


# New Directions in Thought and Culture In the 16<sup>th</sup> and 17th Centuries





**THE SCIENTIFIC  
REVOLUTION**

# The Scientific Revolution

- The Scientific Revolution- Scientific thought in the early 1500s was based on ancient and medieval ideas.
- European notions about the universe were based on Aristotelian principles
- Motionless Earth fixed at the center on the universe, around it moved 10 transparent crystal spheres- Moon, sun, and 5 planets



# Great Chain of Being

Great Chain of Being-stretched from the throne of God to the most lowly insect on Earth



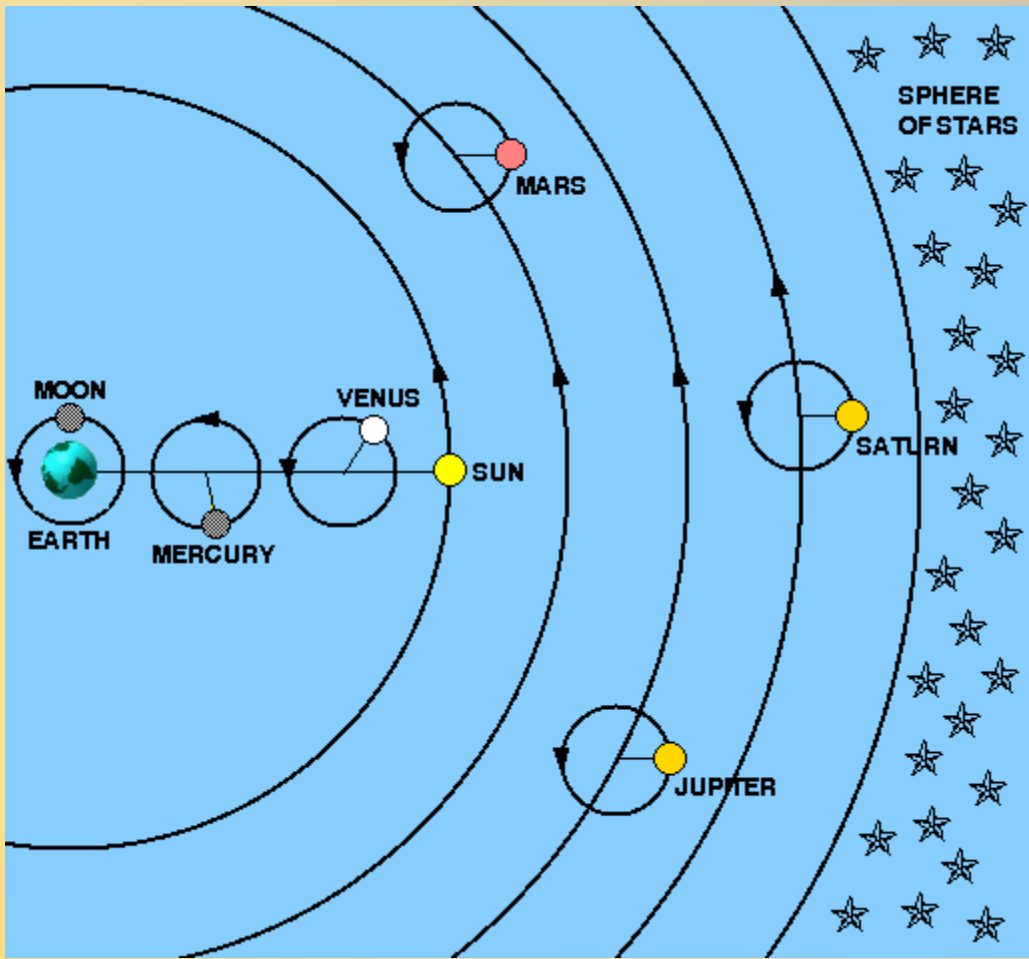
# Nicholas Copernicus

The Copernican Hypothesis- Nicholas Copernicus (1473-1543)



