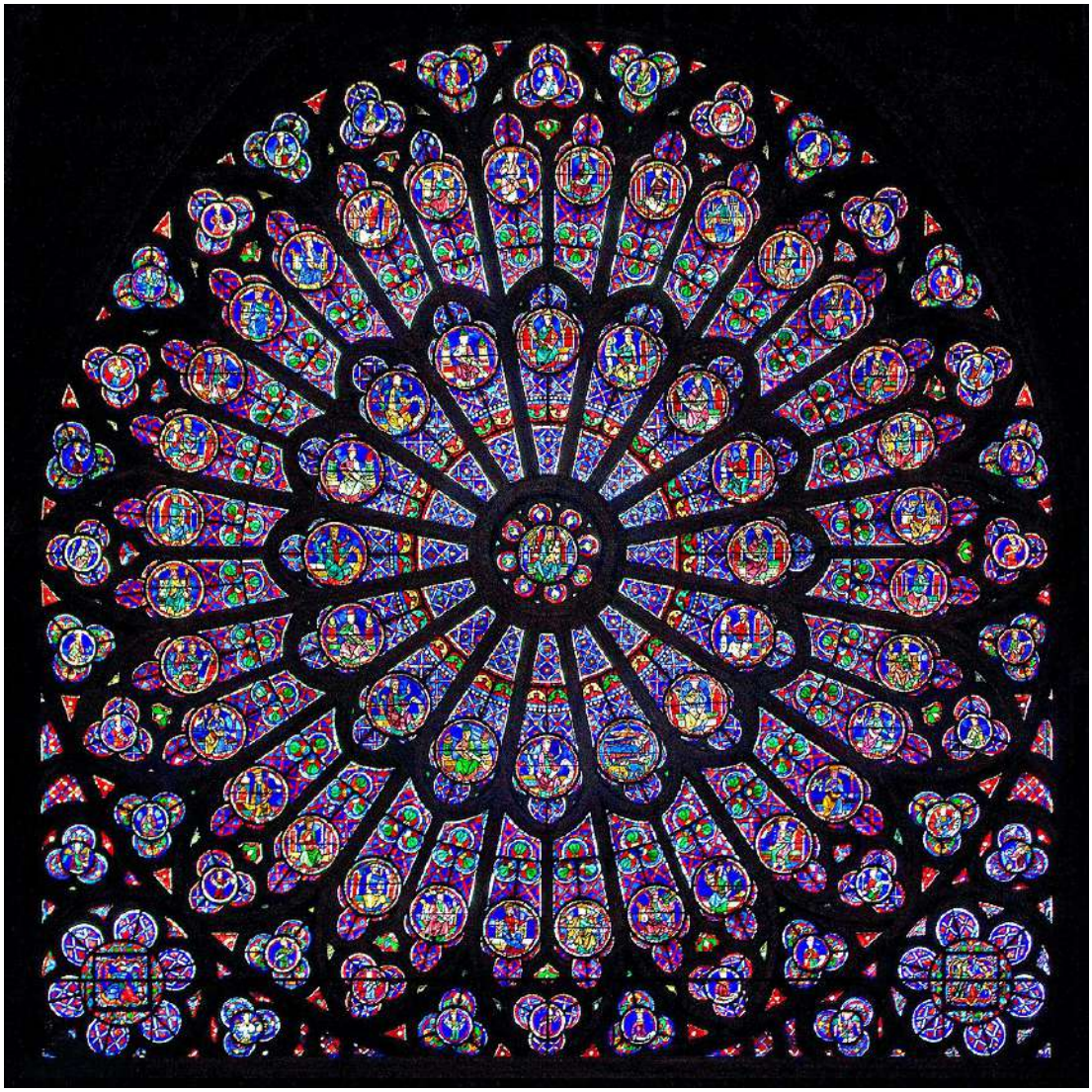

Figure 10.3: **North rose window (about 1250). The colors of medieval stained glass were produced by adding metal oxides.**

10.3 Saint Mark's Basilica, Venice

Built on the site of a previous church

In the eleventh century, the wealth and civic pride of the Venetian Republic led to the building of Saint Mark's Cathedral. The new cathedral was an enlargement and rebuilding of a previous church the had stood on the site, but the enlargement and changes were so great that the cathedral seemed to be an entirely new structure. The construction of Saint Mark's took place between 1063 and 1102.

