

Scientific Revolution

What was the scientific revolution? How did it change the way Europeans viewed the universe and the workings of the human body?

It was the use of reason, mathematics, and technology to understand the physical universe; they relied less on traditional authority, religion, and magic and turned to experimentation, individual experience, and the scientific method to understand the world around them.

Introduction

- (1600s) A scientific revolution spread throughout Europe.
- New technology w/ innovative approaches to seeking knowledge, led to a breakthrough in Western thought. At the forefront of this scientific revolution was an astronomer named **Nicolaus Copernicus**.

A Scientific Revolution

- Copernicus started his scientific career in 1492 at the University of Kraków in **Poland**.
 - Believed that the earth was round
 - It rotated on its axis→revolved around the sun, which stayed at the center of the universe
 - Based his **hypotheses**, theories that attempt to explain a set of facts, on study & observations→did not have the mathematics to prove them
 - Realized that his ideas were revolutionary and even dangerous
 - Disputing or questioning traditional views about the universe could mean harsh consequences
 - Spent more than 30 years writing his treatise in private
 - Friends who realized the significance of Copernicus's ideas helped publish his work just before his death.

New Theories About the Universe

- Other scientists took Copernicus's ideas & explored even further into a scientific understanding of the universe.
 - (1500s) Danish astronomer **Tycho Brahe** set up an observatory to study heavenly bodies & accumulated data on planetary movements.
 - **Johannes Kepler** (German astronomer & mathematician) used Brahe's data w/ the goal of providing mathematical proof for Copernicus's hypotheses.
 - Using math formulas, showed that planets revolve around the sun
 - His findings proved wrong some of Copernicus's views
 - Proved that planets move in oval paths, ellipses, not circles

Challenging the Church

- Kepler challenged the teachings of many academic & religious leaders.
 - He was a Protestant and did not have to fear the Catholic Church.
- Italian mathematician, **Galileo Galilei**, did face opposition from the Church.
 - (1609) Galileo built his own telescope
 - Through observations of Jupiter & its moons, he became convinced that the Copernican theory was correct.
 - (1632) Galileo published his ideas
 - **Pope Urban VIII** demanded that he come to Rome & stand trial
 - Facing possible torture & death, Galileo publicly withdrew many of his writings but continued to work privately.

New Ways of Thinking

- Philosophers → **Francis Bacon** & **René Descartes** incorporated scientific thought into philosophy.
 - **Bacon** → truth resulted only from a thorough investigation of evidence.
 - Helped develop the **scientific method**
 - **Descartes** → inventor of analytical geometry
 - Believed that truth must be reached through reason
 - Saw mathematics as the perfect model for clear & certain knowledge.
 - Believed in one self-evident truth in the statement “I think, therefore I am.”

Newton's Universe

- English scientist **Isaac Newton** → one of the most influential figures in modern science.
 - Used the scientific method as he studied science & mathematics.
 - (1687) Published his theories of gravity & other scientific concepts in his book ***Mathematical Principles of Natural Philosophy*** → (***Principia***)
 - To prove his theory of gravity, he developed **calculus** → calculates changing forces or quantities.

Studying the Natural World

- As astronomy, philosophy, & math advanced, so did anatomy & chemistry
 - Most knowledge of anatomy had come from the work of **Galen**, an ancient Greek.
 - Roman law forbade the dissection of human corpses, forcing Galen to formulate theories by dissecting dogs & apes.
 - Discovered the existence of blood w/in arteries
 - Believed that the liver digested food & processed it into blood

Investigating the Human Body

- French lawmakers (1500s) considered dissecting human bodies illegal.
 - Limitations did not stop **Andreas Vesalius**, a French medical student, from making groundbreaking discoveries in anatomy.
 - (1543) He published ***On the Structure of the Human Body***
- English physician **William Harvey** concluded that blood circulates throughout the body, pumped by the heart & returning through the veins.
- English scientist **Robert Hooke** → important biological discovery → the cell

Experimenting With Chemistry

- **Robert Boyle** took chemistry from mystical / unscientific → established it as a pure science
 - (1627) Chemistry of the day—**alchemy**—trying to turn a base metal (lead) into gold
 - Boyle criticized **alchemists** & their belief that all matter was made up of 4 elements:
 - Earth, fire, water, & air
 - Boyle's book ***The Skeptical Chymist*** (1661) he proved air could not be a basic element because it was a mixture of several elements.
 - Defined an element as a material that could not be broken down by chemical means
- (1774) English chemist & clergyman **Joseph Priestley** discovered oxygen
 - Studied the properties of carbon dioxide led to his invention of carbonated drinks.
- In France, **Antoine Lavoisier** discovered the nature of combustion, → chemical union of a flammable material with oxygen.
 - **Marie Lavoisier** contributed significantly to her husband's work
 - Learned English & Latin → translate scientific essays & books for him