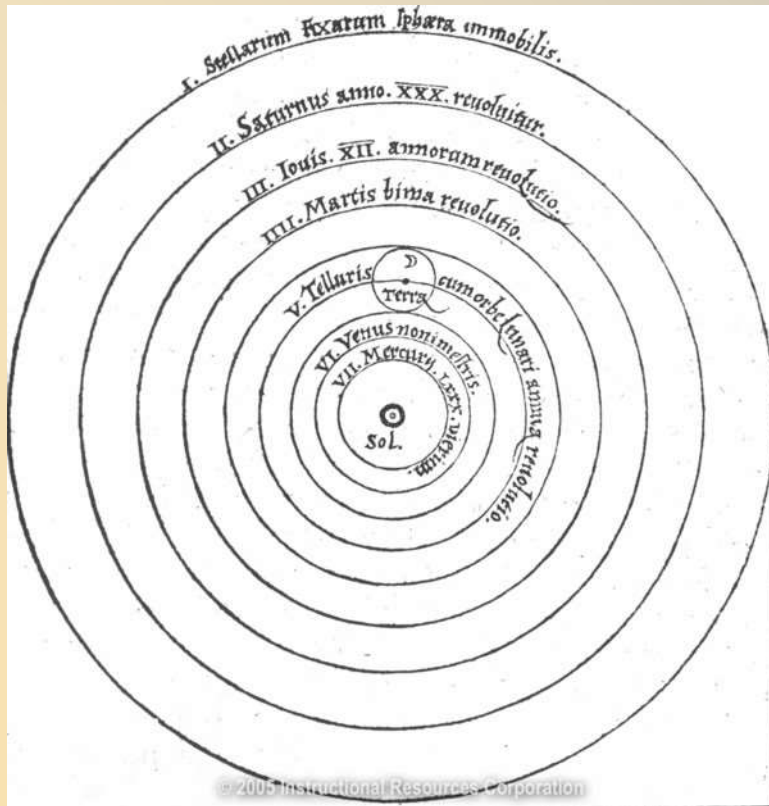
Ptolemy (2<sup>nd</sup> century) Alexandria

Geocentric Theory- Planets (including sun) revolved around the earth

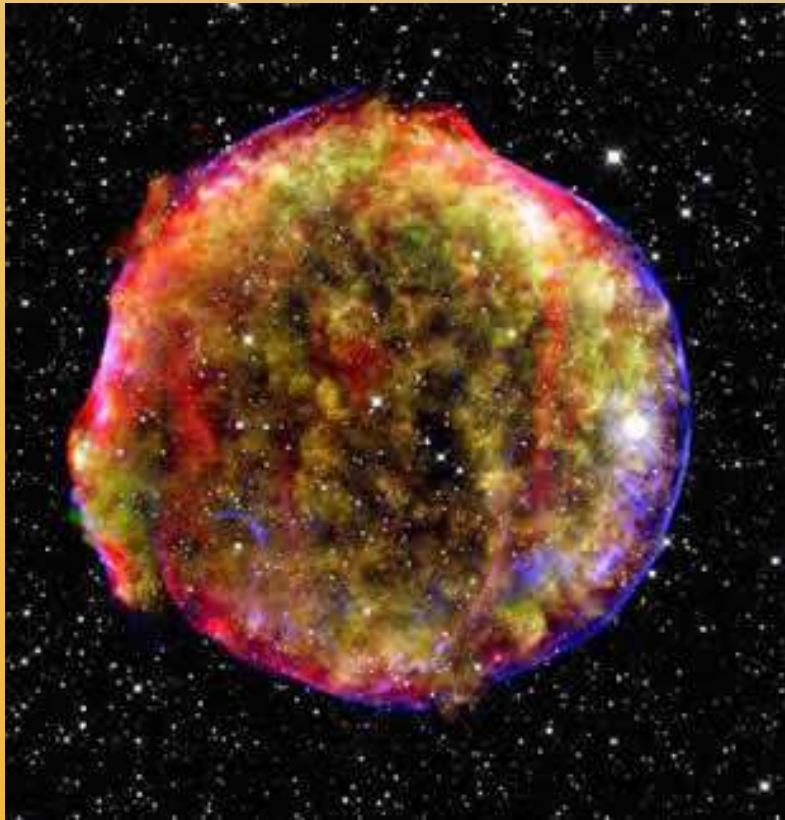


- Copernicus did not publish his *On The Revolutions of the Heavenly Spheres* until 1543, the year of his death

Copernicus was condemned by both Luther and Calvin. Catholic Church did not declare the Copernican hypothesis false until 1616.