Attached to the palace of the Doge

Saint Mark's Basilica is attached to the palace of the Doge (the ruler of the Venetian Republic). Thus Saint Mark's has served as the site of official meetings and investitures for the Republic.

Mosaics

The Doge Dominico Selvo, who was in office from 1071 to 1084, personally financed the mosaic decorations of Saint Mark's. He hired a master mosaicist from Constantinople to perform this work.

Music at Saint Mark's

Wikipedia states that **"All musicians and singers were obligated to be present whenever the Doge attended mass for solemn occasions. They were positioned in the tribunes on either side of the chancel or in the pulpitum magnum cantorum, the large raised platform in front of the altarscreen on the right...**

"This division of the choir into parts and their physical separation, coro spezzato, was integral to the Venetian polychoral style, the development of which was favoured by the particular acoustic qualities of St Mark's. The style was characterized by two groups, each having a self-sufficient four-part harmony without dissonance, singing alternatively or simultaneously for effect, particularly at the end of a composition."

Figure 10.4: **The juncture of the southern and western crossarms, showing the original brickwork and the subsequent embellishment.**

Figure 10.5: **The Creation Dome at Saint Mark's.**

Figure 10.6: **Mosaic of Christ Pantocrator.**

Figure 10.7: **Mosaic of Saint Peter (left) and Saint Paul (right) in the Dome of Pentecost with the nations of Mesopotamia and Judea underneath.**

