

Science and the Body in the Middle Ages

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Part A: The Medieval Universe

Below is the title page of the *Sphaera Mundi* (Sphere of the World) of **John of Sacrobosco**, a medieval English astronomer who described the structure of the universe and the movement of the planets within it as a set of nested spheres, as illustrated by some of the images below. Originally written **around 1230**, his ideas remained of central importance for centuries beyond the Middle Ages as a popular introduction to astronomy. The book from which this image comes was printed in 1490. Although the image was made near the end of the medieval period, some of its details give us insight into the study of astronomy (personified here as *Astronomia* in the centre) during the Middle Ages.

Using this image as a starting point this guide, drawn from the collections of Winchester College, looks at:

1. Ancient Greek Sources of Astronomy



2. Scientific Instruments: Astrolabes and Armillary Spheres

3. Books, Tables and Diagrams

1. Ancient Greek Sources of Astronomy



The figures beside *Astronomia* acknowledge the ancient roots of scientific knowledge.

On the left is Urania, the Greek muse of astronomy.

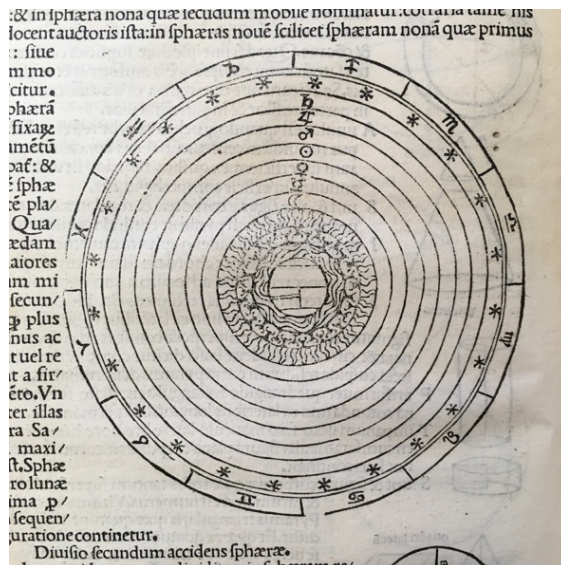
On the right is Claudius **Ptolemy** (c. 100–c. 170 AD), a Greek astronomer who described the Earth as a sphere at the centre of the universe. His description of the universe is known as the **Ptolemaic model** and was widely accepted throughout the Middle Ages.



Another popular medieval text, also called *On the Sphere*, by a contemporary of Grosseteste, John Sacrobosco, contains an image of the Ptolemaic universe (right).

From the centre outwards are:

- The four elements:
- Earth, water, air and fire
- The planets:
 - ☾ the Moon, ☿ Mercury, ♀ Venus, ☼ the Sun,
 - ♂ Mars, ♃ Jupiter, and ♄ Saturn
- The Fixed Stars
- The signs of the Zodiac



According to this model, the planets, Sun and stars move around the Earth. This is based on the model of the universe as understood **Aristotle** (384–322 BC), another Greek philosopher whose work became important again in the Middle Ages.

2. Scientific Instruments: Astrolabes and Armillary Spheres



Left: Back of astrolabe from title page of Sacrobosco book

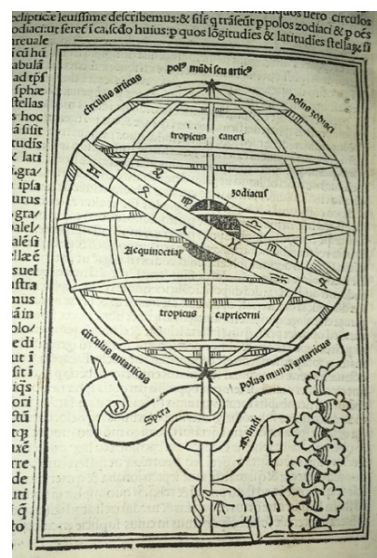
Right: Front of Abī Bakr al Ibarī's (Yemen) Astrolabe, 13th century



An **astrolabe** is essentially a two-dimensional model of the universe, the parts of which can be moved to make a model of the universe for a specific moment in time. It can be used to tell the time, determine the length of day and night, or simulate the movement of the heavenly bodies. They were hugely significant to many religions as they were used to calculate prayer times.

Brief history of the astrolabe:

- 4th century AD: astrolabe thought to have originated in Alexandria (Egypt)
- 8th century onwards: used in Muslim countries, which led instrument making until the 15th century
- 11th century: Europeans learnt of the astrolabe from Muslim Spain, before making them between the 13th and 16th centuries.