- 1572 New Star (shone bright for 2 years)
- 1577 New Comet





# Tycho Brahe

Tycho Brahe (1546-1601) born into Danish nobility

Established as Europe's leading astronomer with his detailed observations of the new star of 1572 (supernova)

Precise observations of planets and stars used the astrolabe and quadrants

The telescope had not yet been invented

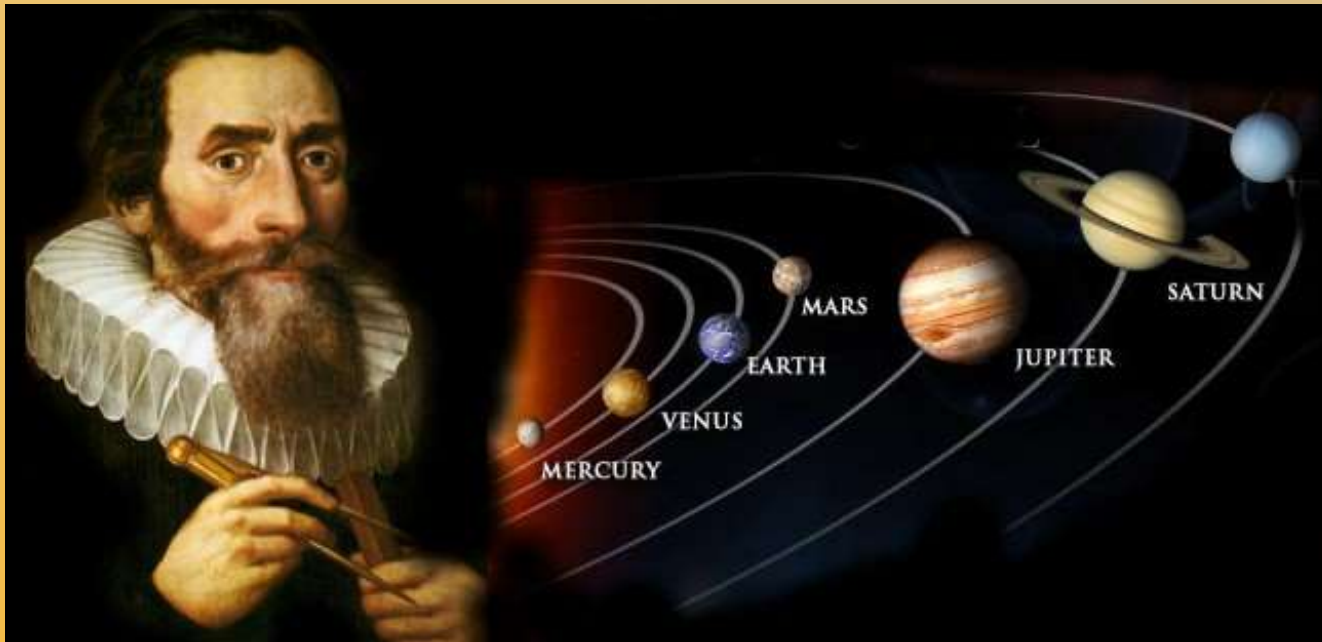




# Johannes Kepler

Johannes Kepler (1571-1630) an assistant of Brahe trained for the Lutheran ministry

- **3 laws of planetary motion**
- 1. Orbits of the planets around the Sun are elliptical not circular
- 2. Planets do not move at a uniform speed in their orbits
- 3. (1619) The time a planet takes to make its complete orbit is precisely related to its distance from the Sun





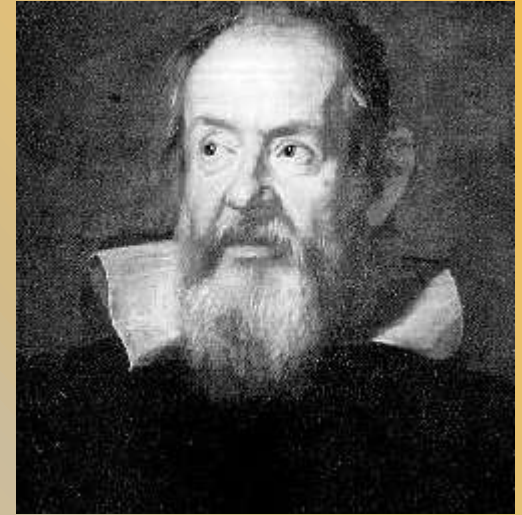
# Telescope invented in Holland



# Galileo Galilei (1564-1642)

Italian astronomer and physicist.