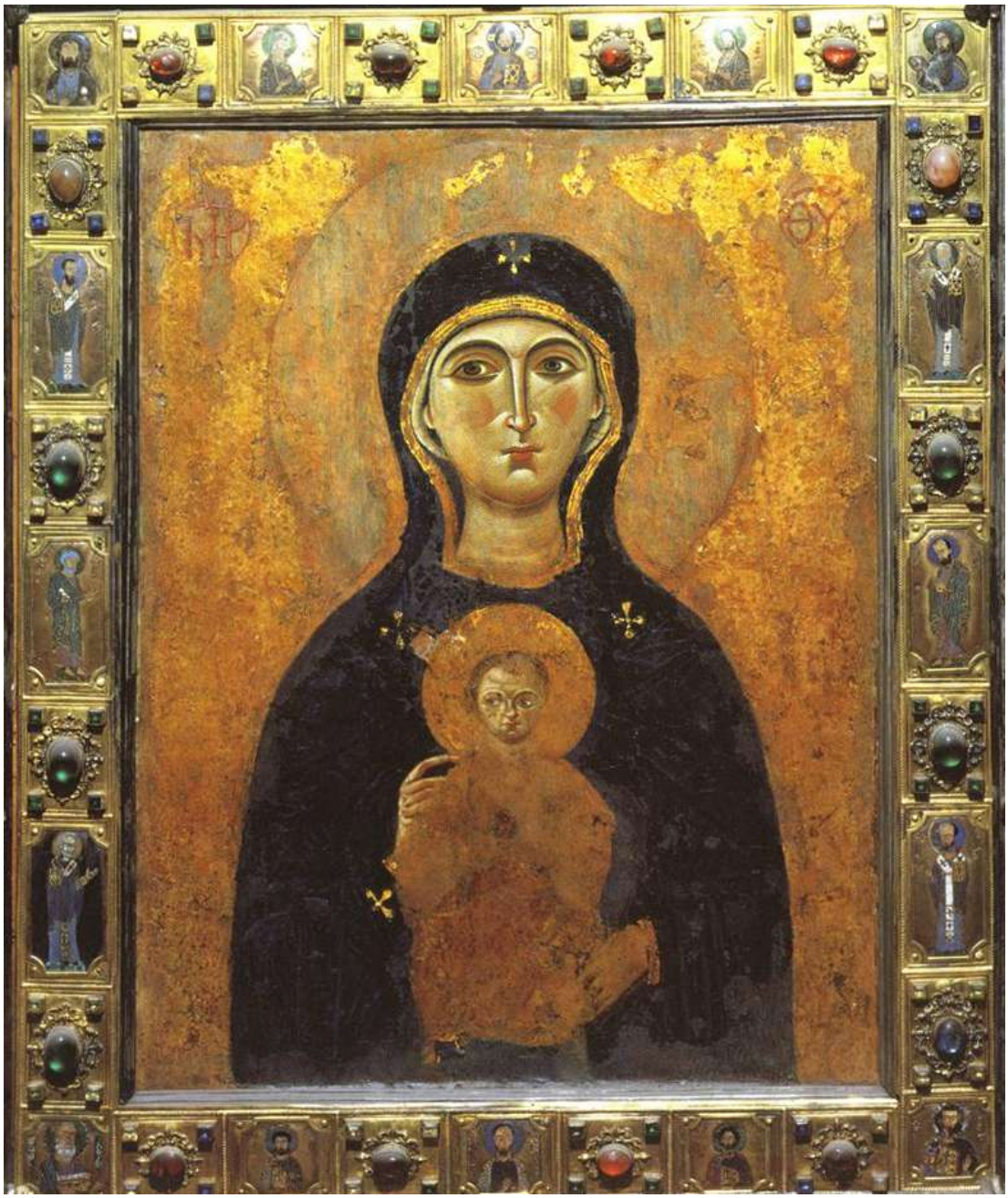

Figure 10.8: **Altar and icon of the Madonna Nicopeia.**

10.4 Canterbury Cathedral, England

Founded in 597, but rebuilt several times

Canterbury Cathedral, in Canterbury, Kent, is one of England's oldest and most famous religious structures. It is the home cathedral of the Archbishop of Canterbury, the head of the Anglican Church.

The cathedral was founded in 597, but it was completely rebuilt between 1070 and 1077. It was again rebuilt, following a fire, 1174.

Archbishop Thomas Becket's conflict with King Henry II

Thomas Becket (1119-1170) was famously murdered in Canterbury Cathedral by four knights in the service of Henry II, king of England. The dispute between King Henry and Archbishop Thomas Becket was over the Constitution of Clarendon, a document drafted by Henry to increase royal power over the clergy. The document introduced laws according to which clergy accused of wrongdoing should be tried in royal courts rather than in ecclesiastical courts.

Becket's refusal to sign the document led to a bitter dispute with the king. According to some accounts, King Henry said, "Will no one rid me of this turbulent priest?" However, according to other accounts, Henry's words were, "What miserable drones and traitors have I nourished and brought up in my household, who let their lord be treated with such shameful contempt by a low-born cleric?"

Murder in the Cathedral

In any case, four knights, Reginald FitzUrse, Hugh de Morville, William de Tracy and Richard le Breton, set out for Canterbury Cathedral to rid King Henry of Becket. At first, they left their weapons outside the cathedral, and hid their armor under their cloaks. The knights told Becket that he was to go to Winchester and give an account of his actions. When he refused, the knights went outside and retrieved their weapons. They rushed in again, shouting, "Where is Thomas Becket, traitor to the King and country?" Becket replied "I am no traitor, and I am ready to die". The knights then struck him on the head with their swords and killed him.

After his death, Thomas Becket was canonized and became a saint. Many pilgrims came to Canterbury Cathedral to pay homage to Saint Thomas.

Another murdered Archbishop

Interestingly, Saint Thomas Becket was not the only murdered and canonized Archbishop of Canterbury. Archbishop and Saint Ælfheah (c.953-1012) was captured by Viking raiders and later murdered by the angry and drunken Vikings when he refused to be ransomed.

