

## Sir Isaac Newton

Born on Christmas Day 1642, the same year Galileo died.

- Sickly as a baby

- Mother married a rich minister when he was 2

- Left him with grandparents

  - Had a major effect on his personality

Stepfather dies. At 12 invited to manage mother's estate

- Unable to get along with farmhands

- Didn't care about agriculture

Three English civil wars during his childhood

Went to Trinity College in 1661

- Undistinguished academic record

  - Kept everything to himself

  - Intensely disliked being criticized

- Graduated in 1665 at age 18

Taught old stuff (Aristotle, geocentric universe)

- Even after Galileo, Copernicus, Kepler work

Last two years began to develop concepts for three great areas

- Laws of Motion and Gravitation

- Nature of White Light (Optics)

- Calculus

- Kept everything to himself

Plague years (1665-1667)

- University closed, returned to family farm

- Further developed basic ideas for gravity, light, calculus

- Didn't tell anyone about them

- Leather bodkin behind eye

- Stared at sun for as long as he could stand it

Apple falling story

- Unparalleled powers of concentration

## Laws of Motion and Universal Gravitation

- Inverse square law

- Keeps Earth, Moon in orbits (not swirling ether or angels)

- Nothing special about Earth, all objects have gravity

- Basic math relationships valid everywhere in the universe

## 1684 visit by Edmond Halley

- wager between Christopher Wren, Halley and Hooke

  - prove inverse square law for orbits

  - orbits elliptical – Kepler

- Newton tells Halley he had calculated it

  - Couldn't find the papers

  - Explained by law of universal gravitation

## Spends the next 18 months writing to fully explaining 3 laws of motion

### PRINCIPIA MATHEMATICA

- Most important scientific work ever

  - Deliberately made very difficult to understand

  - Explained three laws of motion in detail

  - Explained universal gravitation in detail

  - First truly universal law, explained tides, cannonballs, etc.

- Then Hooke claims credit for inverse square law, claims plagiarism

  - Newton again furious

  - Refused to release third and final piece

  - Halley pleads with him and Newton relents

Principia makes Newton the most famous scientist in the world

Turns physics into a math-based science

- As opposed to Natural Philosophy

## Optics

- Light refracted through a prism

  - Different parts refracted differently

    - Red less, blue more

  - Second inverted prism recombines them

- Corpuscular theory of light

  - Tiny particles

  - Others said light was a wave (has properties of both)

- Chromatic aberration

Had returned to Trinity as a “fellow” in 1667  
Gave extremely boring lectures about light

Made a reflecting telescope in 1669

This made him famous

Elected to the Royal Society

Wrote a paper on his ideas about light

Light was a “mixture” of all the colors

Criticized by Robert Hooke

Newton was enraged

Went in to isolation

Irrationally angry with Hooke

Refuses to publish his major paper on light until Hooke dies (1703)

Buys every painting of Hooke and burns them (may not be true)

## Calculus

Frustrated by limitations of conventional mathematics

Controversy about calculus dominated the last 25 years of his life

Gottfried Leibniz in 1684 makes calculus a matter of public knowledge

Almost certainly figured it out independently

Newton says he thought of this 40 years earlier, but never told anyone

Published in 1704

Well established that Newton discovered this

Before Leibniz even studied mathematics

Bitter and nasty back and forth through subordinates

Debate became nationalistic

\*Calculus could find instantaneous changes

makes a denominator approach zero

become infinitesimally small

notation we use is from Leibnitz (simpler than Newton's)

“Einstein's Big Idea”

DuChatelet (Principia translation), Meitner, Marie Lavoisier

Early 1690's

- Newton suffers an apparent nervous breakdown

- Makes accusations about good friends

- Recovers, but doesn't return to scientific work

Appointed head of the Mint

- Makes major improvement in currency

- Becomes the terror of London counterfeiters

Knighted by Queen Anne, the first scientist so honored

Becomes head of the Royal Society

Elected a member of Parliament

- Only time he ever spoke was to ask that a window be closed

Newton and alchemy

- Became obsessed with alchemy

- Late 1670's hair analysis – mercury

- 40 times normal levels

- Alchemists, hatters and thermometer makers

- Suitcase of notes contained mostly alchemy formulas (1696)

- Spent much time studying floor plan of Lost Temple of King Solomon

- Taught himself Hebrew in the process

- Thought it contains clues on the end of the world

Buried in Westminster Abbey, with kings and queens

- Only scientist so honored