- Improved the refracting telescope 1610 discovered 4 moons circling Jupiter, he named them “Medicean Planets”
- Law of the Pendulum- pendulums of equal length swing at the same rate whether their arcs are large or small.
- Law of falling bodies- all objects fall at the same speed regardless of their mass.
- Elaboration and consolidation of the experimental method
- Law of Inertia-rest was not the natural state of objects- objects continue in motion forever unless stopped by some external force.



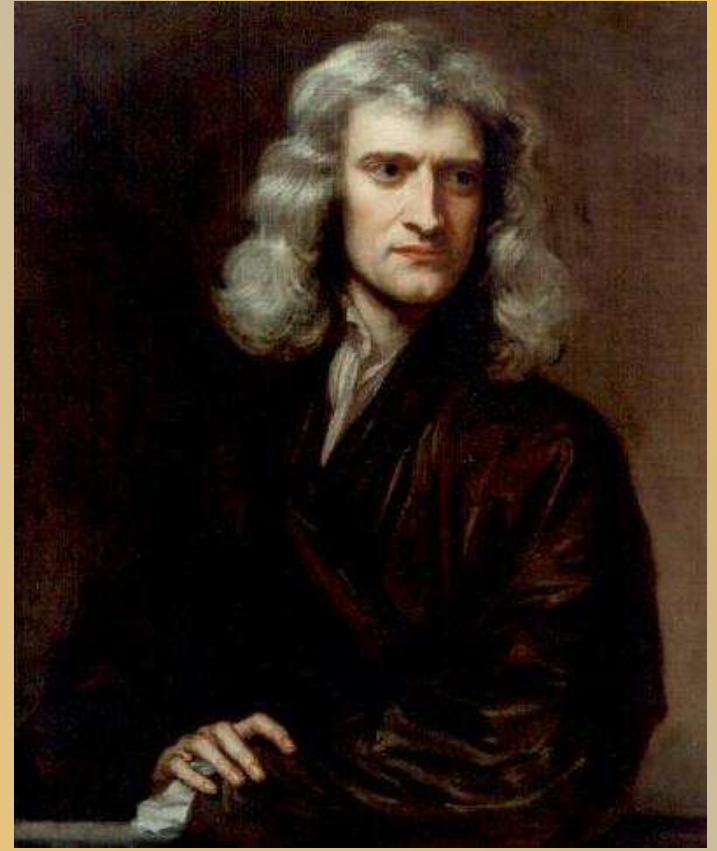
- 1616 Summoned to Rome-ordered not to defend the Copernican theory
- 1632 *Dialogue Concerning the Two Chief World Systems*
- 1633 Galileo was found guilty by the inquisition and was forced to recant
- He served life imprisonment (house arrest)



# Isaac Newton

(1642-1727) Isaac Newton-born into English Gentry, attended Cambridge University

Theory of Gravitation-same force pulls an object to Earth keeps the moon in its orbit every body in the universe attracts every other body





# ■ Opticks (1704)

The science of spectrum analysis-  
sunlight is a mixture  
of light of all colors.



# Isaac Newton- Member of the Royal Society

“If I have seen further (than others) it is by standing on the shoulders or Giants”



# Contribution of Medieval Universities

- Philosophy, Law, Medicine and Theology.
- Science emerged as a branch of Philosophy.
- New in the 15<sup>th</sup> and 16<sup>th</sup> centuries- Mathematics, Astronomy and Physics
- The Renaissance stimulated Scientific enquiry
- Recovery of Classical texts