Figure 10.9: **Canterbury Cathedral UK from the south-west.**

Figure 10.10: **Image of Thomas Becket from a stained glass window.**

Figure 10.11: **Cloisters at Cabterbury Cathedral.**

Suggestions for further reading

1. Bruzelius, Caroline (December 1987). *The Construction of Notre-Dame in Paris*. The Art Bulletin. 69 (4): 540-569.
2. Davis, Michael T. *Splendor and Peril: The Cathedral of Paris, 1290-1350.* The Art Bulletin (1998) 80-1 pp: 34-66.
3. Herrick, James A. (2004). *The Making of the New Spirituality*. InterVarsity Press.
4. Inglis, Erik (2003). *Gothic Architecture and a Scholastic: Jean de Jandun's Tractatus de laudibus Parisius*. Gesta. 42 (XLII/1): 63-85.
5. Jacobs, Jay, ed. *The Horizon Book of Great Cathedrals*. New York City: American Heritage Publishing, 1968
6. Janson, H. W. *History of Art. 3rd Edition*. New York City: Harry N. Abrams, Inc., 1986
7. Follett, Ken (2019). *Notre-Dame: a short history of the meaning of cathedrals*. New York: Viking.
8. Myers, Bernard S. *Art and Civilization*. New York City: McGraw-Hill, 1957
9. Riley, Henry T. (1851). *The fasti; Tristia; Pontic epistles; Ibis; and, Halieuticon of Ovid*. London: H.G. Bohn.
10. Sandron, Dany; Tallon, Andrew (2013). *Notre Dame Cathedral: Nine Centuries of History*. Translated by Cook, Lindsay; Tallon, Andrew. University Park, Pennsylvania: The Pennsylvania State University Press (published 5 April 2020).
11. Stone, Daniel (2001). *The Polish-Lithuanian State, 1386-1795*. University of Washington Press.
12. Williamson, Paul (1995). *Gothic Sculpture, 1140-1300*. Yale University Press.
13. Wright, Craig. *Music and ceremony at Notre Dame of Paris, 500-1550* (Cambridge University Press, 2008)
14. Babington, Margaret (1955), *The Romance of Canterbury Cathedral*, Raphael Tuck
15. Blick, Sarah (2005), *Reconstructing the Shrine of St. Thomas Becket, Canterbury Cathedral*, in
16. Blick, Sarah; Tekippe, Rita (eds.), *Art and architecture of late medieval pilgrimage in Northern Europe and the British Isles*, Leiden and Boston: Brill
17. Collinson, Patrick; Ramsay, Nigel; Sparks, Margaret, eds. (2002) [1995], *A History of Canterbury Cathedral* (revised ed.), Oxford University Press,
18. Cook, G. H. (1949), *Portrait of Canterbury Cathedral*, London: Phoenix House
19. Farmer, David Hugh (1992), *The Oxford Dictionary of Saints (3rd ed.)*, Oxford University Press,
20. Iremonger, F. A. (1948), *William Temple, Archbishop of Canterbury, his life and letters*, Oxford University Press
21. Purcell, William (1969), *Fisher of Lambeth: a portrait from life*, Hodder and Stoughton,
22. Stahlschmidt, J. C. L. (1887), *The Church Bells of Kent: Their Inscriptions*, Founders, Uses and Traditions, Elliot Stock.

23. Willis, Robert (1845), *The Architectural History of Canterbury Cathedral*, London: Longman
24. Withers, Hartley (1897), *The Cathedral Church of Canterbury*, Bell's Cathedral Series (2nd revised ed.), London: George Bell
25. Butler, John (2011), *The Red Dean of Canterbury: the Public and Private Faces of Hewlett Johnson*, Scala Publishing,
26. Foyle, Jonathan (2013), *The Architecture of Canterbury Cathedral*, Scala Arts and Heritage Publishers,
27. Guy, John (2012), *Thomas Becket: Warrior, Priest, Rebel*, Random House, ISBN 1400069076
28. Keates, Jonathan & Hornak, Angelo (2013), *Canterbury Cathedral*, Scala Arts and Heritage Publishers,
29. Michael, M. A. (2004), *The Stained Glass of Canterbury Cathedral*, Scala Arts and Heritage Publishers,
30. Newman, John (2013), *Pevsner's Buildings of England, Kent: North and North East*, New Haven: Yale University Press,
31. Rudolph, Conrad, *The Parabolic Discourse Window and the Canterbury Roll: Social Change and the Assertion of Elite Status at Canterbury Cathedral,* Oxford Art Journal 38 (2015) 1-19
32. Sparks, Margaret (2007), *Canterbury Cathedral Precincts: an historical survey*, Canterbury: Dean & Chapter of Canterbury,
33. Sparks, Margaret & Brayshaw, Karen (2011) *The Library of Canterbury Cathedral. Canterbury*: Friends of Canterbury Cathedral,
34. Weaver, Jeffrey (2013) *The Ancestors of Christ Windows at Canterbury Cathedral.* Los Angeles: Getty Publications,
35. Withers, Hartley (1908) [1896]. *The Cathedral Church of Canterbury: A Description of Its Fabric and a Brief History of the Archiepiscopal See.* Bell.
36. Woolnoth, William (1816). *A graphical illustration of the metropolitan cathedral church of Canterbury: accompanied by a history and description ... of that venerable fabric ... Also comprising biographical sketches of the lives of the archbishops, and deans of Canterbury; and historical notices of the celebrated Convent of Christchurch*, T. Cadell and W. Davies.

Index