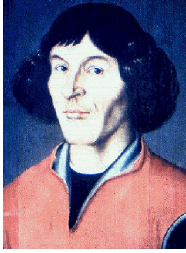


Nicolaus Copernicus

Copernicus was a Polish astronomer who studied in Italy.

In 1543 Copernicus published On the Revolutions of the Heavenly Spheres.



In his book, Copernicus made two conclusions:

1. The universe is heliocentric, or sun-centered.
2. Earth is one of several planets revolving around the sun.

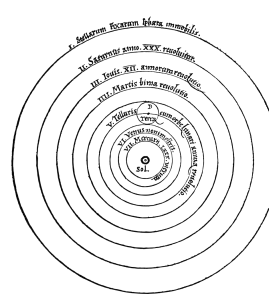
Copernicus' model of the solar system:

1. Sun
2. Moon
3. Mercury
4. Venus
5. Earth
6. Mars
7. Jupiter
8. Saturn

Copernicus came to these conclusions using mathematical formulas.

The Copernican conception of the universe marked the start of modern science and astronomy.

The Copernican Heliocentric Model



Reaction to Copernicus

Most scholars rejected his theory because it went against Ptolemy, the Church, and because it called for the Earth to rotate on its axis.

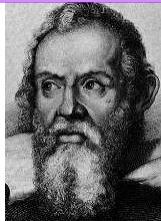
Many scientists of the time also felt that if Ptolemy's reasoning about the planets was wrong, then the whole system of human knowledge could be wrong.



Galileo Galilei

Galileo Galilei was an Italian astronomer who built upon the scientific foundations laid by Copernicus and Kepler.

Galileo assembled the first telescope which allowed him to see mountains on the moon and fiery spots on the sun.



Galileo's discoveries caused an uproar. Other scholars came against him because like Copernicus, Galileo was contradicting Ptolemy.

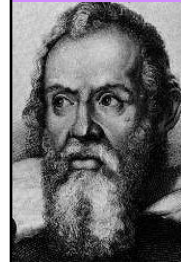
The Church came against Galileo because it claimed that the Earth was fixed and unmoving.



Galileo also discovered that objects fall at the same speed regardless of weight.

He also observed four moons orbiting around Jupiter – exactly the way Copernicus said the Earth rotated around the sun.

Galileo Galilei



When threatened with death before the Inquisition in 1633, Galileo recanted his beliefs, even though he knew the Earth moved.

Galileo was put under house arrest, and was not allowed to publish his ideas.



Sir Isaac Newton



Sir Isaac Newton was an English scholar who built upon the work of Copernicus and Galileo. Newton was the most influential scientist of the Scientific Revolution.

He used math to prove the existence of gravity - a force that kept planets in their orbits around the sun, and also caused objects to fall towards the earth.

Newton published his scientific ideas in his book *Mathematical Principles of Natural Philosophy*. He discovered laws of light and color, and formulated the laws of motion:

1. A body at rest stays at rest
 2. Acceleration is caused by force
 3. For every action there is an equal opposite reaction
- He invented calculus: a method of mathematical analysis.

Francis Bacon

Francis Bacon was an English philosopher who wrote *Advancement of Learning*.

Bacon popularized the scientific method and used it with philosophy and knowledge.

Bacon essentially proposed the Modern "Scientific" Method in his book *Novum Organum* (New Instrument) that to interpret nature one should proceed through inductive reasoning. One should proceed from fact, to accepted truth, and then on to physical law.



Bacon argued that truth could not be known at the beginning of a question, but only at the end after a long process of investigation.

Bacon himself claimed that his empirical scientific method would spark a light in nature that would "eventually disclose and bring into sight all that is most hidden and secret in the universe."

René Descartes



Descartes was a **French** scientist, mathematician, and philosopher.

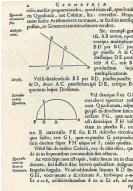
Descartes emphasized **human reasoning** as the road to understanding.

Dubbed the father of modern western philosophy, much of subsequent Western philosophy is a response to his writings, which are studied closely to this day.

He "invented the convention of representing unknowns in equations by x , y , and z , and knowns by a , b , and c ".

He also "pioneered the standard notation" that uses superscripts to show the powers or exponents.

Like Bacon, Descartes also believed that **truth** was only found after a long process of studying and investigation.



Robert Boyle

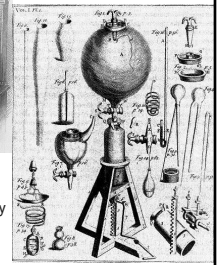
In the 1600s Robert Boyle distinguished between individual elements and chemical compounds.

Boyle also explained the effect of **temperature and pressure** on gases.

Boyle is largely regarded today as the first modern chemist, and therefore one of the founders of modern chemistry, and one of the pioneers of modern experimental scientific



Robert Boyle's first air pump



He is best known for Boyle's law: which describes the inverse proportional relationship between the absolute pressure and volume of a gas, if the temperature is kept constant within a closed system.

Andreas Vesalius

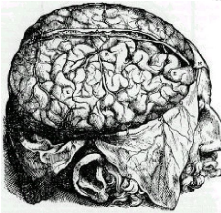
In 1543 Andreas Vesalius published *On the Structure of the Human Body*.

Vesalius' book was the first accurate and detailed book on **human anatomy**.

Vesalius is often referred to as the founder of modern human anatomy.



Medieval human anatomy drawing before Vesalius



Drawings by Vesalius

William Harvey



An English scholar who described the **circulation of blood** for the first time. He showed how the **heart served as a pump** to force blood through veins and arteries.

He was also explored the ways in which animals and humans reproduce.

His doctrine of *omne vivum ex ovo* (all life comes from the egg) was the first definite statement against the idea of **spontaneous generation**. He denied the possibility of generation from excrement and from mud, and pointed out that even worms have eggs.

Venal valves had already been discovered, but here Harvey shows that venal blood flows only toward the heart. He ligatured an arm to make obvious the veins and their valves, then pressed blood away from the heart and showed that the vein would remain empty because it was blocked by the valve.