# Francis Bacon (1561-1626) experimental method



## Scientific Method

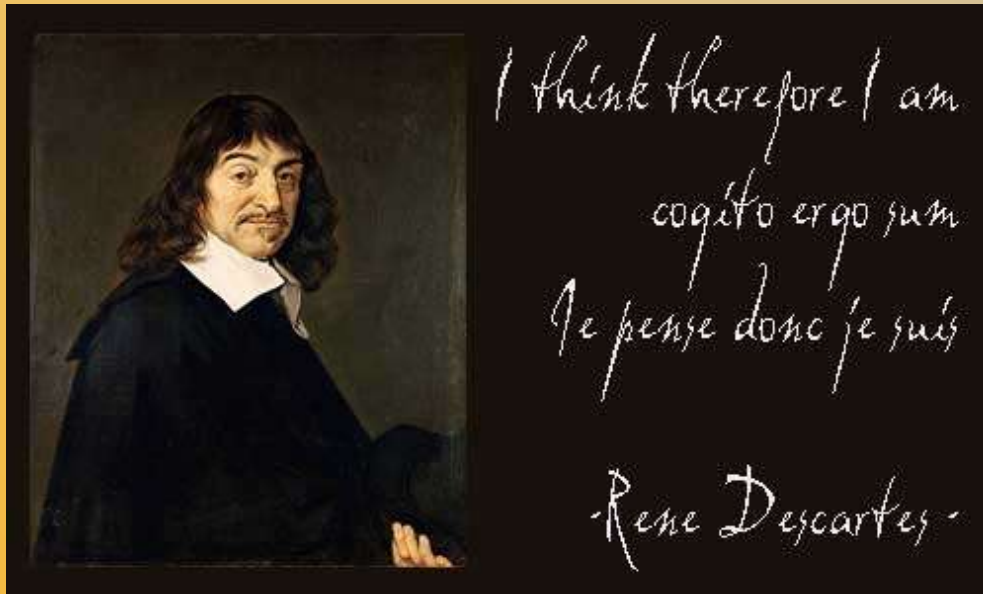
- **Observation**
- **Hypothesis**
- **Experiment**
- **Analysis**
  - Support or reject hypothesis
- **New Hypothesis**
- **Experiment - etc.**

# Rene Descartes' (1596-1650)

Analytical geometry linked algebra and geometry

Empiricism

Descartes' – Reduced all substances to matter and mind-(physical and spiritual) **Cartesian dualism**