An **armillary sphere** is a three-dimensional model of the universe that consists of a framework of concentric rings representing the movement of celestial bodies (planets and stars) around the Earth. (Upper left) Italian armillary sphere, 15th century.

3. Books, diagrams and tables

Knowledge travelled through books, and translations of their texts allowed scientific ideas to spread between cultures. From the 11th century, there was a great surge in the **retrieval and re-editing of texts written before the Middle Ages** and the **translation of new Arabic and Greek texts** (such as that of Ptolemy and Aristotle) **into Latin**.

Medieval manuscripts often contain diagrams that function to help explain the text. These are shown in the book Ptolemy holds in his lap (left). It contains astronomical diagrams, which are much like those found in a medieval scientific manuscript in Winchester's collections: the works of Roger Bacon.



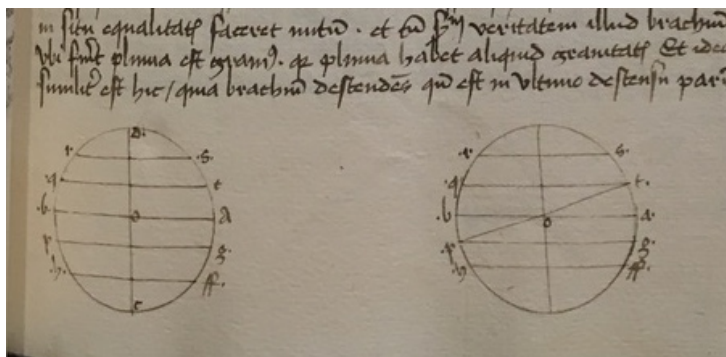
Roger Bacon (c. 1219–c. 1292) was a medieval philosopher and scientist who studied at Oxford before teaching at the University of Paris. He wrote his works in the 13th century – shortly after Sacrobosco's *Sphaera Mundi*.

He was a great supporter of Islamic thinkers and argued that Islamic philosophy should be integrated into Christian learning. He did so in his own work and he applied the methods of **Alhazan** (c. 965–c. 1040, born in Iraq) to older ideas from **Aristotle**.

One of Winchester's manuscripts contains 15th-century copies of Bacon's texts, including:

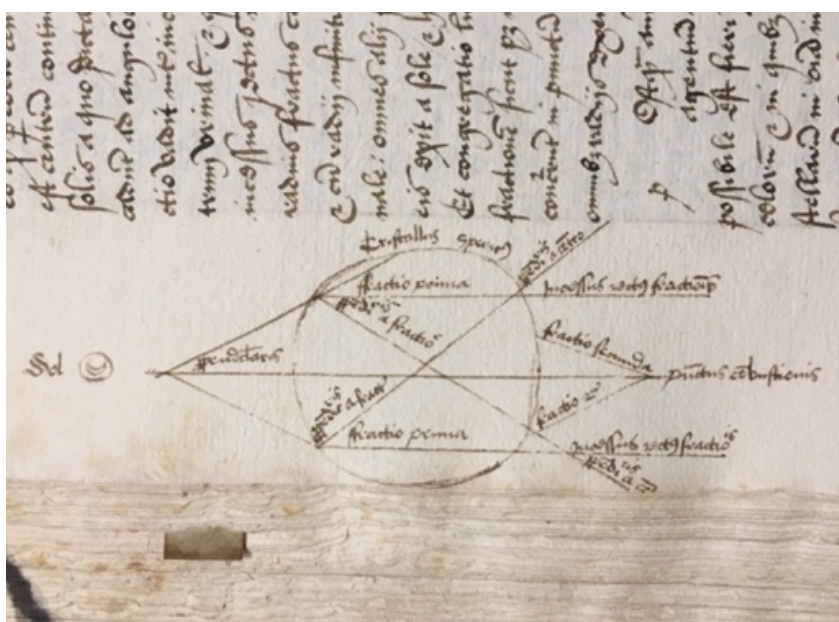
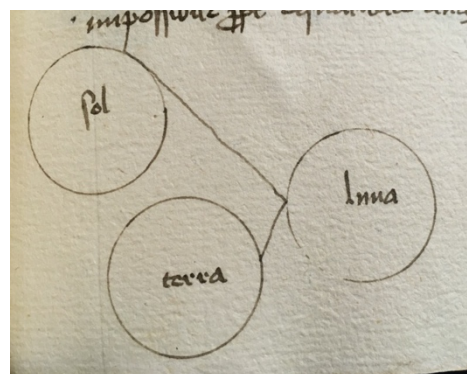
- A treatise on **Optics**, accompanied by diagrams (*De multiplicatione specierum*)
- The '**Great Work**' (*Opus maius*): a huge text which includes texts on perspective (optics), astronomy, weights (mechanics), alchemy, agriculture, medicine, experimental science, and philosophy of science. In 1267, Roger Bacon sent the *Opus Maius* to **Pope Clement IV**, who commissioned the work.
- The '**Third Work**' (*Opus Tertium*): an introduction to the *Opus Maius*

Diagrams in Bacon's texts



This image is from one of Bacon's astronomical texts. The diagram on the right – the same as that in the book held by Ptolemy in the illustration above – is found in many medieval scientific manuscripts and shows the circles of the celestial sphere, as shown by the armillary sphere above.

