



The Scientific Revolution with Dr. Ted Davis

Lecture 7.1: New Sources of Knowledge and New Attitudes about Acquiring It: New Sources of Knowledge

Outline:

New Sources of Knowledge and New Methods – wider use of laboratory experiments and mathematical analysis

- New sources of knowledge, voyages of discovery and new instruments
- During the Scientific Revolution, the older ideas of Aristotle, Ptolemy, Galen and other ancient thinkers were gradually discarded. What would replace them?
 - Instead of getting scientific and medical knowledge from ancient books and commentaries based on them – the method used to earn doctoral degrees in the universities – advocates of the new science relied on new sources of knowledge and stressed other methods to obtain knowledge.
- In the medieval university, natural philosophy [science] and medicine were learned mainly through *the same methods* used in text-oriented disciplines such as law and theology. Classic written texts were read, memorized, interpreted, and argued about in form disputations. The most revered scientific authorities were Greek.
- A good example: teaching anatomy in medieval & Renaissance medical schools. The dissection of a cadaver is from a text from the 14th century. A third person reads from a text.
 - Knowledge was found in the written text, typically a commentary on Galen, such as that by Mondino de Luzzi (c. 1270-1326), not in the human body itself.
- **Voyages of exploration** to Africa, India, and the Far East by Vasco da Gama and others showed Europeans that ancient geographical and anthropological knowledge was flawed. The coastlines were poorly represented in the best maps, based partly on ancient authors – casting doubt on the authority of traditional sources.
 - At the same time, explorers found that the tropics were heavily populated – contradicting Aristotle's view that the "torrid zone" was too hot to be inhabited. This also cast doubt on the authority of traditional sources.
 - "There we learned that the land was not an island but a continent, both because it extends over very long straight shorelines, and because



it is filled with countless inhabitants.” – Amerigo Vespucci, *Mundus novus*, 1504.

- New botanical and zoological knowledge also came from voyages of discovery. European scientists studied and collected plants & animals from all parts of the globe – a tradition that continued down to our own day.
- The importance of new instruments as sources of new knowledge during the scientific revolution cannot be overstated. Almost 25% of the most important scientists of this period invented or developed new instruments! The **telescope**, named in 1611, was available no later than 1608 in the Netherlands.
 - Isaac Newton made a very small reflecting telescope in 1668.
 - The **microscope** was available no later than 1590 in the Netherlands. Generations later, Antoni van Leewenhoek (1632-1723), a cloth merchant, made tiny, powerful single-lens instruments that were capable of 270x, the best at the time.
 - Robert Hooke (1635-1703) used a compound microscope to draw superb images of many things for his book, *Micrographia: or some Physiological Descriptions of Minute Bodies made by Magnifying Glasses* (1665).
 - The mechanical philosophy, with its emphasis on particles of matter in motion, provided some impetus to microscopy during the Scientific Revolution. Hooke thought that, given good enough microscopes, we might eventually see “the figures of the compounding Particles of matter”.
 - Visible light will never see molecules and atoms. Anything smaller than the wavelength of visible light will not be seen with visible light. Other forms of microscopy have fulfilled this.
 - The **barometer**, named in 1663 by Robert Boyle, was based on an experiment designed in 1643 by Galileo’s assistant Evangelista Toricelli (1608-1647) and carried out the following year by Vincenzo Viviani.
 - The **vacuum pump** was invented c. 1647 by Otto von Guericke (1602-1686) in Magdeburg. He carried out a spectacular demonstration of the power of air pressure. Teams of horses could not separate two hollow copper hemispheres when the air was evacuated from between them!