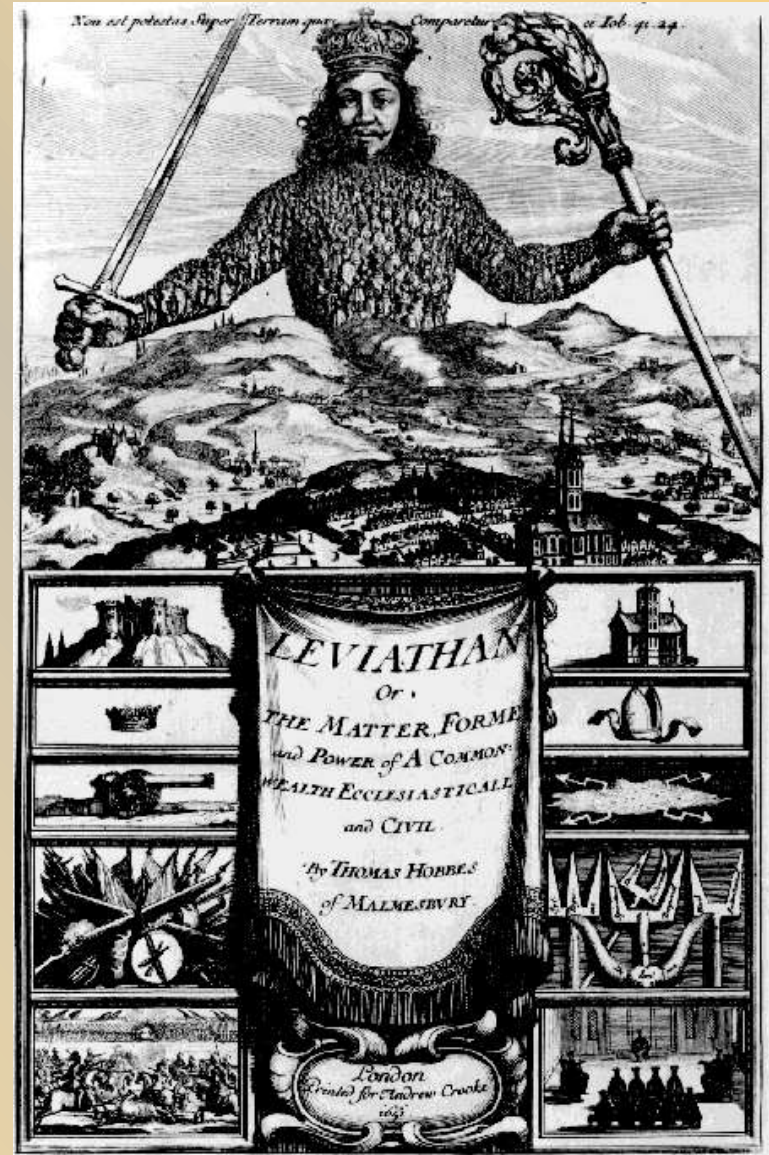


**The Enlightenment** The hope of applying reason and the scientific method to all aspects of society, Government, religion, economics and education.

- Enlightenment- Age of Reason (Progress)  
Create better societies and better people



- Thomas Hobbes – Leviathan (1651)
- The English Civil War convinced him that all humans were naturally selfish and wicked
- Governments were necessary to keep order
- Hobbes called life: Solitary, poor, nasty, brutish and short.
- “Bleak Life” people gave up their rights to a strong ruler in exchange they gained Law and Order.
- The Social Contract – Leviathan (sea monster)
- Hobbes favored absolute monarchy



## Bernard de Fontenelle (1657-1757)

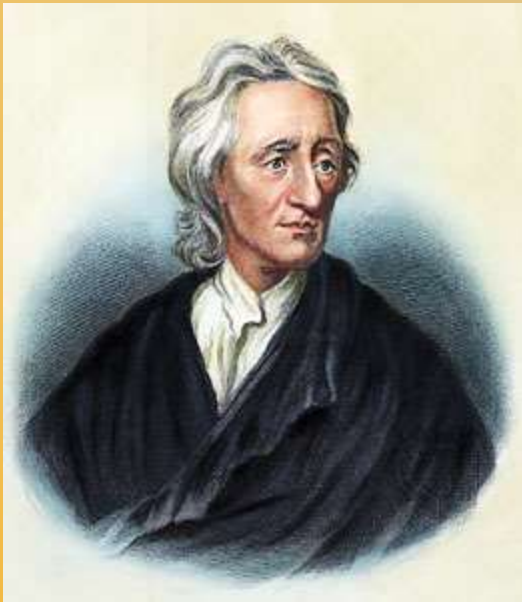
- *Conversations of the Plurality of Worlds* (1686) Concept of Progress
- Along with other writers brought science into conflict with religion  
Fontenelle was skeptical about organized religion





# John Locke

- John Locke- Believed people could learn from experience and improve themselves
- Criticized absolute monarchy and favored self government
- All people are born free and equal with 3 Natural Rights- Life, Liberty and Property. The purpose of government is to protect these rights.



# Two Treatises on Government

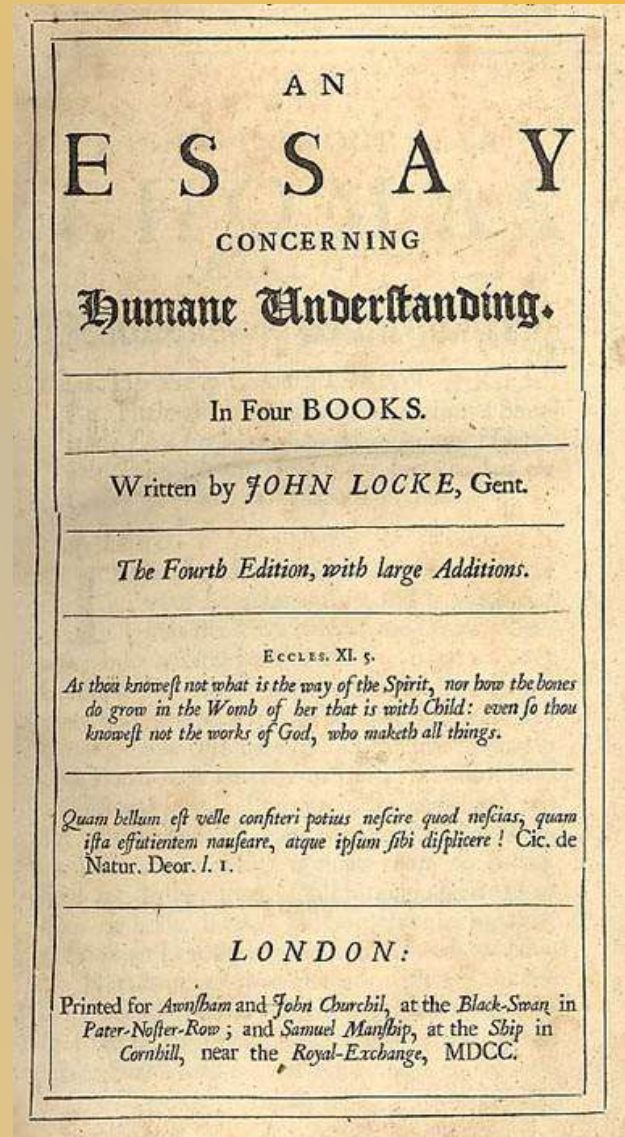
Written in 1690- 2 years after the Glorious Revolution to justify the overthrow of James II.

