A Companion to „Science in the Middle Ages”

Slides 2-4 present general chronology (with link to Slide 89 which contains a map showing the expansion of barbaric tribes from the East)

Slides 6-7 contain a list of most important medieval compilations of fragments of Greek science; the level of these books was quite low, as shown e.g. in excerpts from *Origines* by Isidore of Seville (Slides 11-13). One has to remember that such chaotic compilations remained the only source of knowledge for several centuries!

Slides 8-10.

Greek science has been ridiculed, suppressed and destroyed by Christian authors for being pagan and therefore useless; the illustration in Slide 8 is modern but the text is original. Quite striking is the statement by Saint Augustine, one of the better educated Christian scholars. An example of naive „Christian picture of the world” is shown in Slide 10: *Sinus Romanus* was the Latin name of the Mediterraneanan Sea which was supposed to be situated on the slopes of a big mountain behind which the sun hid itself at sunset (*Sol Occidens*), and then showed itself again at sunrise as *Sol Oriens* (Eastern Sun); the author of that image explained that the river Nile has to flow upwards hence its current was slow compared with the rivers Tigris and Euphrates which both were flowing downhill to *Sinus Persicus* (lower right corner).

Slide 15.

When the Moslems conquered most of the civilised world in south and central Asia, North Africa, and Europe, they tried to absorb Greek science. It was achieved by organizing large scale translations of Greek books into Arabic language. This action preserved a large part of Greek science for later times, because the original Greek libraries and collections of books have been gradually destroyed by wars.

Slides 16-17. Some important Moslem scientists, to be met in later slides

Slides 18-31. Universities

Slide 19 is self-explanatory

Slide 20.

The Bologna type universities were corporations of students who hired teachers to acquire education from them; that type of administration was quite rare. Most universities were corporations of teachers (the Paris type).

Slides 24-25.

The university debates played a very useful role because the participants were allowed to reach beyond the established Aristotelian science.

Slides 26-28.

The number of students at medieval univeristies was quite small. Moreover, only few of them stayed until receiving diplomas.

Slide 31.

The important thing to be remembered is that there were no laboratories in medieval universities. Experiments were not performed. University scholars were doing research of texts, and not phenomena of nature

Slides 32-50.

Mechanics. The criticism of Aristotelian mechanics has been centered on the question what keeps a body in motion after its contact with a mover is terminated. Moslem scientist Avicenna argued that a body acquires an „inclination" to move. A more elaborated theory of „impetus" was proposed by a French scientist Jean Buridan (slides 38-40 and 45). That theory was important in further development of mechanics. In particular it changed the perception and description of a body thrown into a tunnel perforating the Earth globe (slides 42-44)

Slides 46 and 47 illustrate the gradual modification of the Aristotelian description of motion through the introduction of a „mixed motion" (*Motu mixto*)

Slide 48 presents - in a modern form - some proposed modification of Aristotelian mechanics. Remember that it is only an anachronistic representation because formulas were not used in medieval times!

Slides 51-69.

Medieval optics. Experimental facts concerning light were scarce (Slide 53). It did not prevent ancient and medieval scholars to propose various theories of light (Slide 54). The Aristotelian theory is presented in Slides 55 and 56.

Medieval optics was quite different from the present form of that discipline. Its considerable part was the science of vision (Slides 51, 57-59, 64-65). The most important medieval treatises on optics were those of Alhazen (Slide 52), WItelo of Silesia (Slides 63-67) and Theodoric of Freiberg (Slides 68-69) who experimented with sun rays passing through transparent prisms and spheres, and studied refraction of light in these media. Theodoric assumed correctly that the rainbow is caused by passing of sun rays through tiny raindrops of water in our atmosphere and was able to explain the primary rainbow (Slide 69, left picture - two refraction and one internal reflection) and the secondary rainbow (Slide 69, right picture, two refractions and two internal reflections). He did not

know the law of refraction of light and could not calculate the angular dimension of the two rainbows (about 42^o and 52^o , respectively). Nevertheless his work was a remarkable achievement.

Slides 70-77.

Magnetism. The attraction of iron by a magnet (natural magnetic stone, also called lodestone) was well known even at the time of Thales of Miletus. However, in Antiquity and early medieval times no one tried to study magnetism by experiments. A French scholar Pierre of Maricourt, known better under his Latinised name Petrus Peregrinus, was the first who attempted experiments and presented his results in a small booklet, written in the form of a letter (*Epistola*) to his friend in 1269. His style has been remarkably modern. He made himself a spherical magnet (*magnes rotundus*) out of a piece of lodestone and by performing experiments he explained the way to distinguish north and south poles and discovered magnetic attraction and magnetic repulsion. The conclusion of his treatise (Slide 77) shows that in spite of his experimental skill he remained a medieval man and believed that magnetic action is caused by the heavens.

Slides 78-85.

The medieval world picture was a mixture of Aristotelian physics and biblical representation of the heavens. The medieval people were convinced that their picture of the geocentric world was ideal and did not require any modification (Slide 84).

Slide 83 is of special interest because it presents a text in so-called Middle English (quite hard to understand) which is a description of the time equal to 7157.5 years needed to travel by foot to the end of the world! Please notice that Roman numerals are used there (M = 1000, C = 100, L = 50, V = 5, I = 1) so that
seuen.M.i.C and .lvii should be read as 7000 + 100 + 57 = 7157

Slides 86 and 87 contain some details of the development of mathematics in Europe, in particular gradual introduction of various mathematical symbols instead of words.