

# Chapter 20: Scientific Revolution

## Sec.1 New Scientific Ideas (Enlightenment)

- Up to mid. ages Religion ruled science
  - If gave other view then heretic & excommunicated
  - Earth flat/ God created univ. for humans, so Earth must be at center
- 1600's new tech. and knowledge in W. broke religions hold
- First real scientist to go against church
  - Nicolaus Copernicus (Polish astronomer)
    - Entered Krakow Univ. 1492
    - Believed Earth round and rotated on axis and around sun
    - Worked in privacy and did not publish for 30 years
      - He and friends published just before death
    - Based hypotheses (theories) in study and observations
      - Did not have proper math and equipment
- Other scientists follow
  - Tycho Brahe-built observatory for planetary movements
  - Johannes Kepler- used Brahe's data to prove Copernicus hypo.
    - His math showed sun at center w/planets orbiting
    - Proved elliptical orbits /Cop. said circular
    - Planets go at different speeds and speed up as get close to sun
    - Protestant and not need worry about Catholic Church
  - Galileo Galilei (Italian mathematician)
    - 1609 built own telescope
    - Saw moons circling planets
      - Earth revolves around sun and other planets too
    - 1632 published work and Church banned book
      - Pope Urban VIII put him on trial
        - Under threat-recanted much
    - Continued work on motion of objects (orbits)
      - Universal Laws of Physics
        - Body in motion tends stay in motion
        - Straight line until acted upon by another
      - Worked on pendulum-became important clock time control
- New ways of thinking
  - Francis Bacon (English philosopher)
    - All ideas based on tradition or unproven facts – thrown away
    - Truth only from thorough investigation of evidence
      - Scientific Method
        - Observations of facts
        - Hypothesis to explain
        - Test under variable conditions
        - Repeat findings to check
        - If true then is “scientific law”
      - Truth deduced from observations and experiments
  - Rene Descartes (Fr. Mathematical and philo.)
    - Invented analytical geometry
    - With math everything in univ. can be explained
    - “ I think, therefore I am” one absolute truth
  - Isaac Newton

- Studied at Cambridge Univ almost dropped out but tutored
  - 1665 outbreak of Plague closed univ. and returned home
- On farm began work on gravity and physics on own
  - Legend of apple falling
- 1687 published work on gravity and physics (Principia)
  - Explained why planets move as they do
  - Explained force of gravity and developed calculus to prove
- Work helped prove math explain all things in univ.
- Studying the Natural World
- Before Ren. Most anatomy learned from Galen (Roman)
  - Roman law forbade human dissection so did dogs and apes
    - Blood in veins and arteries/ liver digest food and make into blood
    - Some right but some wrong
- Andreas Vesalius (French) - Fr. Not allow human dissection he but did it anyway
  - Said since Galen did dogs and apes- conclusions about humans wrong
  - 1543 published work (On The Structure of the Human Body)
- William Harvey (English physician) late 1600's
  - Blood circulates throughout body and pumped by heart
- Robert Hooke
  - Used "new" microscope to view and identify cells
    - Cells b/c reminded him of honeycomb
- Chemistry
  - Robert Boyle
    - Dispelled alchemy and attacked 4 elements (book- The Skeptical Chymist 1661)
    - Defined "elements" as material that can't be broken down further
  - Joseph Priestly
    - Properties of air and existence of oxygen and CO<sub>2</sub>/invented carbonation
  - Antoine Lavoisier
    - Combustion a chemical reaction between oxygen and flam.
- Material
- Most important discovery-scientific method-
  - Used in ALL scientific discoveries

## Sec. 2 Impact of Science

- New ideas peaked interest of wealthy and nobility
  - Often became patron of scientist (Provided \$ support)
  - Opened Science academies/museums/ observatories
  - Held "salons" (nobility-wealthy-artists-writers-educated-mid. Class)
    - Met and discussed ideas and socialized
- If science governed by logic and math then politics-economics-society too
  - Natural Law explain society through reasoning
    - Thomas Hobbes and John Locke (English) during civil war and social strife
      - Hobbes-monarchy best form of gov. (Book-Leviathan)
        - Violence and disorder natural for humans
        - Need absolute ruler to keep order
        - People have social contract w/ monarch
          - Give up freedom and obey and monarch protect and provide order
        - People have no right to rebel- in general-
      - John Locke (Book-Two Treatises of Gov.)

- People naturally reasonable and moral/ have natural rights
  - Right belonging to all humans from birth-life-liberty-property
- Gov. created to protect rights and gov. should be limited
- If Gov. fail to protect hen should be replaced
- Many revolutionists used to justify uprisings (Am. Thomas Jefferson)

-Other effects of Sci. and reasoning

- Law changed –less value on hearsay and confessions by torture
- Religion-w/logic many move away from organized religion
  - Deism-recognized a “supreme being” w/laws of nature
- Opponents (some of end of Sec. 3)
  - Some felt too much logic/sci/reasoning imprisoned humans
    - Jean-Jacques Rousseau. People rely more on instinct and emotions
    - Humans good but civilization corrupts
    - Return to nature and live simply country life
  - Immanuel Kant/reason not answer problems of metaphysics
    - Philosophy that deals w/spiritual issues
- Others rejected deism b/c not emotionally satisfying
- People questioned philo. Of Enlightenment
  - Romanticism evolved/celebrated emotion and individual
- All marked ending of Age of Enlightenment
  - Ushered in Age of Revolution