## Essay concerning Human understanding

1690- All ideas derived from experience

Tabula Rasa – The Human mind is like a blank slate at birth

Human development is determined by educated and social institution

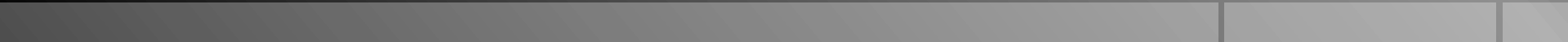
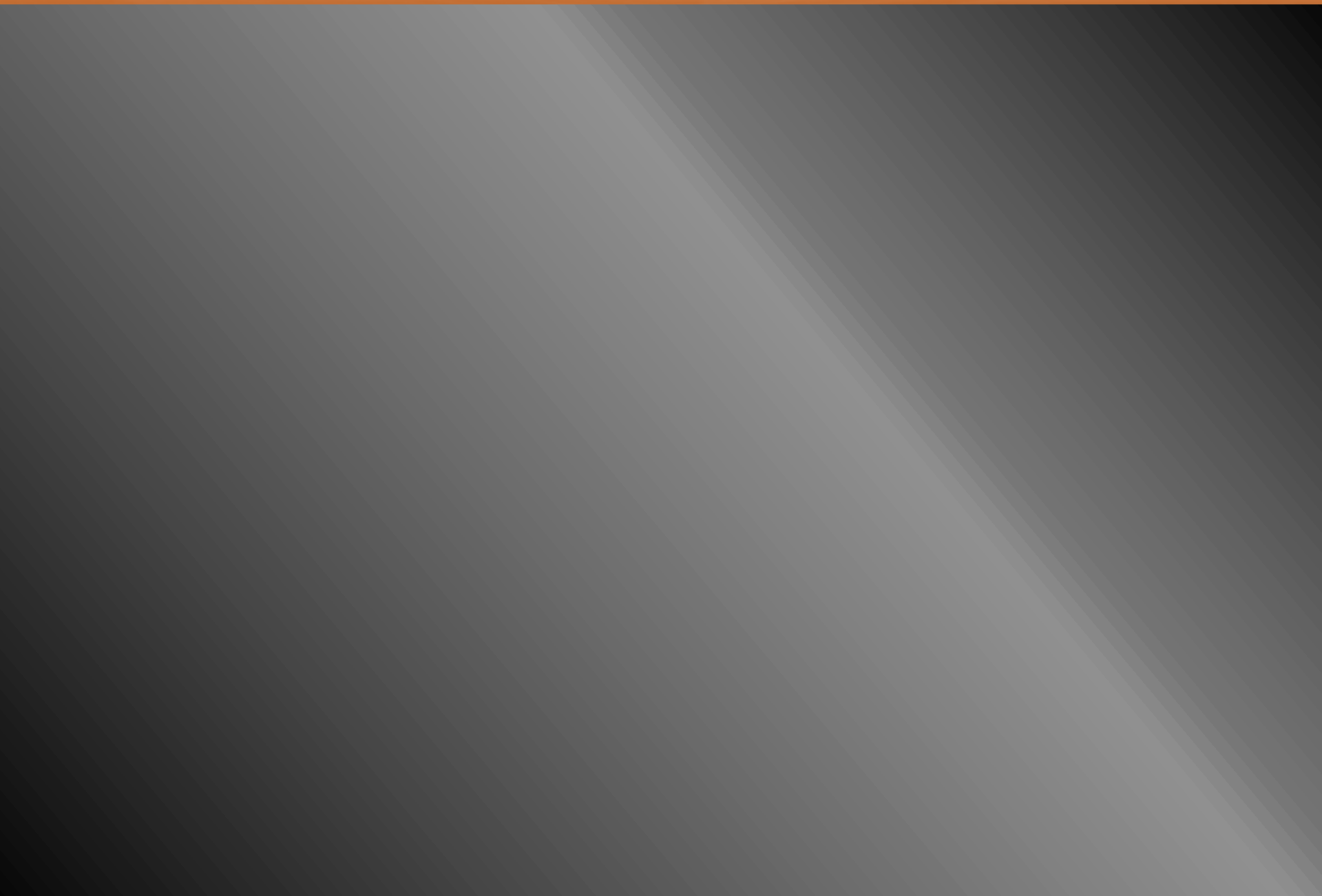