The diagram on the right is in one of Bacon's texts on astronomy. It explains why the Moon (*luna*) does not always appear as a circle from the Earth's perspective, and therefore why it changes shape as its placement in relation to the Sun (*sol*) and Earth (*terra*) changes.



This diagram is found in Bacon's text on Optics. It shows light – coming from the light source on the left (*sol*: Latin for ‘Sun’) – being refracted by a spherical glass container full of water.

Tables

As well as diagrams, astronomical information was often stored in **tables**. The printed table on the right is from a famous set of astronomical tables called the **Alfonsine tables**, the most popularly used astronomical tables in medieval Europe. They were commissioned by **King Alfonso X of Castile** (1221-84) in the mid 13th century. While they originally contained astronomical data from 1252, they continued to be updated and used for three centuries and were first printed in 1483. The tables gathered together the work of Islamic astronomers as well as new observations from astronomers Alfonso gathered in Toledo (Spain).

Tabula Eclipsio Zune ad longitudinē longiorē					Tabula Eclipsio Zune ad longitudinē longiorē				
Latitudo Zune	Dist cta	Distin- ta ca- sus	Distin- ta ca- sus	Distin- ta ca- sus	Latitudo Zune	Dist cta	Distin- ta ca- sus	Distin- ta ca- sus	Distin- ta ca- sus
m ^o 1	0	m ^o 1	0	m ^o 1	m ^o 1	0	m ^o 1	0	m ^o 1
53 1	0	0	0	0	63 36	0	0	0	0
50 33	1	15 55	0	0	60 39	1	19 9	0	0
48 5	2	12 18	0	0	57 43	2	17 10	0	0
45 38	3	18 58	0	0	54 46	3	23 35	0	0
43 10	4	30 46	0	0	51 49	4	29 35	0	0
40 42	5	32 55	0	0	48 53	5	40 44	0	0
38 15	6	36 12	0	0	45 56	6	43 52	0	0
35 48	7	39 5	0	0	42 59	7	47 13	0	0
33 12	8	41 52	0	0	40 3	8	49 15	0	0
30 52	9	43 5	0	0	37 6	9	51 40	0	0
28 15	10	45 44	0	0	34 9	10	53 5	0	0
25 58	11	48 12	0	0	31 13	11	55 25	0	0
23 30	12	47 30	0	0	28 16	12	58 19	0	0
21 3	13	53 11	10 32	25 19	13	45 47	12 35		
18 35	14	55 14	14 12	22 15	14	41 15	17 16		
16 8	15	33 14	17 5	19 16	15	43 2	20 22		
13 40	16	32 5	19 7	16 19	16	38 27	22 13		
11 13	17	31 9	20 39	13 33	17	37 30	24 18		
8 45	18	30 27	21 46	10 38	18	36 27	26 1		
6 18	19	29 58	22 39	7 40	19	35 35	27 51		
3 50	20	29 41	23 1	4 43	20	35 12	27 52		
1 13	21	29 31	23 28	1 48	21	35 10	28 13		
0	22	29 30	23 50	0	22	35 10	28 16		

Using the instructions at the beginning of the text, the tables could be used to find out the planetary positions (referred to as ‘longitudes’) for any given time.

The table on the left is used to predict when the eclipse of the Moon will take place.



Part B: Medicine in the Middle Ages

Trotula: A Medieval Book on Women's Medicine

Trotula is the title of collection of three texts about women's medicine written in the 12th century. They gained this title from the name of one of the authors, a physician called **Trota of Salerno**. While it was originally written in southern Italy, *Trotula* gained popularity all over Europe.

The three texts are:

- ***Conditions of Women*:**
Discusses menstruation and menstrual disorders, childbirth and pregnancy
- ***Treatment of Women*** (the only text by Trota):
How to prepare and apply medical preparations, focusing on treatments for fertility, but also discusses other issues (such as bladder control and chapped lips)
- ***Women's Cosmetics*:**
How to conserve and improve women's beauty, including the care of the hair, face, lips, teeth, mouth, and genitalia.

