

Use of reason, mathematics, and technology
to understand the physical universe.

SCIENTIFIC REVOLUTION

Background Info

- Scientific rev gradually overturned centuries of scientific ideas
- Medieval scientists did not make observations of the natural world
 - Relied on ancient authorities
 - Aristotle & Galen

Background

- Renaissance humanists used works of Ptolemy, Archimedes, & Plato.
- Renaissance artists tried to imitate nature
 - Close observations
 - Perspective, correct anatomical proportions
- New inventions
 - Telescope, microscope, printing press

Background

- Math promoted during Renaissance
 - Math is key to navigation, military science
- Copernicus, Kepler, Galileo, Newton great mathematicians of the time.

Theories about the Universe

1600s – Scientific rev spread throughout Europe.

- Copernicus: (1492, Poland)
 - Heliocentric universe (Sun-centered)
 - Hypotheses
 - Revolutionary and dangerous ideas
- Tycho Brahe: (1500s, Danish astronomer)
 - Observatory
 - Planetary movements
- Johannes Kepler: (German astronomer & mathematician)
 - Mathematical proof & Copernicus and Brahe's data
 - Ellipses



Revolution in Astronomy

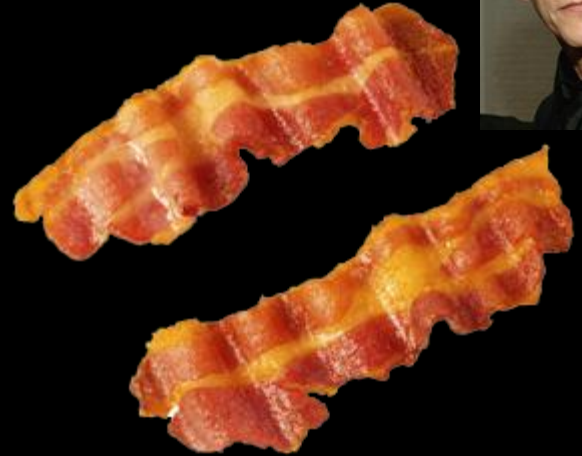
- Galileo Galilei: (Italian mathematician)
 - Telescope (1609) & published "The Starry Messenger" (1610)
 - Condemned by the Catholic Church
 - Heavens not spiritual & humans not center of universe
 - Pope Urban VIII → stand trial → Found guilty (house arrest until death)
- Isaac Newton: (English scientist)
 - Tied together works of Copernicus, Galileo & Kepler
 - (1687) *Mathematical Principles of Natural Philosophy - Principia*
 - Developed calculus
 - Continues in a state of rest/motion (straight line) unless turned aside by a force
 - Rate of change is proportional to the force acting upon it
 - To every action there is an equal and opposite reaction
 - Gravity attracts objects to one another

New Ways of Thinking



- Francis Bacon (Visionary)

- Scientific method
- Truth → thorough investigation



- Rene Descartes

- Analytical geometry
- Reflected on doubt and uncertainty that was everywhere
 - Could not doubt his own existence
- Would accept only things that reason said were true
 - I think, therefore I am [Truth → reason (thinking)]
 - Cannot doubt your mind- can doubt the material world
- Called the father of modern rationalism

Investigating the Human Body

- Galen: (Ancient Greek)
 - Roman law did not allow human dissection (dogs & apes)
 - Blood in arteries
- Andreas Vesalius: (French medical student)
 - Discoveries in anatomy (personally dissected a human body)
 - Corrected Galens' mistakes (blood system starts in liver/heart has a bone)
 - (1543) published *On the Structure of the Human Body*
 - Attacked for his findings & gave up his studies
- William Harvey: (English physician)
 - Blood circulation
 - Observed early fire trucks in England
 - Not criticized like Vesalius
- Robert Hooke: (English scientist)
 - Discovered the cell



= pump

Experimenting with Chemistry

- Robert Boyle
 - Pure science
 - Criticized alchemy
 - (1661) The Skeptical Chymist
- Joseph Priestley - English chemist & clergymen
 - (1774) Oxygen
 - Properties of carbon dioxide
- Antoine Lavoisier - France
 - Combustion
- Marie Lavoisier
 - Learned English & Latin (translation of essays & books)

Women in the Scientific Rev.

- Women were mostly excluded from universities
 - Noblewomen could take part w/their fathers & brothers
- Life devoted to scholarship is at odds with domestic duties women were expected to perform
- New science theories reinforced idea of women subordinate to men
 - Educated women = collectors item → show off but no use at all
- Margaret Cavendish: (English Writer)
 - Not allowed to be a member of the English Royal Society
 - Wrote # of scientific works
 - Critical of belief that humans were masters of the universe
- Maria Winkelmann: (German Astronomer)
 - Educated by father and uncle
 - Discovered a comet in 1702

Science and Religion

- Church feared possible split between science and religion
- Blaise Pascal- tried to convert rationalists to Christianity
 - Humans are weak, deceived by their senses, misled by reason
 - God is a reasonable bet. It is worthwhile to assume he exists. If he does, then we win all. If he does not, we lose nothing.

Spread of Scientific Knowledge

- Secularization- seeing the world in material not spiritual terms.
- French start the French Royal Academy of Sciences
 - Paid for and run by government
- English start the English Royal Society
 - Informal gathering of scientists, little govt. support