# Margaret Cavendish (1623-1673)



Margaret Cavendish

- One of the most prominent female scientists of the 17<sup>th</sup> century.
- She criticized the belief that humans, through science, were the masters of nature.



# Witch Hunts

**MALLEVS  
MALEFICARVM,  
MALEFICAS ET EARVM**  
hærcium fræncâ conterens,  
EX VARIIS AVCTORIBVS COMPILATVS,  
& in quatuor Tomos iustè distributus,

*ÆCOLE DVO PRIORES VANDI DEMONVM  
viciat, præcipuos totum delibent, Inquisitoris Inquisitorum  
intento, hærendæ etiam cum illis inquisitoribus, etiam deique  
tam pœnitentiâ sicut Inquisitoribus, & pœnitentiâ compellunt,  
Tunc prout Inquisitoribus ad Dantiam, & Inquisitoribus male-  
ficus de Christo sicut Inquisitoribus, Quatuor vero Inquisitoribus,  
Brandellionem, & Inquisitoribus continet.*

**TOMVS PRIMVS.**  
*Index Anthonii, regium, veridicorum Inquisitoribus,*  
Litteræ Inquisitoribus, Inquisitoribus Inquisitoribus, Inquisitoribus Inquisitoribus  
Orationes & Confessiones Inquisitoribus  
*Et sic Inquisitoribus Inquisitoribus, et Inquisitoribus Inquisitoribus, Inquisitoribus Inquisitoribus  
Litteræ Inquisitoribus.*



Sumptibus CLAYDII BOVRGEAT, sub signo Mœti, in Gallia.  
M. DC. LXXII.  
Mœti, in Gallia.



# MIDWIVES



Fig. 399. Niederkunft auf dem Geburtsstuhl.



# Baroque Art





The Marquise de Pompadour, by Francois Boucher, 1759.







We have natural rights: Life Liberty Property





Jean  
Jacque  
Rousseau  
was an



"If absolute  
sovereignty be  
not necessary in  
a state, how  
comes it to be so  
in a family? .... If  
all men are born  
free, how is it  
that all women  
are born slaves?"  
~ Mary Astell

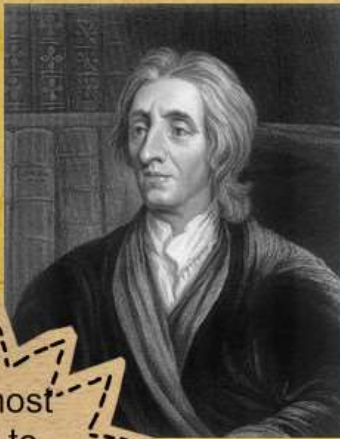


Mary Astell  
was an  
extremely  
influential

Cesare  
Bonesana  
Beccaria,  
an Italian



Beccaria shown with one  
of his passions: books.



Perhaps most  
influential to  
both his era  
and the  
forming of  
another



Francois  
Marie  
Arouet  
(a.k.a.)

Authors of the  
Age of  
Enlightenment