As was often the case in medieval scientific texts, we can trace the ideas in these texts to **Arabic sources**. For example:

- *The Conditions of Women* takes much from a Latin translation (Constantine the African's *Viaticum*) of a late 11th-century Arabic text (Ibn al-Jazzar's *Zad al-musafir*).
- In *Women's Cosmetics*, the author notes that much of the advice is from Muslim women.

The Winchester copy of *Trotula*

The copy in the Winchester College Fellows' Library (MS 26) was written in Latin in the late 13th or 14th century and has been bound with other typical medical texts, including some on surgery, anatomy and prognosis. This copy is particularly useful as it contains medieval annotations (notes in the margins) and marginalia (drawings in the margins) that tell us about what its readers thought about the text.

Strangely, these notes and images only appear in the *Trotula* texts, showing the reader was particularly interested that those texts.



Marginalia



The hands (called ‘manicules’) point to remedies that function as contraceptives or which promote conception. An example of one of these contraceptives (translated from Latin) is:

“If a woman does not wish to conceive, let her carry against her nude flesh the womb of a goat which has never had offspring.”



This mournful face is next to an ointment which the text says can be used for sunburn and lesions caused by the Sun or wind



The text next to this figure is a remedy for teeth that are loosened by cold.

Signs of Misogyny?

These images and notes are also valuable as indications of **medieval views on gender**. While they may seem harmless or humorous they have been thought by some historians to indicate the misogynistic – meaning strongly prejudiced against women – views of the readers. The texts are focused on medical treatments for women, but the only parts highlighted are those to do with remedies for men, or parts of women’s medicine that can benefit men, such as recipes to control fertility and avoid pregnancy. As Monica Green, a historian of medicine, described:

“The Winchester manuscript shows how marginalia that might initially be taken as whimsical or playful appear, on closer analysis, rather more vulgar and frightening.

When these readers turn to women, their jokes become cruel.” [*Making Women’s Medicine Masculine: The Rise of Male Authority in Pre-Modern Gynaecology*, 2008, p. 236)

Conclusions: In the Middle Ages...

- Knowledge travelled through books in the form of texts and images
- Much of medieval knowledge is taken from Arabic sources and translations, and built upon ancient Greek works, such as those of Aristotle and Ptolemy
- Texts from the 12th and 13th centuries continued to be copied, used, and often updated centuries later

Timeline of sources discussed

c. 350 BC	Aristotle writes 'On the Heavens'
2 nd century AD	Claudius Ptolemy writes his astronomical text, the <i>Almagest</i>
1011-1021	Alhazan (Iraq) writes his famous 'Book on Optics' (<i>Kitāb al-Manāẓir</i>)
10 th century	Ibn al-Jazzar (Tunisia) writes 'Provisions for the Traveller and Nourishment for the Sedentary' (<i>Zad al-musafir</i>)
Mid 12 th century	Trota of Salerno writes the <i>Treatment of Women</i> (part of <i>Trotula</i>)
Mid 13 th century	King Alfonso X of Castile commissions the Alfonsine Tables
c. 1230	John of Sacrobosco writes <i>Sphaera Mundi</i>
1267	Roger Bacon sends his <i>Opus Maius</i> to Pope Clement IV
13 th –15 th centuries	Copies of Sacrobosco's <i>Sphaera Mundi</i> , <i>Trotula</i> , Roger Bacon's works and the Alfonsine tables in the Fellows' Library produced

Online Resources:

- Representation of the body in medieval manuscripts:
www.cabinet.ac.uk/corpus
- On Islamic manuscripts: <https://islamsci.mcgill.ca/RASI/ismi.html>
- Medicine in the Middle Ages, *British Library Online*: <https://www.bl.uk/the-middle-ages/articles/medicine-diagnosis-and-treatment-in-the-middle-ages>
- Medical Knowledge in the Early Medieval Period, *British Library Online*:
<https://www.bl.uk/medieval-english-french-manuscripts/articles/medical-knowledge-in-the-early-medieval-period>
- Medieval Science and Mathematics, *British Library Online*:
<https://www.bl.uk/medieval-english-french-manuscripts/articles/medieval-science-and-mathematics>

Questions for reflection

1. Consider the difference between modern scientific textbooks, which are obsolete after a few decades, and medieval texts, which were copied and read for centuries after they were written. What does that suggest about the nature of medieval science?
2. How can these books help historians to understand scientific and medical knowledge in circulation during the medieval period?
3. What role(s) did images play in these books?
4. Besides medical and scientific ideas in circulation during the Middle Ages, what else can the above-mentioned books tell us about the medieval period?
5. What evidence is there that science and religion were not entirely separate during this time?